Marginal Propensities to Consume with Mental Accounting*

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Abstract

The empirical literature on marginal propensities to consume (MPCs) has identified several puzzles that are difficult to reconcile with standard theories of consumption. This paper proposes a model of dissaving-averse households, a behavioural feature consistent with mental accounting, that accounts for these puzzles jointly. The model generates high MPCs out of income, low MPCs out of income news and wealth, and asymmetric MPCs, i.e. stronger responses to income losses than to gains, for high-liquidity households. A quantitative life-cycle model with mental accounting preferences shows that asymmetric MPCs weaken the effectiveness of redistributive fiscal policy.

Keywords: Consumption, Mental accounting, Fiscal stimulus
JEL Codes: D12, D91, E21, H31

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1 Introduction

The marginal propensity to consume (MPC) is central to the transmission of fiscal and monetary policy, as it quantifies how consumption responds to changes in income. At the same time, understanding the magnitude of the MPC helps discriminate between competing models of consumption behaviour. In this context, the empirical literature has identified several puzzles that are difficult to reconcile with traditional theories of household consumption behaviour. Consumption appears overly sensitive to contemporaneous income changes, insensitive to changes in wealth and news about future income, and only loosely related to liquidity constraints.

This paper first aggravates the divide between theory and data by putting forward an additional puzzle: consumption responds more strongly to income losses than to income gains, even in the absence of liquidity constraints. It then resolves this divide by proposing a unifying theoretical framework of consumption behaviour that jointly explains this asymmetry alongside the established puzzles.

Five widely documented empirical observations highlight the disconnect between empirical and theoretical MPCs. First, MPCs are larger than predicted by the permanent income hypothesis (Parker et al., 2013; Fagereng et al., 2021; Crawley and Kuchler, 2023). Second, the MPC out of income losses is larger than the MPC out of income gains, i.e. MPCs are asymmetric (Baker, 2018; Bunn et al., 2018; Christelis et al., 2019; Fuster et al., 2021). Third, responses to news about future income changes are smaller than those to current income. (Ganong and Noel, 2019; Graham and McDowall, 2024; Fuster et al., 2021). Fourth, responses to wealth changes are similarly low (Di Maggio et al., 2020; Chodorow-Reich et al., 2021; Christelis et al., 2021). A combination of liquidity constraints and transaction costs can, in principle, account for these four facts. However, a fifth observation is that the magnitude of the MPC is only weakly related to household liquidity (Parker et al., 2013; Christelis et al., 2019; Lewis et al., 2019; Fuster et al., 2021).

Several theories can explain high MPCs out of income or low MPCs out of income news or wealth without relying on liquidity constraints (Reis, 2006; Kueng, 2018; Laibson et al., 2021; Lian, 2021a; Boutros, 2022; Ilut and Valchev, 2023), but they fail at generating larger consumption responses to income losses than to income gains. For this reason, I focus on the MPC asymmetry as the central statistic to discriminate between consumption models. To support this focus, I provide additional evidence on the extent of MPC asymmetries in the data. Drawing on household responses to hypothetical income shocks from the Fed Survey of Consumer Expectations (SCE), I find an average MPC of 0.20 for positive shocks and a substantially larger MPC of 0.73 for negative shocks. Compared to Fuster et al. (2021), who study smaller shocks using the same survey, the asymmetry here is about twice as large. This suggests that size effects might play an important role in the determination of the MPC asymmetry.

The central empirical finding is that asymmetric consumption responses are pervasive across households and cannot be readily explained with liquidity constraints. In the SCE, about 85 percent of households report stronger spending adjustments to income losses than to gains – far exceeding typical estimates of the share of liquidity-constrained households. Although the asymmetry declines with liquid wealth – the difference between the MPC out of income losses and income gains decreases from 0.62 for the bottom quintile to 0.42 for the top quintile – it remains large in absolute terms. I document that the asymmetry is present across various measures of liquidity, making it unlikely to reflect the behaviour of wealthy hand-to-mouth households, who hold substantial wealth but behave like liquidity-constrained households due to a large share of illiquid assets (Kaplan et al., 2014).

The observed MPC asymmetry is at odds with the predictions of conventional consumption models. Models with borrowing constraints and idiosyncratic income risk predict larger responses to losses than to gains for low-liquidity households due to the concavity of the consumption function (Kaplan and Violante, 2010), but still imply symmetric MPCs for unconstrained households. This result holds even when households can invest in an illiquid asset, which increases the share of constrained households, but does not materially affect the behaviour of unconstrained households (Kaplan and Violante, 2014). I also illustrate that the introduction of asymmetric portfolio adjustment costs does not generate meaningful asymmetries in MPCs.

To rationalize these patterns, I extend the standard consumption model by incorporating mental accounting preferences (Shefrin and Thaler, 1988; Graham and McDowall, 2024). Mental accounting posits that individuals split their financial resources into separate mental categories, each governed by specific rules or purposes. Using funds for something other than its intended purpose creates a mental burden, violating the assumption of fungibility. Although such violations are often invoked to explain household consumption behaviour, they are rarely explicitly formalized (Baugh et al., 2021; Fuster et al., 2021; Boehm et al., 2023).

I consider a framework with two mental accounts, one for income and one for assets. Funds pertaining to the income account are earmarked for spending, while funds in the asset account are earmarked for savings. The model's key feature is a utility cost of consuming from the mental account for assets. This cost is governed by the level of *dissaving-aversion* that households exhibit, i.e. how much they dislike spending out of the asset account.

The partition between mental accounts is given by a saving rule against which households benchmark their saving decisions. Saving more than suggested by the saving rule implies that consumption is fully covered by funds from the income account while saving less implies consumption out of the asset account, which is costly. The assumption of households following saving rules is supported by the data. Most households in the SCE report planning their savings.

The design of the saving rule is central to the predictions of the model and marks the most relevant deviation from the mental accounting framework in Graham and McDowall (2024). Motivated by behavioural theories of costly information acquisition and processing (Gabaix, 2014; Ilut and Valchev, 2023), I model the saving rule as the outcome of an optimization problem that only partially accounts for the household's state vector. By contrast, Graham and McDowall (2024) assume a simpler rule-of-thumb in which the saving rule is given by households' current wealth. I illustrate that added sophistication in the formation of the saving rule generates consumption responses that are consistent with the empirical evidence.

The mental classification of funds implies distinct responses of the saving rule to different shocks. Income windfalls are assigned to the income account, leaving the rule unchanged, while wealth windfalls are classified as assets, leading the rule to adjust one-for-one with the wealth windfall. Combined with dissaving-aversion, this classification generates rich non-linearities in consumption behaviour.

The main theoretical contribution is to show analytically that the mental accounting framework generates predictions consistent with three empirical puzzles. First, it implies larger MPCs out of income losses than out of income gains. Second, it predicts that responses to income news are smaller than responses to contemporaneous income changes, in excess of what a model without mental accounting would predict. Third, it yields MPCs out of wealth that are lower than MPCs out of income. Intuitively, all three results follow from dissaving-aversion: because spending from the asset account is costly, households dampen consumption responses that require drawing on assets.

To study the implications of dissaving-aversion in a quantitative setting, I incorporate mental accounting preferences into a life-cycle model with income risk and borrowing constraints. The strength of the dissaving-aversion motive is disciplined by two moments in the data: the average MPC out of losses and the share of households in the SCE that report following a savings plan. To interpret the magnitude of the calibrated level of dissaving-aversion, I quantify the savings distortions induced by mental accounting relative to a fully rational benchmark. The results imply that the average household would require a 0.64 percent increase in lifetime consumption to be as well off as a household that follows optimal decision rules without mental accounting.

The quantitative model makes three further contributions. First, it generates large MPC asymmetries across all levels of wealth that closely match those observed in the data. The magnitude of the asymmetry depends on the size of the income shock, providing a potential explanation for the differences in empirical estimates of MPC asymmetries across studies. Second, it accounts for empirical facts one and five which the analytical framework could not capture: it predicts relatively high MPCs out of gains for unconstrained households – because income windfalls relax the mental accounting constraint much like borrowing constraints – and it flattens the gradient of MPCs in wealth by reducing the central role of liquidity. Third, it reproduces lower MPCs out of income news and wealth, consistent with facts three and four and the predictions of the analytical model. A key contribution of the quantitative model is therefore to demonstrate that the mental accounting framework can account for a broader set of empirical MPC puzzles, extending beyond responses to anticipated income changes emphasized in Graham and McDowall (2024).

The policy implications of pervasive MPC asymmetries are considerable. They suggest a cautious approach to certain types of redistributive fiscal policies as the traditional logic of redistributing from high-income (low MPC) to low-income (high MPC) households does not necessarily apply. If high-income households respond strongly to losses, the resulting consumption decline may offset the additional spending generated by transfers to low-income households. A simulation of the mental accounting model suggests that the effectiveness of a simple redistributive policy in which the bottom half of the income distribution receives transfers crucially depends on how the transfers are financed. A one-off income tax on the richest quarter of households slightly *reduces* aggregate consumption while taxing wealth or future income instead of current income substantially increases aggregate consumption, reflecting low MPCs out of wealth and income news, but high MPCs out of income.

More broadly, the framework suggests a potential asymmetry in the aggregate effects of fiscal and monetary policy. If MPCs at the micro-level are indicative of aggregate MPCs, fiscal contractions should trigger stronger consumption responses than fiscal expansions, consistent with recent empirical evidence of asymmetric fiscal multipliers (Barnichon et al., 2022). A similar pattern arises for monetary policy, though the mapping to aggregate consumption is arguably more intricate. Grigoli and Sandri (2022) shows that consumption responds more to contractionary than expansionary monetary shocks while Tenreyro and Thwaites (2016) and Angrist et al. (2018) show that output responds more to interest rate hikes than cuts.

The remainder of this section relates this paper to the literature. Section II presents the empirical facts motivating this study. Section III describes the data and empirical results. Section IV introduces the analytical framework. Section V presents the quantitative model while Section VI draws out implications for fiscal policy. Section VII concludes.

Literature. This paper contributes to a broad literature documenting anomalies in consumption behaviour, reviewed in the next section, that traditional models struggle to explain. Its main contribution is to provide a unified rationale for these patterns without relying on borrowing constraints or transaction costs. On the empirical side, it complements existing work by studying relatively large hypothetical income shocks and showing that asymmetric consumption responses are sizeable across all levels of wealth and liquidity.

Several behavioural extensions have been proposed to rationalize specific features of observed consumption responses, especially high MPCs out of income gains. Examples include present bias (Laibson et al., 2021), temptation preferences (Attanasio et al., 2020), near-rationality (Kueng, 2018), bounded rationality (Boutros, 2022), anticipation-dependence (Thakral and To, 2021) or imperfect reasoning (Ilut and Valchev, 2023). Lian (2021a) propose that anticipation of future mistakes amplifies both MPCs out of gains and losses. Ganong and Noel (2019) show that present bias can generate high MPCs out of predictable income losses. Most closely related, Graham and McDowall (2024) introduce mental accounting to explain high MPCs out of predictable income gains. In contrast, my model explicitly addresses MPC asymmetries and illustrates their relevance for redistributive fiscal transfers. At the same time, it *jointly* explains the previously mentioned consumption patterns through the addition of just one behavioural assumption. Whereas Graham and McDowall (2024) show that MPCs out of anticipated income gains exceed those out of losses, I show that MPCs out of unanticipated income losses exceed those out of gains.

This paper also contributes to the literature on mental accounting by providing a theoretical foundation for its empirical findings. Evidence for mental accounting appears both in how households allocate resources across different categories of goods (Milkman and Beshears, 2009; Hastings and Shapiro, 2013; Abeler and Marklein, 2017; Hastings and Shapiro, 2018; Liu et al., 2021) and in how it shapes total consumption expenditure (Bernard, 2022; Gelman and Roussanov, 2023). This paper relates to the latter and uses mental accounting to explain the division of resources between consumption and saving.

2 Stylized facts about MPCs

This section reviews five well-documented empirical facts about MPCs that have been established over a variety of methodologies and data sets.[1]

Fact 1: MPCs out of income are large. According to the permanent income hypothesis, the consumption response to transitory income fluctuations should be close to zero. In practice, meta-surveys suggest that MPCs are substantially above zero (Jappelli and Pistaferri, 2010; Havranek and Sokolova, 2020). While theories of liquidity constraints can explain large MPCs among households close to the borrowing limit, there is ample evidence of high MPCs even among unconstrained households. This finding is robust across a variety of methodologies, data sources, and definitions of both MPC and liquidity. For example, Parker et al. (2013) estimate an average quarterly MPC of 0.12-0.30 out of tax rebates, with little variation for high-liquidity households. Using lottery winnings, Fagereng et al. (2021) and Golosov et al. (2021) find MPCs of about 0.50 for high-liquidity households. Crawley and Kuchler (2023) apply semi-structural methods in the spirit of Blundell et al. (2008) and estimate an MPC of 0.32 for highly liquid households.

Fact 2: MPCs are asymmetric. The permanent income hypothesis predicts symmetric consumption responses to income gains and losses due to the linearity of the consumption function. In reality, however, several studies report stronger responses to losses than to gains using hypothetical survey questions (Christelis et al., 2019; Fuster et al., 2021; Kotsogiannis and Sakellaris, 2023), reported consumption behaviour (Bracha and Cooper, 2014; Sahm et al., 2015; Bunn et al., 2018) and transaction-level data from household financial accounts (Baker, 2018).[2] Liquidity constraints can, in principle, generate such asymmetries through a concave consumption function, but only for households with low liquidity.

Fact 3: MPCs out of income news are low. For a permanent income consumer, only the present value, not the timing, of income changes should determine the consumption response. In practice, however, several studies find little adjustment to news about future income. Using transaction-level data, Kueng (2018) and Graham and McDowall (2024) document negligible anticipation effects for pre-announced payments, but large responses once the predictable income change materializes (see also Olafsson and Pagel, 2018). In a survey setting, Fuster et al. (2021) similarly find smaller responses to news about future income changes than to comparable immediate changes. Borrowing constraints can account for muted responses to future

[1] Due to the extensive number of empirical studies, the review is certainly non-exhaustive and there may be contrasting evidence on selected findings.

[2] Baugh et al. (2021) find larger responses to income gains than to income losses, but study *expected* instead of *unexpected* income changes, which are not the focus here. See also Ballantyne (2021) and Boudt et al. (2022) for asymmetry estimates from semi-structural methods.

gains, but they counterfactually predict immediate responses to future losses (Ganong and Noel, 2019).

Fact 4: MPCs out of wealth are low. For a permanent income consumer, changes in wealth and income should elicit identical consumption responses as long as they affect permanent income equally. In reality, however, MPCs out of wealth are far lower than those out of income. Several studies find MPCs out of housing wealth of less than 0.10 (Mian et al., 2013; Christelis et al., 2021; Guren et al., 2021; Graham and Makridis, 2023), while Chodorow-Reich et al. (2021) estimate an MPC of just 0.03 out of stock market wealth. Comparisons of capital gains and dividend payouts also reveal much smaller responses to the former (Baker et al., 2007; Di Maggio et al., 2020). In a randomized control trial, Bernard (2022) shows that consumption responds less to windfalls deposited into an instant-access savings account than when the same funds are paid out in cash. A combination of transaction costs and borrowing constraints can in principle generate lower MPCs out of wealth, but the empirical evidence suggests these mechanisms are insufficient to account for the observed magnitudes.

Fact 5: The link between MPCs and liquidity is often weak. In theory, many of the anomalies discussed above can be explained by liquidity constraints (Deaton, 1991). Empirically, however, the evidence is mixed: in many cases, there is no clear relationship between MPCs and access to liquidity, or the link is too weak to account for the observed magnitudes (e.g. Lewis et al. (2019)). Unless one assumes that liquidity constraints are systematically mismeasured and that most households are in fact liquidity-constrained, these findings suggest that additional mechanisms must be at play.

Several alternative theories have been suggested that can explain high MPCs out of income or low MPCs out of income news and wealth without relying on liquidity constraints (Reis, 2006; Kueng, 2018; Laibson et al., 2021; Lian, 2021a; Boutros, 2022; Ilut and Valchev, 2023), but they are unsuccessful at generating larger consumption responses to income losses than to gains. The next section present evidence on the degree of this asymmetry and its relationship to household liquidity.

3 Evidence on the pervasiveness of asymmetric MPCs

This section documents the pervasiveness of MPC asymmetries in the data. The main contribution is to show that stronger consumption responses to income losses are widespread across households and that their magnitude cannot be explained by liquidity or other observable characteristics.

3.1 Setting

I measure MPCs using hypothetical survey questions from the New York FED Survey of Consumer Expectations (SCE), a monthly online survey of about 1,300 households. The SCE provides detailed information on household income, balance sheets, demographics, and expectations, making it well suited for studying the determinants of MPCs.

Survey-based hypothetical scenarios are widely used to elicit MPCs (Jappelli and Pistaferri, 2014; Bunn et al., 2018; Christelis et al., 2019; Fuster et al., 2021) and offer several advantages over other methods. First, they allow for direct measurement of MPCs out of negative income shocks, whereas quasi-natural experiments (Parker et al., 2013; Fagereng et al., 2021) or semi-structural methods (Blundell et al., 2008; Kaplan et al., 2014; Commault, 2022; Crawley and Kuchler, 2023) are often limited to measuring responses to positive income shocks or a mix of both. Second, they capture MPCs out of both positive *and* negative income shocks for the same household at the same point in time. This is important if households face different types of shocks or if MPCs vary over time, for example with the business cycle. Third, the survey standardizes the magnitude of the income shock across households, avoiding the contamination of MPC estimates that arises when other methods average shocks of varying size.

A potential concern is that households' stated consumption intentions may diverge from their actual behaviour. However, the literature suggests that survey-based MPCs are reliable. For the 2008 and 2020 stimulus payments, Parker and Souleles (2019) and Parker et al. (2022) compare self-reported consumption responses with actual consumption responses and find that the reported use of stimulus payments is highly informative about the actual spending response. Bunn et al. (2018) find similar values for reported and hypothetical MPCs. Ex-ante intended and ex-post reported responses also tend to align (Shapiro and Slemrod, 2003; Sahm et al., 2010), with some evidence that ex-post responses are even larger (Graziani et al., 2016). Sahm et al. (2015) finds that such responses are particularly aligned for tax increases, i.e. negative income shocks.

MPC measure. The SCE measures MPCs through two survey questions:

Suppose next year you were to find your household with 10% more income than you currently expect. What would you do with the extra income?

Now imagine that next year you were to find yourself with 10% less household income. What would you do?

Respondents provide both a qualitative and a quantitative answer, specifying the share of additional income they would spend, save or use to pay down debt or, in the case of income loss, the share they would absorb by reducing spending, drawing down savings, or borrowing. Appendix A.1 describes the response options in more detail.

Compared to the existing MPC literature, the income shock considered here is relatively large. Studies based on tax rebates typically examine gains of only a few hundred dollars, and work on income losses often uses shocks of comparable size (e.g. Fuster et al., 2021). By contrast, with a median annual household income of $65,000, the 10% change in the SCE corresponds to a much larger shock, comparable to Christelis et al. (2019) which consider losses of one to three months of income.

Some caveats apply to the phrasing of the SCE questions and response options. First, the term *spending* may include both non-durable and durable consumption. In what follows, I will interpret it as referring to non-durables. Section 3.2 discusses in more detail how to map non-durable responses to total consumption and the role of durables in generating MPC asymmetries. Second, the questions are silent about the horizon over which households adjust spending. Third, respondents may differ in how they interpret the persistence of the income shock. To align the empirical MPC with the theoretical framework, I assume households view the shock as transitory. This assumption is supported by the finding that the level of the MPC out of income gains is comparable to that in other articles studying transitory income changes. More generally, as long as the same household interprets the two (identically phrased) questions regarding income gains and losses consistently, the difference (asymmetry) between responses should be well measured, even if the level of each MPC is biased.[3]

Sample description. I combine the monthly SCE core survey with two lower-frequency modules, the Spending Survey and the Household Finance Survey. Incorporating balance sheet information from the Household Finance Survey comes at the cost of losing the panel dimension.[4] I restrict the sample to households that answer both MPC questions and winsorize financial variables at the 1 percent level. The final cross-section covers 4,009 households over the period 2015–2018.

Table 1 reports summary statistics for demographic and financial variables, as well as for MPCs, which are discussed in the next section. Although the SCE is designed to be nationally representative, it somewhat oversamples higher-income, wealthier and more educated households. Survey weights are provided to account for these differences.

3.2 Results

Figure 1 shows the distribution of MPCs across households for income gains (MPC^+) and losses (MPC^-). The average MPC^+ is 0.20, well within the range of existing estimates. Nearly half of households indicate little to no adjustment in response to a positive income shock, while very few indicate that they would spend the entire gain.

This pattern is reversed for income losses. Almost half of households state that they would fully absorb the loss by cutting consumption, and only a small fraction report no adjustment. The average MPC^- is 0.73, which is comparable to Bunn et al. (2018) and Bracha and Cooper (2014), but higher than in Christelis et al. (2019), Surico and Trezzi (2019) or Fuster et al. (2021).

The right panel of Figure 1 highlights this divergence by showing the distribution of MPC asymmetries, defined as the household-level difference between MPC^- and MPC^+. Almost all households adjust consumption more strongly to negative than to positive shocks, and the average asymmetry is large at 0.53. A quarter of households report cutting consumption fully in response to a loss while not increasing it at all in response to a gain. For comparison, Fuster et al. (2021) – also using the SCE but with a much smaller income change of \$500 – find an average asymmetry of 0.25.[5] This suggests that the size of the shock plays an important role in

[3]Despite the identical phrasing of the gain and loss questions, one might worry that households interpret the persistence of the two scenarios differently due to different experienced histories of shocks. Empirical evidence, however, suggests that the persistence of positive and negative income shocks is similar for the median household (Arellano et al., 2017; Guvenen et al., 2021).

[4]MPCs are similar across the larger sample without balance sheet variables and the final sample. The panel structure of the larger sample also shows that MPCs are fairly stable within households.

[5]The authors field a special module to study consumption responses across several scenarios. Their survey

Table 1: Summary statistics

	Mean	Median	Std. dev.	Min	Max	N
Demographics						
Age	50.72	51.00	15.24	18	96	4,009
Female	0.48	0.00	0.50	0	1	4,009
College degree	0.56	1.00	0.50	0	1	4,009
Homeowner	0.74	1.00	0.44	0	1	3,684
Financial variables						
Income	82,137	65,000	69,549	0	400,000	3,630
Bank holdings	21,735	3,000	61,906	0	1,600,000	3,421
Liquid assets	90,409	10,000	234445	0	1,600,000	3,450
Liquid debt	27,695	10,000	48,463	0	300,000	3,660
Total assets	450,130	239,000	602,383	0	4,585,000	3,284
Total debt	96,766	36,500	133,111	0	880,000	3,642
Spending responses						
MPC+	0.20	0.10	0.24	0	1	4,009
MPC-	0.73	0.85	0.31	0	1	4,009

Notes: Liquid assets include money in checking and savings accounts, stocks and bonds. Total assets additionally include retirement funds and housing wealth. Liquid debt includes credit card debt, auto loans, student loans, and medical or legal bills. Total debt additionally includes mortgages.

shaping MPC asymmetry.

The existence of sign asymmetries is not, in itself, surprising. Standard models with borrowing constraints predict higher MPCs out of losses than gains for liquidity-constrained households. The size and ubiquity of the asymmetry, however, suggest that liquidity constraints cannot be its main driver.

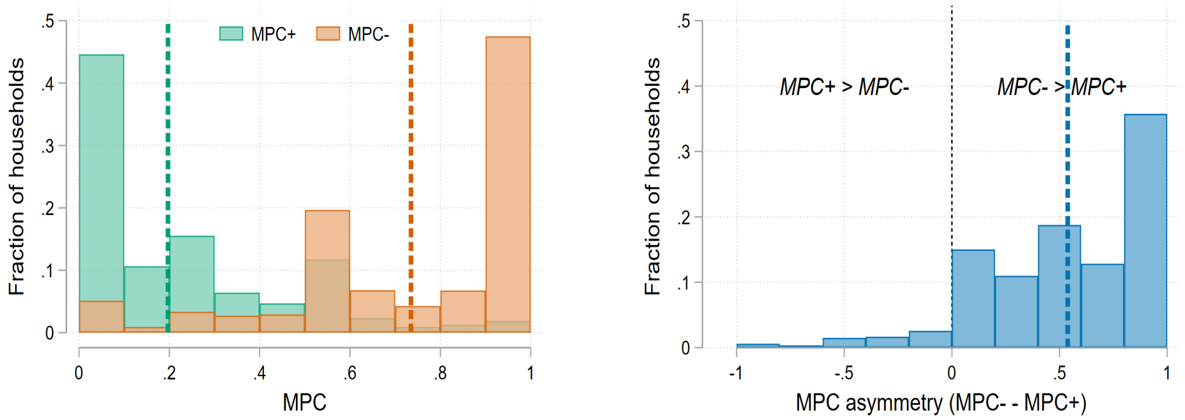
To understand the role of liquidity, Figure 2 plots the average MPC asymmetry across quintiles of net liquid wealth, defined as the sum of bank deposits, stocks and bonds minus liquid debt. Asymmetries are visible throughout the wealth distribution. They decline somewhat with wealth, but far less than theory would predict. While a standard consumption model with borrowing constraints and idiosyncratic income risk would predict symmetric MPCs for unconstrained households, the data suggest that even the top quintile exhibits an average asymmetry of 0.42. Appendix Figure A1 confirms that sizable asymmetries remain even for the top 10 and 5 percent of the wealth distribution.

The decomposition in Figure 2 shows that MPCs out of gains are relatively stable across wealth groups, while MPCs out of losses fall with wealth. The narrowing of the asymmetry at higher wealth levels is therefore driven almost entirely by smaller loss responses. Still, even the wealthiest households display large consumption responses to negative shocks.

The weak relationship between MPC^+ and wealth has been documented in several settings (Bunn et al., 2018; Christelis et al., 2019; Fuster et al., 2021; Colarieti et al., 2024). In the SCE, the low MPC^+ among low-wealth households is largely driven by net debtors, who

module differs in other respects as well, though shock size is the most salient distinction.

Figure 1: Distribution of MPCs out of income gains, losses and asymmetries



Notes: This figure reports the distribution of MPCs out of gains (MPC^+), losses (MPC^-) and their difference (asymmetry). The dashed lines denote the average MPC^+, MPC^- and MPC asymmetry in the sample.

predominantly use windfalls to repay debt (Kosar et al., 2023; Boutros and Mijakovic, 2024). Appendix Figure A2 illustrates this point showing that once net debtors are excluded, the relation between MPC^+ and wealth is essentially flat.[6]

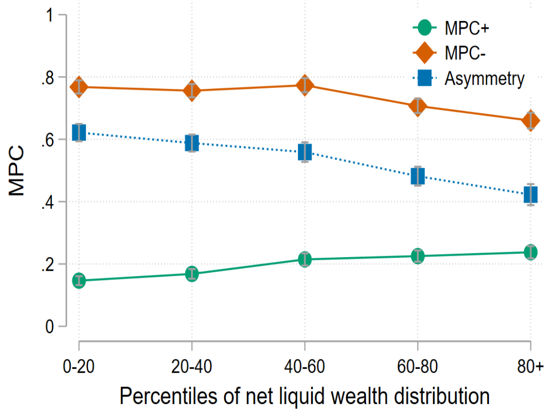
Irrespective of the measure of liquidity, consumption responds more strongly to income losses than to gains (Figure 3). MPCs look similar when measured against liquid wealth or total wealth (liquid plus illiquid), which rules out wealthy hand-to-mouth households as the main explanation (Kaplan and Violante, 2014). The asymmetry remains even under a narrow definition of liquidity that includes only funds in checking and savings accounts. Moreover, also households with substantial liquid wealth relative to income display large asymmetries: even the top quintile, which holds liquid wealth exceeding annual income, fails to smooth relatively small income losses.

To address the concern that observed balance sheets may not fully capture households' effective liquidity, I also exploit an SCE question about households' ability to cover unexpected expenses. Panel D of Appendix Figure A3 shows that the asymmetry remains large under this alternative measure. Appendix A.2 further demonstrates that the asymmetry is robust across other observable characteristics and confirms these results in a formal regression framework.

As noted earlier, the survey question does not specify whether "spending" refers only to non-durable consumption or also includes durables. This distinction can matter, since MPCs that include durable purchases are sometimes much larger (Parker et al., 2013). To assess its relevance here, I follow the mapping from MPC (the marginal propensity for notional consumption flow) to MPX (the marginal propensity for expenditure) proposed by Laibson et al. (2022). For non-durables, consumption flow and expenditure coincide, but for durables they

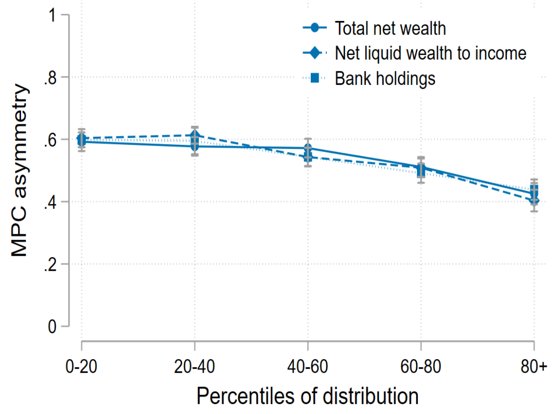
[6] Boutros and Mijakovic (2024) further show that net wealth positions are not sufficient to accurately characterize the MPC. Because a large part of the population simultaneously holds liquid assets *and* credit card debt, gross wealth positions are more informative about marginal propensities than net positions. Other factors may also explain the positive slope. The large size of the transfer may matter, as shown in Andreolli and Surico (2021). Alternatively, Colarieti et al. (2024) emphasize the role of non-economic characteristics such as psychological traits or past experiences.

Figure 2: MPCs across the net liquid wealth distribution



Notes: MPC asymmetry is defined as the difference between the MPC out of losses and the MPC out of gains. Grey bars indicate 95% confidence bands.

Figure 3: MPC asymmetries across measures of liquidity constraints



Notes: Each line corresponds to the MPC asymmetry across the respective distribution. Grey bars indicate 95% confidence bands. Total net wealth is defined as total assets (liquid assets + retirement funds and housing wealth) - total debt (liquid debt + mortgages). Bank holdings refer to money in checking and savings accounts.

can differ. The mapping $MPX = (1 - s + \frac{s}{r+\delta})MPC$, with s the durable share of notional consumption, r the real interest rate, and δ the depreciation rate of durables, implies a conversion factor of 1.5 for standard parameter values.[7] Interpreting the survey question as capturing the MPX would therefore yield notional MPCs of $MPC^{+} = 0.20/1.5 = 0.133$ and $MPC^{-} = 0.73/1.5 = 0.486$, which still display a large asymmetry. Empirical evidence supports this conclusion. Christelis et al. (2019) separate durable and non-durable consumption responses to income gains and losses and find similar asymmetries across both measures.

3.3 Validity

The magnitude and ubiquity of MPC asymmetries may appear surprising, even though, as noted earlier, hypothetical survey questions typically capture actual spending behaviour well. To further assess the validity of the survey data, I conduct three additional exercises in this section.

MPCs out of hypothetical income gains vs tax refunds. The SCE asks participants how much of their annual tax refund they spent or they planned to spend, which allows a direct comparison with the MPC out of the hypothetical income gain. Appendix Figure A4 shows that the two distributions are similar. The average MPC out of tax refunds is slightly higher because more respondents report spending the entire refund. This is consistent with theory, since refunds are usually much smaller than 10% of annual income and MPCs tend to decline with the size of the transfer.

[7] The conversion factor is computed for a one-year horizon with $s = 0.1215$, $r = 0$ and $\delta = 0.2$ as in Laibson et al. (2022).

Financial literacy. A potential concern is that households may lack the financial literacy to anticipate their own responses. To address this, I construct a financial literacy measure from seven questions in the SCE that ask respondents to perform simple quantitative exercises. Restricting the sample to the most financially literate households leaves the asymmetry essentially unchanged (Appendix Figure A5).

Intentions vs Actions. Finally, I exploit the panel structure of the SCE to compare intended and realized expenditures. Households report the likelihood of purchasing goods in seven categories over the next four months. I then compare these intentions with actual purchases reported later. Appendix Table A2 shows that intended spending is a strong predictor of realized spending across both linear probability and logit models, though the strength of the relationship varies across categories.

4 A simple model with mental accounting

The evidence shows that most households adjust consumption asymmetrically to income gains and losses, even when they have ample liquidity. This pattern suggests a systematic behavioural pattern that induces households to save large fractions of income windfalls, but deters them from using savings to buffer income losses. Such behaviour is inconsistent with conventional consumption models featuring liquidity constraints or income risk, and also several extensions of that framework including common behavioural theories as discussed in Appendix D. I propose instead an extension of the standard consumption model that incorporates mental accounting (Shefrin and Thaler, 1988; Thaler, 1990; Graham and McDowall, 2024).

This section first introduces the concept of mental accounting. It then lays out the basic theoretical framework and derives three analytical results within a stylized model that are consistent with empirical facts two to four: asymmetric MPCs, low MPCs out of income news and low MPCs out of wealth.

4.1 Background

Mental accounting theory suggests that individuals split their financial resources into separate mental categories or "accounts". Each account is assigned specific rules or purposes, breaking the assumption of fungibility, i.e. the notion that money has no labels. The need to keep mental accounts can stem, for example, from self-control problems (Thaler and Shefrin, 1981) or decision-making based on imperfect information (Kőszegi and Matějka, 2020; Lian, 2021b). A simple formulation considers two broad accounts, one for income and one for assets. Funds pertaining to the income account are earmarked for spending, while funds in the asset account are earmarked for savings. Using funds for something other than its intended purpose, for example spending out of the asset account, can create a mental burden.

Evidence for mental accounting has been found in a variety of applications, such as the allocation of resources across different types of consumption goods (Milkman and Beshears, 2009; Hastings and Shapiro, 2013; Abeler and Marklein, 2017; Hastings and Shapiro, 2018;

Liu et al., 2021) and across consumption and savings (Bernard, 2022; Gelman and Roussanov, 2023). Mental accounting is also frequently discussed as an explanation for other puzzling aspects of household consumption behaviour that are difficult to explain otherwise: differences in spending propensities out of capital gains and dividends (Baker et al., 2007; Di Maggio et al., 2020), anticipation-dependence (Thakral and To, 2021), co-holding of liquid assets and debt (Olafsson and Gathergood, 2020), asymmetric consumption smoothing of expected income changes (Baugh et al., 2021) or the implementation design of transfers (Boehm et al., 2023).

4.2 Basic framework

Households are assumed to maintain two mental accounts, one for income and one for assets. Funds in the asset account are not perfect substitutes for funds in the income account. The partition between the two accounts is determined by a savings rule, which can be interpreted as a mental rule-of-thumb that households use to facilitate decision-making. Formally:

Definition (Mental accounts). Let $m = y + a$ denote current cash-on-hand, the sum of current income y and assets a. Let a^{plan} denote the target level of assets implied by the savings rule. Then:

- Resources up to a^{plan} are classified into the asset account,
- Resources above a^{plan}, i.e. $m - a^{plan}$, are classified into the income account.

The original mental accounting framework emphasizes how windfalls, i.e. unexpected resource shocks, are mentally categorized. Income windfalls are treated as additions to the income account, while shocks that change wealth are assigned to the asset account. Shefrin and Thaler (1988) further introduce a third account for *future* income, distinct from the account for *current* income. For simplicity, I focus on a two-account setting, but show how it can also accommodate changes in future income. The distinction across windfalls can be formalized in terms of the savings rule:

Definition (Classification of windfalls).

1. *Income windfalls:* a^{plan} does not change in response to unexpected income windfalls. These windfalls are therefore assigned to the income account.
2. *Wealth windfalls:* a^{plan} changes one-for-one with windfalls that change wealth. These windfalls are therefore assigned to the asset account.
3. *Future income windfalls (news):* a^{plan} does not change in response to unexpected future income windfalls. Such windfalls are left unassigned in the two-account framework.

The precise form of the savings rule will be developed once the model environment is introduced. At this stage, it is enough to treat a^{plan} as a behavioural device that partitions resources across accounts. Framing it in this way reflects insights from macroeconomic theories that stress the cognitive costs of fully optimal planning. In particular, households may face costs of acquiring information, as in the bounded rationality framework of Gabaix (2014), or of processing information, as in the two-system thinking framework of Ilut and Valchev (2023). The savings rule can therefore be interpreted as a heuristic: simple enough to reduce complexity, but flexible enough to adjust when shocks are economically meaningful.[8]

A central idea of mental accounting is that negative deviations from the savings rule are costly since they imply spending out of the mental account for assets. The asymmetry arises because mental accounting imposes an explicit ordering of mental accounts in which consuming out of the income account is preferred to consuming out of the asset account. I will refer to this feature as *dissaving-aversion*.

Formally, I introduce mental accounting through a modified utility function, as in Graham and McDowall (2024):

$$u^{MA}(c) = u(c) - \lambda(a)d(a', a^{plan}) \tag{1}$$

$$d\left(a', a^{plan}\right) = \begin{cases} 0 & \text{if } a' \geq a^{plan} \\ u(c) - u\left(c^{plan}\right) & \text{if } a' < a^{plan} \end{cases} \tag{2}$$

$$\text{where} \quad c^{plan} \equiv c(a^{plan}) \tag{3}$$

where $u(c)$ denotes a standard utility function over consumption and $\lambda(a)d(a', a^{plan})$ denotes the disutility from deviating from the savings rule.

The disutility term consists of two elements: first, a penalty function $d(a', a^{plan})$, which depends on the deviation of the actual savings decision a' from the savings rule a^{plan}. Given a budget constraint, the deviation in savings can be mapped into the deviation of consumption c from the consumption level that the household obtains following strictly the savings plan, c^{plan}.[9] $d(a', a^{plan})$ is specified in such a way that only negative deviations from the savings plan, i.e. consumption out of the mental account for assets, are penalized. Saving more than planned does not affect the household's utility directly. The second element of the disutility term, $\lambda(a)$, denotes the strength of the dissaving-aversion motive. This formulation of the disutility term is convenient as bounding $\lambda \in [0, 1]$ leads to two extreme types of consumption behaviour at each bound, permanent income consumers for $\lambda = 0$ and hand-to-mouth consumers for $\lambda = 1$. Allowing λ to depend on assets permits the strength of dissaving-aversion to vary with wealth.

The basic framework is a variant of the mental accounting model laid out in Graham and McDowall (2024) that studies the timing of consumption responses to tax refunds. My formulation differs in two important aspects. First, I introduce a different specification of the savings rule, i.e. partition of mental accounts. Whereas Graham and McDowall (2024) postulates a

[8]An interpretation is that a^{plan} corresponds to the optimal savings allocation of a household that does not take the entire state space into account. For instance, suppose income consists of a persistent component z and a transitory component e. The savings rule may then be represented as $a^*(z)$, a function of the persistent component only, thereby ignoring the realization of e. In this interpretation, households update their mental accounts when they receive a promotion that persistently raises income, but not when they receive a one-off bonus payment.

[9]The object c^{plan} will be introduced once the budget constraint is specified. For a simple formulation of the form $c_t = y_t + Ra_t - a_{t+1}$, c^{plan} would be given by $c^{plan} = y_t + Ra_t - a^{plan}$.

rule of the form $a^{plan} = (1+r)a$, I will show that a more sophisticated rule is needed to match the consumption responses outlined in Section 2. Second, I allow for a more flexible penalty term $\lambda(a)$ as opposed to a constant λ which is required to match the heterogeneity in consumption responses across the distribution of liquid wealth. The savings rule, in particular, will be critical in reconciling the theoretical predictions with the empirical evidence.

Mental accounting preferences bear some resemblance to expectations-based loss aversion around a reference point (Kőszegi and Rabin, 2009). In the latter framework, utility depends not only on consumption itself but also its deviation relative to a reference point which is referred to as 'gain-loss utility'. Both approaches introduce a reference point into preferences, but they differ in its definition and formation. In the mental accounting framework, the reference point a^{plan} consists of a level of assets whereas with loss aversion it consists of a level of consumption. The mental accounting reference point is also not necessarily expectations-based, as will become clear once the savings rule is formalized in the next section. These differences in reference points have first-order implications for consumption behaviour, a point I return to in Appendix D.

4.3 A simple two-period model of mental accounting

Households in this economy live for two periods $t \in \{0, 1\}$ and are born with zero initial wealth.[10] In period 0, they receive income y_0 and choose how much to consume and save. In period 1, they consume the return on their savings. Households follow a savings plan which is formed endogenously. Utility is logarithmic and augmented by a penalty term for deviating from the savings plan.[11] For simplicity, I assume that households face no penalty in the second period and that the dissaving-aversion parameter λ is constant.[12] Finally, households discount the future with a subjective discount factor β and save at an exogenous gross interest rate R. This yields the following problem:

$$\max_{c_0, c_1} \quad u(c_0) - \lambda d(a_0, a_0^{plan}) + \beta u(c_1) \tag{4}$$

$$\text{s.t.} \quad c_0 + a_0 = y_0; \quad c_1 = Ra_0; \tag{5}$$

Maximizing with respect to a_0 yields the following Euler equation:

$$\beta R u'(c_1) = \begin{cases} u'(c_0) & \text{if} \quad a_0 \geq a_0^{plan} \\ (1-\lambda)u'(c_0) & \text{if} \quad a_0 < a_0^{plan} \end{cases} \tag{6}$$

The savings decision governs which Euler equation the household faces. Saving less than planned reduces marginal utility today by a factor $1 - \lambda$. Saving weakly more than planned preserves the standard Euler equation. Combining the Euler equation and the budget con-

[10] Appendix B.1 extends the model to allow for initial wealth.

[11] Appendix B.2 generalizes to CRRA utility.

[12] Because it is always optimal to consume all savings in $t = 1$ and households do not expect any deviations from their savings plan, the results are identical if this assumption is relaxed. See also Appendix B.3.

straint, we can derive an expression for c_0:

$$c_0 = \begin{cases} \frac{y_0}{1+\beta} & \text{if } a_0 \geq a_0^{plan} \\ \frac{y_0}{1+\frac{\beta}{1-\lambda}} & \text{if } a_0 < a_0^{plan} \end{cases} \tag{7}$$

Savings plan. The final ingredient is the definition of the savings plan. I assume that household's form their plan by solving the equivalent problem without mental accounting – that is, they benchmark against the optimal savings decision implied by standard preferences given current income. Formally, it is defined as the value of a_0 that solves:

$$a^{plan} \equiv \arg\max_{a_0} \Big\{ u(y_0 - a_0) + \beta\, u(Ra_0) \Big\}. \tag{8}$$

which yields an optimal savings allocation in period 0, a_0^*:

$$a_0^* = \frac{\beta}{1+\beta} y_0 \equiv a_0^{plan} \tag{9}$$

With the definition of the savings plan at hand, we can define planned consumption as the level of consumption if one strictly followed the savings plan:

$$c_0^{plan} = y_0 - a_0^{plan} \tag{10}$$

This object will be useful for providing intuition behind the results that follow.

To derive an expression for the MPC, assume that income in $t = 0$ unexpectedly changes by a fraction ϵ. Since income changes are assigned to the mental account for income, the savings rule is unaffected, i.e. $a_0^{plan}(y_0 + \epsilon y_0) = a_0^{plan}(y_0)$. This yields the following proposition.

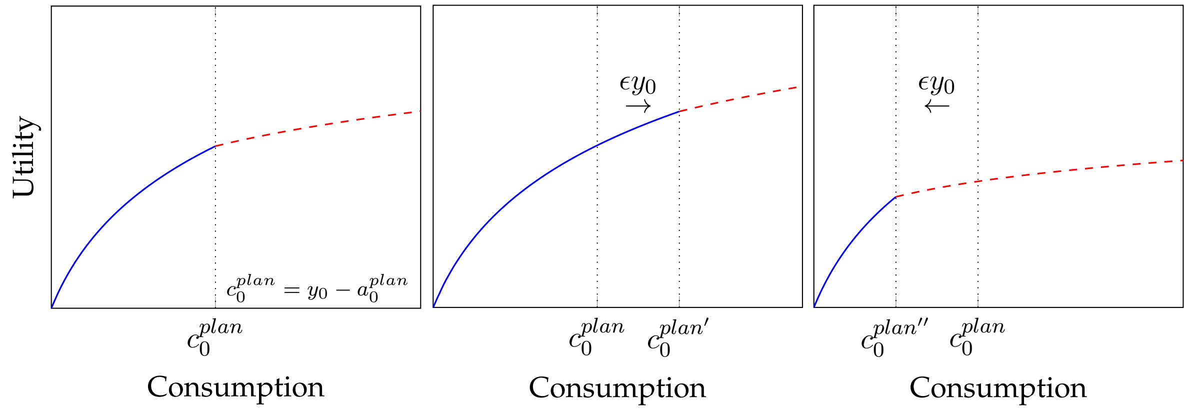
Proposition 1 (MPC asymmetry): Define MPC^+ as the MPC out of positive income changes ($\epsilon > 0$) and MPC^- as the MPC out of negative income changes ($\epsilon < 0$). Then $MPC^- > MPC^+$ for any level of dissaving-aversion $\lambda \in (0, 1]$ and size of the income change $|\epsilon| \in (0, 1)$.

$$MPC = \frac{\Delta c_0}{\Delta y_0} = \frac{\tilde{c}_0(y_0 + \epsilon y_0) - c_0(y_0)}{\epsilon y_0} = \begin{cases} \frac{1}{1+\beta} & \text{if } \epsilon \geq 0 \\ \min\left\{ \frac{1}{1+\beta} \left(\frac{1+\epsilon}{\epsilon} \frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon} \right), 1 \right\} & \text{if } \epsilon < 0 \end{cases} \tag{11}$$

Proof. See Appendix B.4. □

Proposition 1 shows that the MPC depends on the *sign* of the income change. To gain intuition for this result, suppose y_0 increases by a fraction ϵ. This increase does not move planned savings, but it moves planned consumption by ϵy_0. The increase in planned consumption relaxes the dissaving constraint and additional consumption is not penalized up to an increase of ϵy_0. Hence, as long as the household does not want to increase consumption beyond the increase in income, we recover the standard MPC without mental accounting. Now suppose y_0 decreases by a fraction ϵ. Again, this decrease does not move planned savings, but it reduces planned consumption by ϵy_0. Any consumption beyond planned consumption is now

Figure 4: Illustration of MPC asymmetries with mental accounting



penalized by $1 - \lambda$ in terms of marginal utility. This results in an MPC out of losses that is higher than the MPC out of gains. Figure 4 illustrates the mechanics graphically through shifts of the kink in the utility function that are generated by mental accounting preferences.

Compared to the mental accounting model in Graham and McDowall (2024), which predicts that MPCs out of anticipated income gains exceed those out of anticipated income losses, Proposition 1 suggests the opposite asymmetry for unanticipated income changes. This highlights the role of two distinct margins: the difference between anticipated and unanticipated income changes, and the design of the savings rule. For example, under the savings rule in Graham and McDowall (2024), $a^{plan} = Ra$, the assumption of zero initial wealth implies $a_0^{plan} = 0$, so the mental accounting constraint never binds and the resulting MPC is symmetric.

The magnitude of the asymmetry in the model depends on the degree of dissaving-aversion λ and the size of the shock ϵ. When $\lambda = 0$, the model collapses to the standard benchmark with symmetric MPCs. When $\lambda = 1$, the MPC out of losses is 1, and households behave as hand-to-mouth in response to negative shocks. The next result explores in detail how the asymmetry varies with the size of the income shock ϵ.

Corollary (MPC and shock size): MPC^- is decreasing in the size of the income shock, $\frac{\partial MPC^-}{\partial \epsilon} > 0$, for any level of dissaving-aversion $\lambda \in (0, 1]$ and income shock $\epsilon \in (-1, 0)$. MPC^+ is independent of the size of the shock.

Proof. Follows directly from taking derivatives with respect to ϵ in expression 11. See Appendix B.4. $\square$

The corollary shows that MPC^- declines as the size of the loss increases, while MPC^+ is unaffected. Intuitively, a larger income loss reduces planned consumption more strongly, which raises the marginal utility of consuming above the plan and dampens the adjustment. As a result, households cut spending less in relative terms, leading to a smaller MPC^- and an asymmetry that shrinks with shock size. The negative relation between MPC^- and shock size contrasts with standard models with liquidity constraints which typically predict the opposite. An alternative interpretation of the size gradient, not captured in this simple framework, is that larger shocks may induce agents to update their savings plans, i.e. classify part of the income change in their mental accounts for assets (due to increased salience, for example). This would bring behaviour closer to the predictions of a conventional model.

The next two propositions illustrate that the mental accounting model also makes predictions about the MPC out of wealth and income news that are consistent with the empirical evidence. To accurately compare the MPC out of wealth with the previously derived MPC out of income, I add an initial level of wealth w_0 to the household problem to be able to study proportional changes to wealth. Since changes in wealth are assigned to the mental account for assets, the saving plan moves one-to-one with the wealth shock, i.e. $a_0^{plan}(w_0+\epsilon w_0) = a_0^{plan}(w_0)+\epsilon w_0$.

Proposition 2 (MPC out of wealth): The MPC out of wealth, $\frac{\Delta c_0}{\Delta w_0}$, is smaller than the MPC out of income:

$$MPC^{+,wealth} = \frac{\Delta c_0}{\Delta w_0} = \max\left\{\frac{1}{1+\beta}\left(\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon}\right), 0\right\} < MPC^{+}$$

$$MPC^{-,wealth} = \frac{\Delta c_0}{\Delta w_0} = \frac{1}{1+\beta} < MPC^{-}$$

for any level of dissaving-aversion $\lambda \in (0,1]$ and $|\epsilon| \in (0,1)$

Proof. See Appendix B.4. □

Proposition 2 states that wealth shocks generate smaller MPCs than income shocks, both for gains and losses. While many theoretical explanations of low MPCs out of wealth are based on liquidity differences between income and wealth, the mental accounting model introduces non-fungibility by assigning income and wealth shocks to different mental accounts, i.e. through differential responses of the savings plan. Because unexpected changes in wealth shift the savings plan one-to-one and therefore leave planned consumption unchanged, consuming out of additional wealth is penalized and yields lower MPCs than for income gains. Similarly, because planned consumption is unchanged, wealth losses require lower cuts in consumption than income losses, yielding again lower MPCs.

Turning to income news, I assumed that future income changes are assigned to neither of the two mental accounts. Consequently, the savings rule does not adjust, i.e. $a_0^{plan}(y_1+\epsilon y_1) = a_0^{plan}(y_1)$. For current income shocks, this meant that planned consumption shifted through the budget constraint, expanding the set of choices that avoided the dissaving penalty. In contrast, when only future income changes, the current budget constraint is unaffected and c_0^{plan} remains fixed.[13] This yields the following result.

Proposition 3 (MPC out of income news): The MPC out of income news, $\frac{\Delta c_0}{\Delta y_1}$, is lower than

[13] Intuitively, one may think of income news as entering a third mental account, corresponding to future income.

the MPC out of contemporary income changes:

$$MPC^{+,news} = \frac{\Delta c_0}{\Delta y_1} = \max\left\{\frac{1}{1+\beta}\left(\frac{1+\epsilon}{R\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{R\epsilon}\right), 0\right\} < MPC^{+}$$
$$MPC^{-,news} = \frac{\Delta c_0}{\Delta y_1} = \frac{1}{R(1+\beta)} < MPC^{-}$$

for any level of dissaving-aversion $\lambda \in (0,1]$, income change $|\epsilon| \in (0,1)$ and gross interest rate $R \geq 1$.

Proof. See Appendix B.4. □

Proposition 3 implies that MPCs out of income news are smaller than MPCs out of current income changes. Standard models with borrowing constraints can generate lower MPCs out of positive income news for liquidity-constrained households, but not for unconstrained households and neither for constrained nor unconstrained households in the case of negative income news.[14] By contrast, the mental accounting model generates low MPCs out of news for all households without relying on liquidity constraints. The key mechanism is the non-fungibility between current and future income, introduced through their assignment to different mental accounts. Since future income shocks leave both the savings plan and planned consumption unchanged, any increase in consumption is penalized in response to positive news. Similarly, maintaining the current consumption level is not penalized in response to negative income news, unlike in the case of current income losses.

Due to the simplicity of the setting, the analytical model does not speak directly to empirical facts one and five, i.e. large MPCs out income gains and the relevance of liquidity constraints. Section 5 therefore introduces a richer life-cylce model of mental accounting that jointly addresses all five empirical facts and allows for direct comparisons with conventional models that feature borrowing constraints and income risk. Before turning to the model, I provide some empirical support for the assumption of savings rules as a proxy for mental accounting behaviour.

4.4 Validation

Suggestive evidence for the existence of savings rules comes from survey responses in the SCE. Table 2 shows that roughly two thirds of households report keeping a budget or planning their savings. Reported planning behaviour, however, is heterogeneous across the distribution of net liquid wealth: wealthier households are less likely to plan their savings, with just over half of households in the top quintile reporting that they do so.

The data permit a partial test of the prediction in Proposition 1 by comparing the MPCs of households that report having a savings plan to those that do not. Table 3 presents regression results indicating that households who explicitly state that they keep a budget or follow a

[14] Except for minor differences due to discounting of future income receipts.

Table 2: Share of households with budget or savings/debt repayment plan

Percentile of net liquid wealth distribution	0-20	20-40	40-60	60-80	80+
Keeps budget (in %)	68.0	66.1	72.0	65.9	59.6
Has savings/debt repayment plan (in %)	68.7	66.2	59.1	64.7	53.3

Notes: Households are coded as keeping a budget if they answer the following question with yes: "Do you have a (family) budget, or otherwise plan your monthly spending and saving?" Households are coded as having a savings/debt repayment plan if they answer either of the following questions with yes: "People budget in different ways. Do you (and your family) generally try to focus more on trying to save regular amounts of money?" or "People budget in different ways. Do you (and your family) generally try to pay off regular amounts of debt?"

Table 3: MPCs and savings plans

	MPC^{Asy}	MPC^{Asy}
Keeps budget	0.106***	0.092***
	(0.017)	(0.019)
Has savings/debt repayment plan only	0.070***	0.047*
	(0.018)	(0.020)
R^2	0.02	0.06
Controls	NO	YES
Observations	4009	3341

Notes: Households are coded as keeping a budget if they answer the following question with yes: "Do you have a (family) budget, or otherwise plan your monthly spending and saving?" Households are coded as having a savings/debt repayment plan only if they answer "yes" to either "People budget in different ways. Do you (and your family) generally try to focus more on trying to save regular amounts of money?" or "... try to pay off regular amounts of debt?" but not if they answer "yes" to "... try to keep your spending within a certain limit?". Controls include net liquid wealth, income, housing status, age and income expectations. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Observations are weighted using survey weights.

savings plan exhibit more asymmetric MPCs. This pattern holds both unconditionally and after controlling for a set of covariates. Interpreting savings plans as a valid proxy, this evidence suggests that households subject to mental accounting differentiate more sharply between positive and negative income changes in their consumption responses.

5 A quantitative model with mental accounting

This section incorporates mental accounting into a life-cycle model with idiosyncratic income risk and borrowing constraints. Enriching the model along these dimensions generates new predictions about MPCs that were not captured in the stylized framework and allows me to test how well the model matches quantitatively the empirically observed consumption responses.

5.1 Model environment

Time is discrete. The economy is populated by a continuum of households, indexed by i. Households live for J periods and work for J^R periods after which they retire. While working, households receive a stochastic income $y_{i,t}$. Households can save in a risk-free asset a that pays an interest rate r. Borrowing is not allowed in this economy, i.e. $\underline{a} = 0$. Households have mental accounting preferences given by:

$$u^{MA}(c_{i,t}) = u(c_{i,t}) - \lambda_0 e^{a_{i,t}\lambda_1} d(a_{i,t+1}, a_{i,t+1}^{plan}) \tag{12}$$

Relative to the two-period model, I allow the strength of the dissaving-aversion parameter to vary with the household's asset position.[15] In particular, dissaving-aversion is modelled as an exponential function with level parameter λ_0 and decay parameter λ_1. This allows the model to flexibly capture two potential features: the covariance between wealth and dissaving-aversion at the intensive margin, i.e. the same household exhibiting different degrees of dissaving-aversion for different levels of wealth and, at the extensive margin, different shares of behavioural relative to fully rational households at different levels of wealth. Stango and Zinman (2023), for example, show that households living in worse financial conditions have stronger behavioural biases.

Log income is given by a deterministic life-cycle component $\bar{y}$ and a stochastic component that is modelled as a persistent-transitory process, where the persistent component follows an AR-1 process. The innovations to the persistent and transitory component are orthogonal to each other and independent over time and across households.

$$\log Y_{i,t} = \bar{y}_t + z_{i,t} + e_{i,t} \tag{13}$$

$$z_{i,t} = \rho_z z_{i,t-1} + u_{i,t}, \quad u_{i,t} \sim N(0, \sigma_z^2) \quad e_{i,t} \sim N(0, \sigma_e^2) \tag{14}$$

This yields the following recursive formulation:

$$V(j, z, e, a) = \max_{c,a'} u^{MA}(c) + \beta \mathbb{E} V(j+1, z', e', a') \tag{15}$$

$$\text{s.t.} \quad c + a' = (1+r)a + y, \quad a' \geq \underline{a} \tag{16}$$

where j denotes age.

The final element that needs to be defined is the savings plan, which partitions the mental accounts for income and assets. To do so, I generalize the rule from the stylized framework in Section 4. I again specify the savings plan as the optimal savings policy from the equivalent household problem without mental accounting preferences. To be consistent with the idea that income windfalls are classified as income, I select the savings policy in which the transitory

[15] Note that furthermore, a_{t+1} now denotes the choice of savings in period t that is carried over into $t+1$ instead of a_t.

shock is set to zero, i.e. the savings plan does not respond to transitory income changes:

$$a_{i,t}^{plan} = \tilde{a}^*(j, z, e = 0, a) \quad \text{from} \quad \tilde{V}(j, z, e, a) = \max_{c,a'} u(c) + \beta \mathbb{E} \tilde{V}(j+1, z', e', a') \quad \text{s.t.} \tag{16}$$

Compared to the previous savings rule, this rule is more sophisticated as households additionally consider their current age and asset position, state variables that did not feature in the stylized model when forming their savings plan. The role of income, in turn, is preserved. Transitory income changes do not affect the saving rule and are classified as income, whereas persistent changes are allowed to shift in the saving rule.[16] Intuitively, this formulation preserves the heuristic nature of the savings plan while allowing households to update their mental accounts in response to economically meaningful events.

5.2 Calibration

Table 4 provides an overview of the calibrated parameters. I first calibrate several parameters outside of the model. A model period is one year. Households work for 40 years and then spend 20 years in retirement. The interest rate is set to 2 percent. The degree of risk aversion γ is set to 2. The deterministic income component is estimated from PSID data by regressing the logarithm of income on a cubic polynomial in age and time dummies to control for trends in income over time. The persistence and variance of the stochastic processes are taken from Kaplan and Violante (2022). Retirement income depends on the employment history of households. It is determined by the persistent component of income earned in the final period before retirement and fluctuates with the transitory income state. The replacement rate is set to 0.6. Population shares are calibrated to match the age distribution in the SCE sample. Households' initial asset holdings are chosen to approximate the net asset holdings of households in the SCE between ages 25-30.

The parameters β, λ_0 and λ_1 are calibrated using simulated method of moments. The discount factor β is chosen to match the average net wealth-to-income ratio in the SCE sample.[17] The dissaving-aversion parameters λ_0 and λ_1 are jointly disciplined by two moments of the data. The level parameter λ_0 is set to match the average MPC out of income losses. To calibrate the decay parameter λ_1, I use information on the prevalence of savings plans across the wealth distribution from Table 2. In particular, I set λ_1 such that the ratio of dissaving-aversion between the bottom and top quintile of the wealth distribution, $\frac{\lambda(a^{q1})}{\lambda(a^{q5})} = \frac{e^{\lambda_1 a^{q1}}}{e^{\lambda_1 a^{q5}}}$, matches the ratio of households reporting a savings plan between the bottom and top quintiles in the data. This moment is intended to capture heterogeneity in behavioural frictions across the wealth distribution, interpreting the presence of savings plans as a proxy for the intensity of mental accounting behaviour. While this introduces a slight inconsistency between data and model – in the data, some households follow a savings plan while others do not whereas in the model all households do – the dilution of internal and external margin allows me to externally disci-

[16]The analogy to the previous rule is clearer if one considers the persistent component z as the analogue to the deterministic and anticipated income component y_0 in Equation 9.

[17]Calibrating the model to net liquid wealth instead of net total wealth yields qualitatively similar results.

Table 4: Calibration

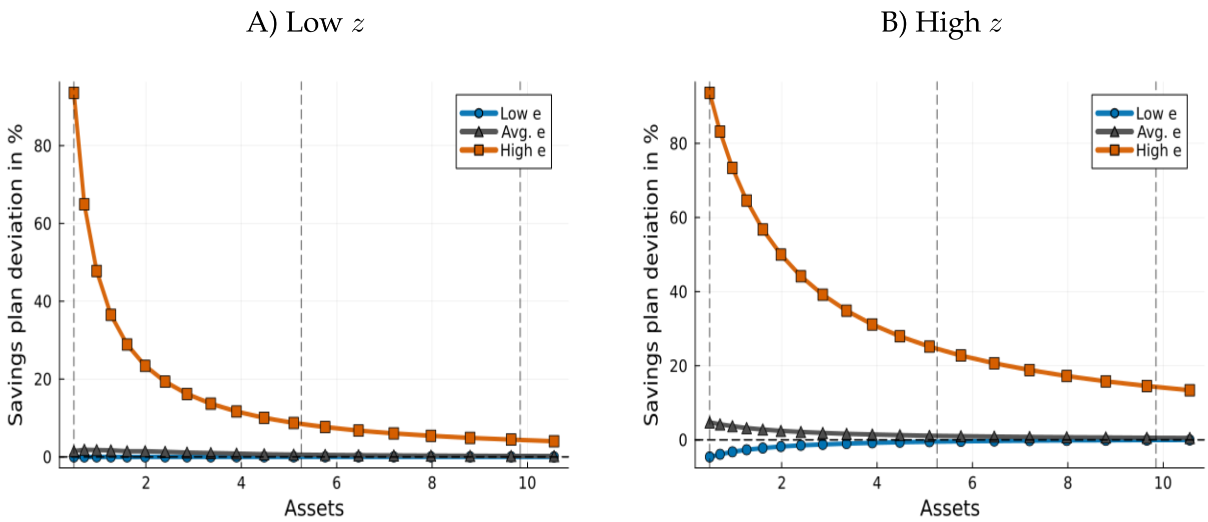
Parameter	Description	Value	Source/Target
External			
γ	Risk aversion	2	Standard
J	Length of life-cycle	60	Standard
J^R	Length of working-life	40	Standard
$\bar{y}$	Life-cycle income profile	Cubic polynomial	PSID
ω	Replacement rate	0.6	Standard
r	Interest rate	0.02	Standard
ρ_z	Persistence of z_t	0.953	PSID (Kaplan and Violante, 2022)
σ_z^2	Variance of innovation in z_t	0.0422	PSID (Kaplan and Violante, 2022)
σ_e^2	Variance of e_t	0.0494	PSID (Kaplan and Violante, 2022)
$\underline{a}$	Borrowing limit	0	Standard
Internal			
β	Discount factor	0.93	Avg. net wealth-to-income
λ_0	Dissaving aversion - level	0.69	Avg. MPC^-
λ_1	Dissaving aversion - decay	-0.015	Top-bottom ratio of households with savings plan

pline the gradient of the dissaving-aversion motive without explicitly targeting the MPC. The moment selection is overall conservative in the sense that I target neither the MPC out of gains, the asymmetry of MPCs nor the behaviour of MPCs across the wealth distribution.

The level parameter of the dissaving-aversion motive λ_0 is calibrated to 0.69, with a moderate decay in wealth of $\lambda_1 = -0.015$. The average level of dissaving-aversion across the simulated households of $\bar{\lambda} = 0.63$ is below the one estimated in Graham and McDowall (2024) who finds a value of 0.80. This is not surprising given that the models are not only structurally different across several dimensions – the share of households subject to mental accounting frictions, the specification of the savings rule, the dissaving-aversion motive and other life-cycle components – but are also calibrated based on different moments. Table C1 of the Appendix shows that the model matches the targeted data moments exactly.

Before turning to the model's predictions for MPCs, it is useful to inspect the relation between planned and actual savings, a fundamental building block for consumption-savings decisions in the mental accounting framework. Figure 5 illustrates how the actual savings decision $a^*(j, z, e, a)$ deviates from the savings plan $a^{plan}(j, z, e, a)$ for a household aged $j = 20$ across different income realizations and asset levels. Households save more than prescribed by their plan when facing a positive transitory income shock and less when facing a negative shock. More importantly though, the deviations are asymmetric: across both low and high persistent income states, the excess savings in the case of a positive income shock are substantially higher than the negative deviation in the case of a negative shock. This tendency is further exemplified by the positive savings deviation in the case of the average transitory income shock in which $e = 0$. The asymmetry in savings plan deviations reflects the asymmetric nature of the dissaving cost, which effectively concavifies the utility function and leads households to accumulate more savings on average than in a model without mental accounting.

Figure 5: Deviations from the savings plan



Notes: This figure reports savings plan deviations, computed as $\frac{a' - a^{plan}}{a^{plan}}$, for a household aged $j = 20$ across different levels of transitory income and wealth. The left panel reports the deviation for a household with a low, the right panel for a household with a high persistent income realization. Low and high values of e are defined as two standard deviations below and above the mean, respectively. The dashed vertical lines indicate the 30th, 50th and 70th percentile of the asset distribution.

5.3 MPCs in the mental accounting model

How well does the calibrated model match the empirical evidence on MPCs? To mirror the SCE survey design, I compute MPCs out of income gains and losses by simulating households' consumption responses to an exogenous and transitory 10 percent increase or decrease in income.

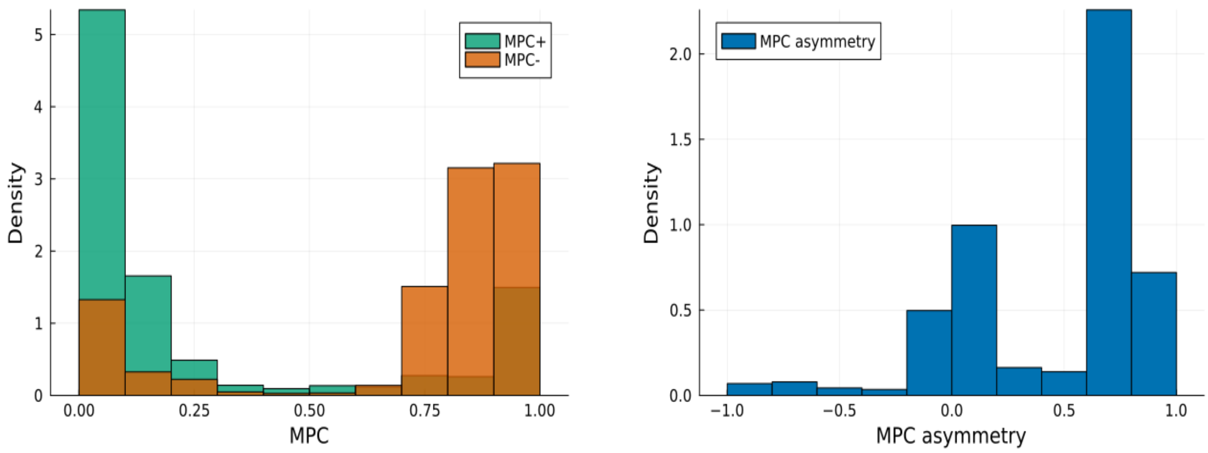
MPC asymmetry. As a first test, Figure 6 reports the model-implied distribution of MPCs. The left panel shows large MPCs out of losses that are concentrated at high values above 0.7, while MPCs out of gains are much smaller, with most mass below 0.3. This closely mirrors the empirical distributions reported in Figure 1. The right panel plots the difference between the MPCs out of losses and gains and shows that the model also replicates the MPC asymmetry at the household level. A large share of households has very asymmetric MPCs of close to one. At the same time, some households exhibit nearly symmetric MPCs, consistent with permanent income behaviour.

Figure 7 examines heterogeneity across the wealth distribution. As in the data, asymmetries are sizeable at all levels of wealth. The model generates an average asymmetry of 0.44, compared to 0.53 in the data.[18] Inspecting MPCs out of income gains and losses separately reveals that both are moderately decreasing in wealth. They are somewhat larger for liquidity-constrained households, but remain at high levels for unconstrained households.

To contrast the predictions of the mental accounting model with a standard model without mental accounting, I solve a version of the model in which $\lambda = 0$, i.e. a one-asset model with borrowing constraints and income risk. Since mental accounting preferences affect the wealth

[18] Using the mapping from MPX to MPC discussed in Section 3.2, the data-based asymmetry is 0.38.

Figure 6: Distribution of model MPCs



Notes: MPCs are computed by simulating a transitory 10% income shock. MPC asymmetry denotes the difference between the MPC out of losses and gains. Due to numerical error in the simulation of MPCs, some households have MPCs that are marginally below 0 or above 1. These are recoded to 0 and 1, respectively.

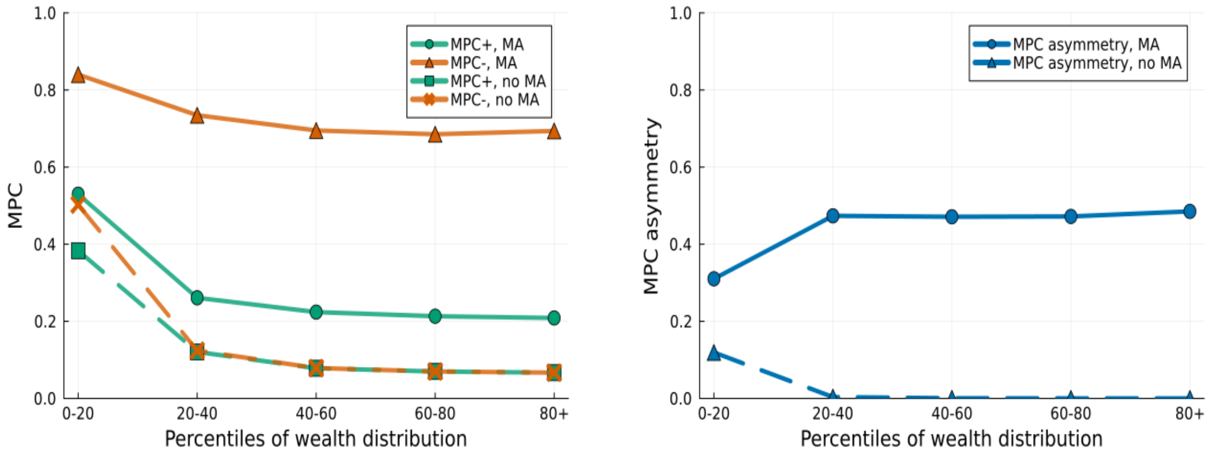
distribution, I recalibrate the discount factor in the model without mental accounting to match the same average net wealth-to-income ratio. A comparison of the two models illustrates the relevance of mental accounting. The standard model generates much smaller MPCs out of income losses and, as a result, produces little to no asymmetry between gains and losses except near the borrowing constraint.

MPC out of gains. The mental accounting model also generates higher MPCs out of gains than a model without mental accounting, and this holds across the entire wealth distribution, not just near the borrowing limit. Intuitively, mental accounting introduces an additional constraint on consumption, which tends to suppress spending relative to a frictionless benchmark. Positive income shocks relax this constraint and lead to large consumption responses, similarly to the mechanics of a borrowing constraint. In this way, mental accounting helps explain why even households with substantial liquid wealth exhibit large consumption responses to income windfalls.

MPC and liquidity constraints. The mental accounting model preserves the traditional role of liquidity constraints in generating large MPCs, but it adds another channel through which consumption becomes sensitive to income changes. Unlike liquidity constraints, which operate through external borrowing limits, mental accounting frictions arise from households' internal savings rules. Because these rules depend on planned rather than actual liquidity, households may exhibit large MPCs even when they hold substantial assets. In this way, mental accounting weakens the tight empirical link between MPCs and liquidity and helps explain why the relationship often appears muted in the data.

One factor determining the wealth gradient of the MPC is the size of the income shock. Figure 8 compares consumption responses to a 3% and 30% income change and shows that size affects both the level and the wealth gradient of the MPC. Larger shocks amplify asymmetries in the mental accounting framework, primarily through stronger responses to income losses. This suggests that different shock sizes may reconcile why empirical estimates of MPC

Figure 7: Model MPCs across the wealth distribution



Notes: MPCs are computed by simulating a transitory 10% income shock. Solid lines denote MPCs from the mental accounting model (MA), dashed lines denote MPCs from the model without mental accounting (no MA).

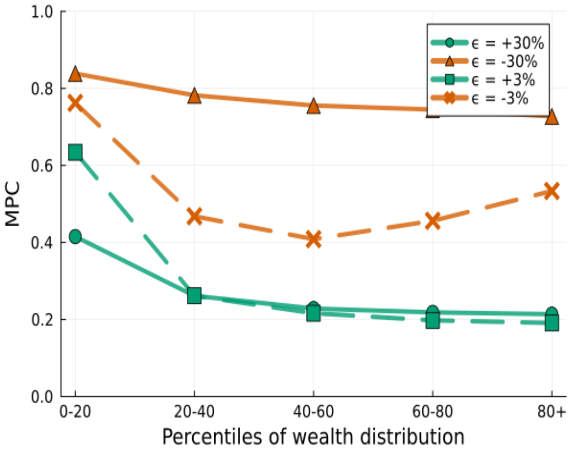
asymmetries differ across studies. For instance, Fuster et al. (2021) find an average asymmetry of 0.25 – about half the size found in this paper – but study a much smaller shock ($500 vs. 10% of annual income). In fact, the 3% shock in Figure 8 produces an average asymmetry of 0.23, closely aligned with their result.

At first sight, these findings seem at odds with the analytical model, which implied that MPCs out of losses decline with shock size. The difference arises because in the stylized setting households were exactly at the mental accounting constraint, whereas in the quantitative model some are above and some below it. A larger shock pushes more unconstrained households into the constrained region, raising their MPCs. This compositional effect dominates the decline among already-constrained households, leading to higher average MPCs out of losses for larger shocks.

Shock size also matters for the wealth gradient of MPCs out of gains. In the model, larger shocks flatten the gradient, consistent with recent empirical evidence from Andreolli and Surico (2021), who show that MPCs out of gains decline with wealth for small shocks but are flat for large shocks. They explain this finding with non-homothetic preferences, but mental accounting produces qualitatively similar patterns. Quantitatively, however, the model still predicts MPCs that are too high at the lower end of the wealth distribution, because it abstracts from household debt. As shown in the empirical analysis, debt depresses MPCs and can offset the effect of liquidity constraints. Extending the model with a wedge between borrowing and saving rates, or with motives for co-holding debt and assets, would further flatten the slope of MPCs across wealth (Kosar et al., 2023; Boutros and Mijakovic, 2024).

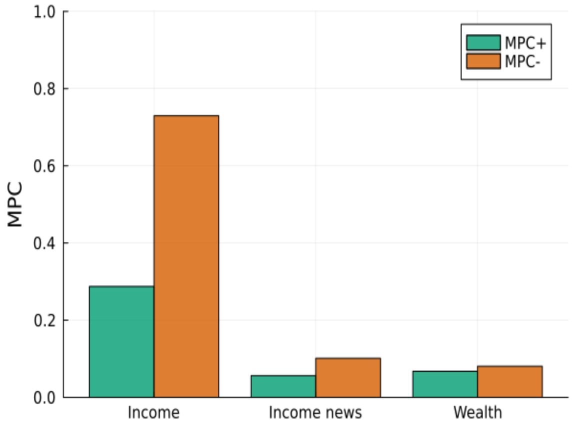
MPC out of income news. Figure 9 compares consumption responses to news about an income shock one period ahead with responses to a contemporaneous income shock. As in the stylized theoretical framework, the news shock affects neither the mental account for income nor assets. Consistent with the analytical predictions, the mental accounting model generates much smaller MPCs out of income news than out of current income. The sign asymmetry ob-

Figure 8: Model MPC by size of income shock



Notes: MPCs are computed by simulating transitory proportional income shocks of different sizes.

Figure 9: Model MPC out of wealth and income news



Notes: MPCs are computed by simulating (i) a transitory 10% shock to current income, (ii) news about a 10% shock to income next period and (iii) a 10% shock to current wealth.

served for contemporaneous shocks also carries over. This aligns with the empirical evidence in Fuster et al. (2021) who find larger consumption adjustments in response to negative than to positive income news. In contrast, the model without mental accounting generates meaningful differences only for liquidity-constrained households facing income gains, but not otherwise.[19]

MPC out of wealth. The model also predicts low MPCs out of wealth. As shown in Figure 9, the average MPC out of both wealth gains and losses is several times smaller than the corresponding MPC out of income. Since the wealth shock is classified into the mental account for assets, planned consumption remains unchanged, thereby dampening the spending response. The model without mental accounting, instead, treats wealth and income as fully fungible and therefore produces identical MPCs out of the two. While adding transaction costs can lower MPCs out of illiquid wealth, it cannot explain the low MPCs observed for liquid wealth. The mental accounting model matches this feature naturally, as the classification mechanism applies regardless of the degree of liquidity.

5.4 Discussion

The role of λ. How should we interpret the size of λ? Direct welfare comparisons between households with and without mental accounting are problematic because preferences differ across the two settings. An alternative approach consists of quantifying the distortions induced by mental accounting. To this end, I simulate households in the model without mental accounting, but force them to follow the policy functions of households with mental accounting. I then calculate the consumption-equivalent compensation required to be as well off as

[19] Druedahl et al. (2022) find that households that are not liquidity-constrained respond immediately to the receipt of news about future income in the context of mortgage payments. Differently to the transitory shock studied here, these changes are persistent and are therefore not necessarily inconsistent with the mental accounting framework.

the households that follow the optimal decision rules without mental accounting. The implied distortion corresponds to a lifetime consumption loss of about 0.64 percent.

Another perspective is to consider the broader implications for wealth and consumption dispersion or life-cycle dynamics. Appendix Figure C1 shows that the mental accounting model does not materially change household behaviour along these dimensions. Both the cross-sectional dispersion and the life-cycle profile of wealth and consumption are similar across the economies with and without mental accounting. This reflects the fact that mental accounting primarily affects the response to transitory, but not to persistent changes. Adding this extra degree of freedom thus improves the model's fit to the data on transitory consumption responses without compromising its performance elsewhere.

Finally, how important is heterogeneity in λ? In the baseline model, dissaving-aversion declines with wealth to reflect observed heterogeneity in behavioural biases. Panel A of Appendix Figure C2 compares this baseline with a model where λ is held constant at its average value. At first glance, the two models generate similar levels of MPCs out of gains and losses. Qualitatively, however, the constant-λ specification produces an upward-sloping profile of MPCs out of losses with wealth at higher wealth levels – contrary to the empirical evidence. This suggests that while heterogeneity in λ may not be essential for matching average MPCs, it is important for replicating the wealth gradient in the data.

Alternative saving rules. While the savings rule used here is motivated by established behavioural theories, one can imagine alternative rules that households might follow. A prominent example is the simple rule-of-thumb $a^{plan} = (1 + r)a$ proposed in Graham and McDowall (2024). Under this rule, all wealth is earmarked for saving and all income for spending.

Replacing the baseline rule with this simpler one produces very different predictions. As shown in Panel B of Appendix Figure C2, the simple rule generates overall high MPCs but negligible asymmetries, in contrast to the large asymmetries documented in the SCE. This difference arises because the two rules imply very different saving plans (see Appendix Figure C3) and the distance from the savings plan determines the strength of the mental accounting friction. The baseline rule adjusts flexibly with age and persistent income shocks, keeping actual and planned savings relatively close. By contrast, the simple rule is rigid. It depends only on current wealth, so deviations from the plan are systematically larger and distort consumption–savings choices more strongly.

An older household illustrates the mechanism. Under the simple rule, all existing wealth is mechanically assigned to the asset account, so the household is effectively required to keep saving even late in life, when it would normally want to draw down retirement assets. This rigid classification pushes actual savings far below the plan, creating very large consumption adjustments to both gains and losses. By contrast, the baseline rule takes the household's life-cycle stage into account, allowing the savings plan to decline in retirement. As a result, actual and planned savings remain closer, and the model generates the asymmetric MPCs observed in the data.

Panels C and D of Appendix Figure C2 show MPCs with two alternative savings rules:

a naive rule, where the household ignores both persistent and transitory changes ($a^{plan} = \tilde{a}^*(j, z = 0, e = 0, a)$), and a sophisticated rule, where it incorporates both persistent and transitory income realizations into the savings plan ($a^{plan} = \tilde{a}^*(j, z, e, a)$). Under the naive rule, households display large MPCs but little asymmetry. As with the simple rule $a^{plan} = (1 + r)a$, deviations from the savings plan are large and distort consumption strongly. Under the sophisticated rule, by contrast, MPC asymmetries become even larger than in the baseline. Because transitory income changes are taken into account, actual and planned savings are even more closely aligned, amplifying the asymmetry.

Portfolio adjustment costs. A simple savings rule where all wealth is earmarked for saving and all income for spending may appear similar to an asymmetric portfolio adjustment cost. In both cases, accessing wealth is costly while accumulating it is not. To test whether such costs can generate meaningful MPC asymmetries, I solve a version of the model without mental accounting but with the assumption that any reduction in the stock of assets incurs a monetary cost. This is not necessarily consistent with the empirical setting where liquid wealth is in principle costless to access, but serves as a useful thought experiment.

Panel E of Appendix Figure C2 reports MPCs from a model with a small (one tenth of monthly income) and a large (one half of monthly income) adjustment cost, broadly in line with the fixed costs considered in Kaplan and Violante (2014). While MPCs are larger than in a model without costs, the model fails to reproduce the empirically observed asymmetry, regardless of the cost size. In particular, it struggles to generate large MPCs out of losses. This is not surprising. Households that are net savers – for example, in mid-life or after a high income realization – can smooth a negative shock by reducing flow savings without drawing down assets and paying the adjustment cost. Net borrowers – such as retirees or households with low income – already incur the cost by decumulating assets. An additional loss does not impose extra costs, so they also smooth consumption.

6 Implications for fiscal policy

Large asymmetries in MPCs have important implications for the design of fiscal policies, in particular for redistributive measures. The commonly held view that redistribution from high to low-income households stimulates aggregate demand by reallocating resources from low to high-MPC households does not necessarily apply. If high-income households have large MPCs out of income losses, their reduction in consumption may more than offset the increase in consumption by low-income households. To assess the quantitative significance of this argument, this section compares the effectiveness of fiscal transfers under different financing schemes.

I evaluate a policy in which the government provides targeted lump-sum transfers to the bottom half of the income distribution. The transfer size is calibrated to roughly match the stimulus checks distributed under the COVID-19 relief package in the United States.[20] I then

[20] Eligible individuals received $1,400 ($2,800 for married couples), plus an additional $1,400 per eligible child. With an average household size of about 2.5, this implies a payment of roughly $3,500 per household. This amounts

consider three alternative financing schemes: (i) a contemporaneous one-off proportional income tax on the top quartile of the income distribution, (ii) a future income tax of the same design which is announced contemporaneously and implemented one period later and (iii) a one-off proportional wealth tax on the top quartile of the wealth distribution.

Figure 10 reports the contemporaneous percentage change in aggregate consumption following the introduction of the transfer policy under each financing scheme. For comparison, it also shows results from a model without mental accounting preferences.

The first policy design illustrates that redistributive measures can be less effective when MPCs are asymmetric. When transfers are financed through a contemporaneous income tax on the top quarter of the income distribution, aggregate consumption in the mental accounting model actually *falls* by 0.01 percent. The reduction in spending by high-income households, who exhibit large MPCs out of losses, fully offsets the additional spending by transfer recipients. By contrast, in the model without mental accounting, redistribution raises aggregate consumption.

The second design underscores the importance of timing. Financing the transfers through a future rather than current income tax yields a larger contemporaneous increase in aggregate consumption, since consumption is less sensitive to changes in future income than to current income. Relative to the model without mental accounting, the mental accounting model predicts a stronger response, primarily because MPCs out of income gains are larger. Note, however, that this exercise abstracts from the dynamic response of aggregate consumption, which depends on the consumption response to expected income changes and the intertemporal MPC.

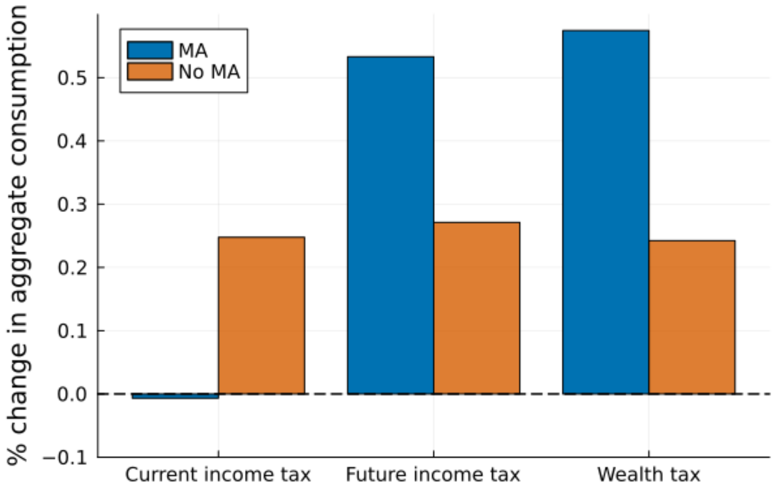
The third policy design suggests that also the type of tax matters. Financing transfers with a wealth tax instead of an income tax generates a larger increase in aggregate consumption, as consumption is less sensitive to wealth changes than to income changes. Again, this policy is more effective in the mental accounting model since MPCs out of income gains are larger.

This fiscal policy exercise illustrates how the type and timing of financing shape aggregate outcomes when households hold mental accounts. At the same time, the results are suggestive of broader aggregate effects. If asymmetric consumption responses at the individual level translate into asymmetric responses in the aggregate, mental accounting could be one potential explanation for asymmetric fiscal multipliers. For example, Barnichon et al. (2022) document that fiscal contractions trigger larger consumption responses than fiscal expansions.[21]

to around five percent of median income in the SCE sample, and therefore around half the size of the hypothetical 10 percent shock for the median household.

[21] Ben Zeev et al. (2023) also find larger responses to negative than to positive fiscal shocks, but these differences do not translate into asymmetric multipliers.

Figure 10: Effects of redistributive fiscal transfers under different financing schemes



Notes: This figure reports the contemporaneous change in aggregate consumption following lump-sum transfers to the bottom 50 percent of the income distribution financed by a (i) one-off proportional income tax on the top 25 percent of the income distribution, (ii) the announcement of a one-off proportional income tax on the top 25 percent of the income distribution one period ahead and (iii) a one-off proportional wealth tax on the top 25 percent of the wealth distribution. MA refers to the model with mental accounting, no MA to the one without. Scenario (i) and (ii) require a 3.7% tax, scenario (iii) a 0.7% tax.

7 Conclusion

This paper proposed a simple extension of the standard consumption framework that incorporates mental accounting. The framework resolves several empirical puzzles in the consumption literature without relying on theories of liquidity constraints, including the excess sensitivity of consumption to contemporaneous income changes and the muted response to changes in wealth or news about future income. At the same time, mental accounting also generates larger consumption responses to income losses than to gains, a feature of the data that many models fail to capture.

A quantitative evaluation of the mental accounting model illustrated that these mechanisms can have important implications for certain types of fiscal policy. In particular, redistributive transfers may be less effective in stimulating aggregate demand than in a conventional framework when the households financing them sharply reduce consumption in response to income losses. The effectiveness of fiscal policy therefore depends on appropriate targeting on both sides: the allocation of transfers and the design of the financing scheme. More broadly, asymmetric household responses suggest that fiscal contractions may trigger stronger aggregate consumption effects than fiscal expansions, pointing to a potential role for mental accounting in shaping the size and symmetry of fiscal multipliers.

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APPENDIX

A Empirical appendix

A.1 Survey questions

This appendix shows the phrasing of the survey questions and the response options. If households select response option 4-7, they are additionally asked to quantify what percentage they would spend, save or use to pay down debt in case of an income gain, and by how much they would cut spending, savings or increase debt in case of an income loss.

MPC out of income gains: *Suppose next year you were to find your household with 10 percent more income than you currently expect. What would you do with the extra income?*

1. Save or invest all of it
2. Spend or donate all of it
3. Use all of it to pay down debts
4. Spend some and save some
5. Spend some and use part of it to pay down debts
6. Save some and use part of it to pay down debts
7. Spend some, save some, and use some to pay down debts

MPC out of income losses: *Now imagine that next year you were to find yourself with 10% less household income. What would you do?*

1. Cut spending by whole amount
2. Not cut spending at all, but cut my savings by the whole amount
3. Not cut spending, but increase my debt by borrowing the whole amount
4. Cut spending by some and cut savings by some
5. Cut spending by some and increase debt by some
6. Cut savings by some and increase debt by some
7. Cut spending by some, cut savings by some and increase debt by some

A.2 MPC heterogeneity

This section studies MPC heterogeneity across several observable characteristics. Figure A3 shows graphically that MPC asymmetries are present across different income, age and housing status groups. To study the relation between MPCs and individual characteristics more formally, I estimate the following specification:

$$MPC_i^j = \beta_0 + \sum_{k=2}^{5} \beta_k \, \mathbf{1}\{Q_i^{\text{wealth}} = k\} + \gamma' X_i + u_i$$

Table A1: MPCs and household characteristics

	MPC^{Asy}	MPC^{Asy}	MPC+	MPC+	MPC-	MPC-
Net liq. asset quintile 2	-0.042	-0.039	0.023	0.011	-0.019	-0.027
	(0.024)	(0.025)	(0.014)	(0.014)	(0.019)	(0.020)
Net liq. asset quintile 3	-0.045	-0.046	0.054***	0.035*	0.010	-0.011
	(0.026)	(0.027)	(0.016)	(0.017)	(0.020)	(0.020)
Net liq. asset quintile 4	-0.161***	-0.147***	0.079***	0.075***	-0.082***	-0.072***
	(0.026)	(0.027)	(0.015)	(0.015)	(0.020)	(0.021)
Net liq. asset quintile 5	-0.194***	-0.165***	0.081***	0.070***	-0.114***	-0.095***
	(0.027)	(0.029)	(0.015)	(0.016)	(0.022)	(0.023)
Age between 35-55		0.030		0.005		0.035
		(0.023)		(0.014)		(0.018)
Age $>$ 55		-0.042		0.047**		0.005
		(0.025)		(0.015)		(0.020)
Income		-0.015		-0.010		-0.025**
		(0.011)		(0.006)		(0.008)
Mortgager		0.054*		-0.053***		0.000
		(0.023)		(0.013)		(0.018)
Homeowner		0.002		-0.013		-0.011
		(0.024)		(0.015)		(0.019)
Income expectations		0.013		0.008		0.021
		(0.017)		(0.010)		(0.014)
Constant	0.636***	0.769***	0.145***	0.260***	0.782***	1.029***
	(0.017)	(0.117)	(0.009)	(0.070)	(0.014)	(0.089)
R^2	0.03	0.04	0.02	0.04	0.02	0.03
Observations	3444	3341	3444	3341	3444	3341

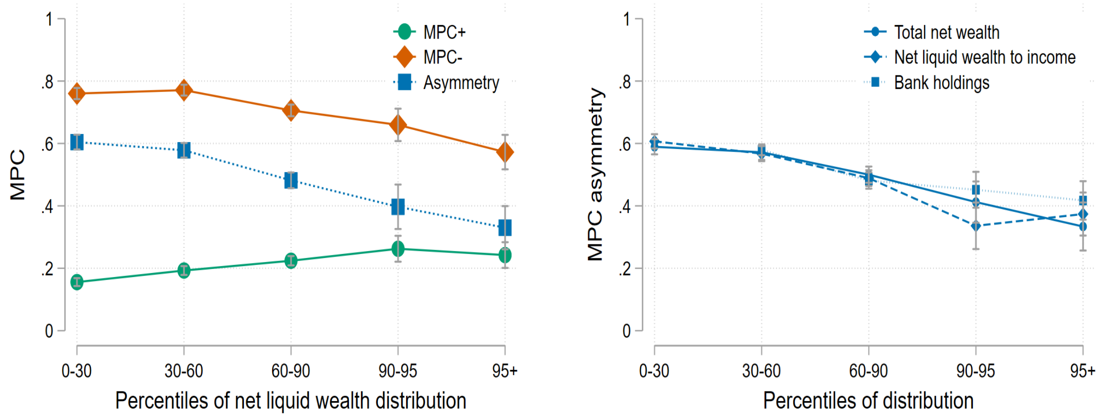
Notes: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Observations are weighted using survey weights. The dependent variables are the MPC asymmetry in columns 1 and 2, the MPC out of gains in columns 3 and 4 and the MPC out of losses in columns 5 and 6.

where MPC_i^j denotes the MPC measure $j \in \{+, -, \text{asymmetry}\}$ for household i, Q_i^{wealth} denotes the wealth quintile of household i, and X is a vector of control variables that are typically considered to affect MPCs.

Table A1 shows that observable characteristics only explain a small share of variation in MPCs. As noted earlier, MPC asymmetries are negatively correlated with net liquid wealth (Column 1). This difference primarily stems from the negative correlation of MPCs out of losses with wealth (Column 5), but also partly the positive correlation between MPCs out of gains and wealth (Column 3). Columns 2, 4 and 6 add controls to the respective specifications. Older households have somewhat lower MPC asymmetries, as well as households with higher income. Households with mortgages have higher MPC asymmetries due to a lower MPC out of income gains. Income expectations do not seem to significantly affect MPCs.

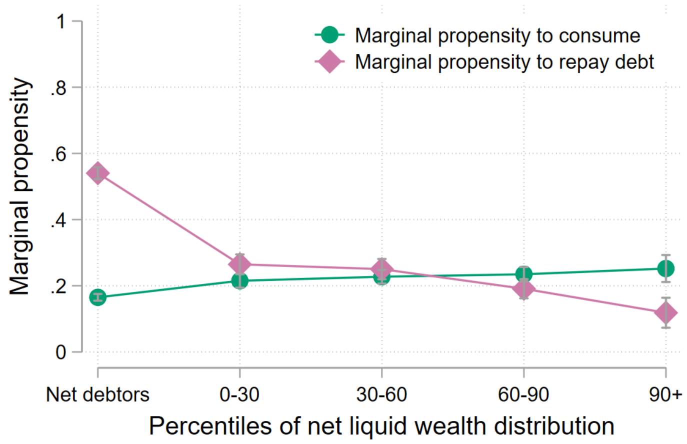
Figure A1: MPCs across the wealth distribution for higher percentiles

A) Net liquid wealth B) Other measures of wealth



Notes: MPC asymmetry is defined as the difference between the MPC out of losses and the MPC out of gains. Grey bars indicate 95% confidence bands. In the right panel, each line corresponds to the MPC asymmetry across the respective distribution. Total net wealth is defined as total assets (liquid assets + retirement funds and housing wealth) - total debt (liquid debt + mortgages). Bank holdings refer to money in checking and savings accounts.

Figure A2: Marginal propensities to consume and repay debt across debtors and creditors

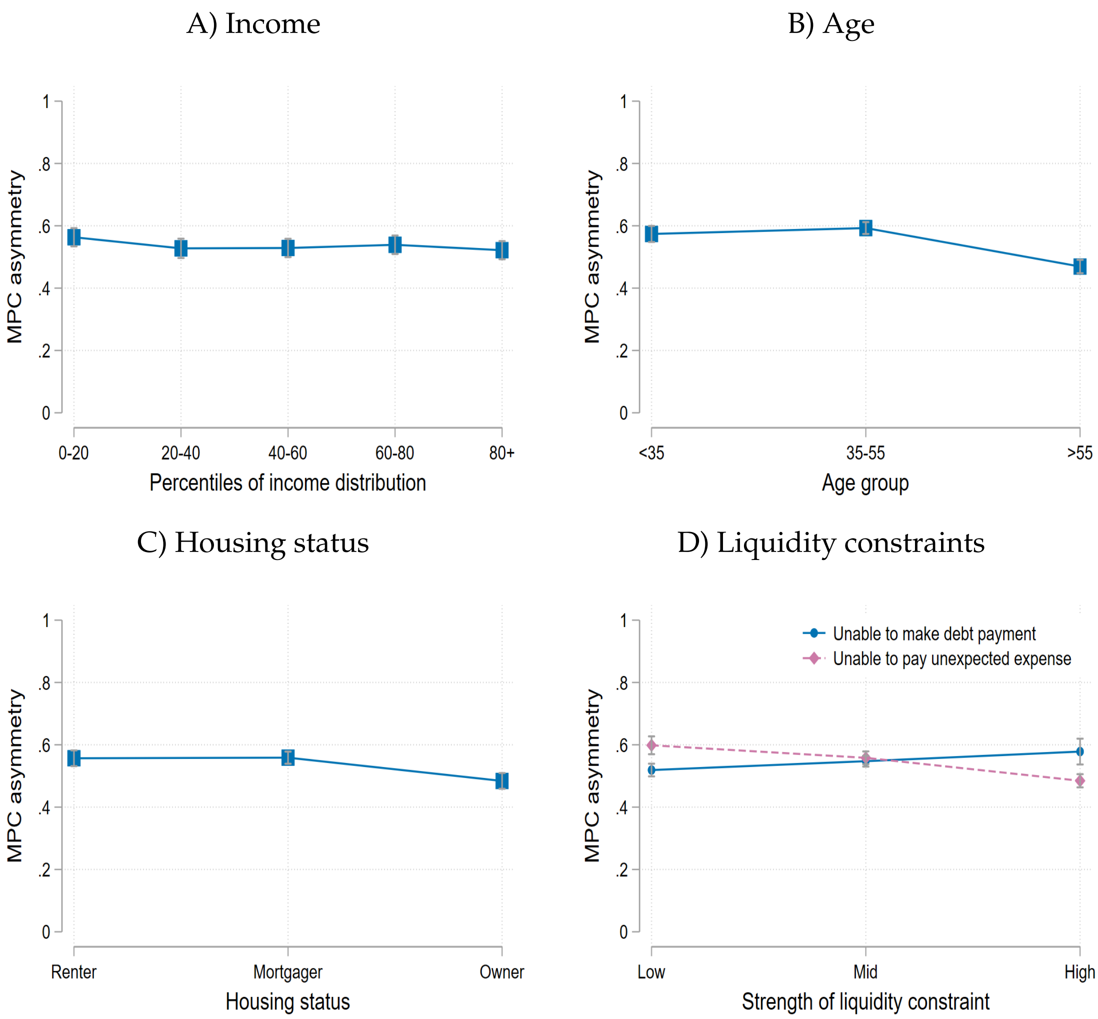


Notes: Net debtors are defined as households that hold net liquid debt. Percentiles of the wealth distribution are computed conditional on holding positive net liquid wealth. Grey bars indicate 95% confidence bands.

A.3 Additional robustness checks

This section collects empirical evidence on the validity of household responses in the SCE. It shows that household spending in hypothetical scenarios is similar to actual spending behaviour, that spending plans predict actual spending decisions and that spending behaviour between financial literate and illiterate households is not too different.

Figure A3: MPC asymmetries across observable characteristics



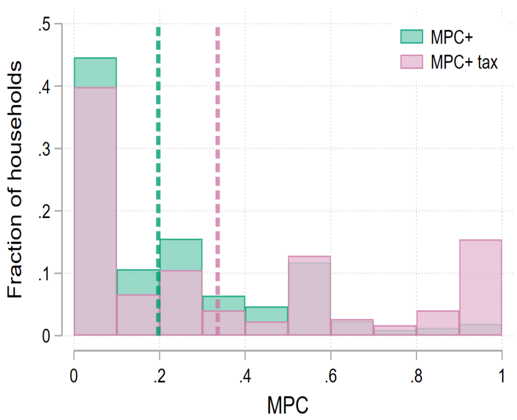
Notes: Grey bars indicate 95% confidence bands. Panel D groups households according to their likelihood of not being able to make a debt payment or come up with $2,000 for an unexpected expense.

Table A2: Planned vs actual expenditure.

	(1) Appliances	(2) Electronics	(3) Furniture	(4) Home repairs	(5) Car	(6) Trips	(7) House
LPM	0.30***	0.37***	0.39***	0.48***	0.41***	0.56***	0.28***
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
Logit	0.20***	0.31***	0.23***	0.37***	0.25***	0.44***	0.08***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
R-squared LPM	0.04	0.05	0.08	0.13	0.07	0.21	0.10
R-squared Logit	0.04	0.04	0.09	0.11	0.07	0.17	0.17
Observations	5704	5693	5683	5691	5673	5690	4741

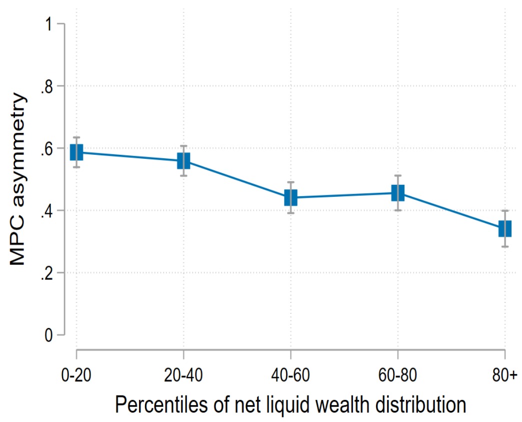
Notes: The table reports estimates of a linear probability model and a logit model in which an indicator variable that denotes the purchase of a good at time t is regressed on the stated probability in t-1 of purchasing that good. Marginal effects are reported for the logit estimates. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure A4: MPCs out of tax refunds versus hypothetical scenarios



Notes: Dashed lines denote the average MPC out of gains and tax refunds, respectively.

Figure A5: MPC asymmetries for most financially literate households



Notes: Grey bars indicate 95% confidence bands. Households are coded as financially literate if they answered all questions about financial literacy correctly. This is the case for around one third of the sample (N=1,382).

B Theory

B.1 Mental accounting model with initial wealth

This section studies the relationship between MPCs and wealth in the mental accounting framework. Introducing initial wealth w yields the following problem:

$$\max_{c_0,c_1} \quad u(c_0) - \lambda d(a_0, a_0^{plan}) + \beta u(c_1)$$
$$\text{s.t.} \quad c_0 + a_0 = y_0 + w; \quad c_1 = Ra_0$$

Solving this problem yields the following consumption allocation:

$$c_0 = \begin{cases} \frac{w+y_0}{1+\beta} & \text{if } c_0 \leq c_0^{plan} \\ \frac{w+y_0}{1+\frac{\beta}{1-\lambda}} & \text{if } c_0 > c_0^{plan} \end{cases}$$

The savings plan is derived as in the benchmark problem and given by $a_0^{plan} = \frac{\beta}{1+\beta}(w + y_0)$. Following the earlier logic, this yields the following MPCs:

$$MPC^+ = \left(\frac{w + y_0 + \epsilon y_0}{1 + \beta} - \frac{w + y_0}{1 + \beta} \right) \frac{1}{\epsilon y_0} = \frac{1}{1 + \beta}$$

$$MPC^- = \min \left\{ \left(\frac{w + y_0 + \epsilon y_0}{1 + \frac{\beta}{1-\lambda}} - \frac{w + y_0}{1 + \beta} \right) \frac{1}{\epsilon y_0}, 1 \right\}$$

Hence, the MPC^+ does not depend on initial wealth. For MPC^-, take the derivative of the first argument with respect to wealth (with some abuse of notation):

$$\frac{\partial MPC^-}{\partial w} = \left(\frac{1}{1 + \frac{\beta}{1-\lambda}} - \frac{1}{1 + \beta} \right) \frac{1}{\epsilon y_0} > 0$$

for $\epsilon \in (-1, 0)$. Hence, MPC^- is increasing in initial wealth w.

B.2 Mental accounting model with CRRA utility

This appendix generalizes the 2-period model to any CRRA utility function $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$. The consumption allocation is given by:

$$c_0 = \begin{cases} \frac{y_0}{1+\beta^{\frac{1}{\gamma}} R^{\frac{1-\gamma}{\gamma}}} & \text{if } c_0 \leq c_0^{plan} \\ \frac{y_0}{1+(\frac{\beta}{1-\lambda})^{\frac{1}{\gamma}} R^{\frac{1-\gamma}{\gamma}}} & \text{if } c_0 > c_0^{plan} \end{cases}$$

The MPC is given by:

$$
\begin{aligned}
MPC = \frac{\Delta c_0}{\Delta y_0} &= \frac{\tilde{c}_0(y_0 + \epsilon y_0) - c_0(y_0)}{\epsilon y_0} \\
&= \begin{cases} \frac{1}{1+\beta^{\frac{1}{\gamma}} R^{\frac{1-\gamma}{\gamma}}} & \text{if } \epsilon > 0 \\ \min\left\{ \frac{1}{1+\beta^{\frac{1}{\gamma}} R^{\frac{1-\gamma}{\gamma}}} \left(\frac{1+\epsilon}{\epsilon} \frac{1+\beta^{\frac{1}{\gamma}} R^{\frac{1-\gamma}{\gamma}}}{1+(\frac{\beta}{1-\lambda})^{\frac{1}{\gamma}} R^{\frac{1-\gamma}{\gamma}}} - \frac{1}{\epsilon} \right), 1 \right\} & \text{if } \epsilon < 0 \end{cases}
\end{aligned}
$$

B.3 Mental accounting model with dissaving-aversion in t=0,1

Introducing dissaving-aversion in t_1 yields the following optimization problem:

$$
\begin{aligned}
\max_{c_0, c_1} \quad & u(c_0) - \lambda d(a_0, a_0^{plan}) + \beta \left(u(c_1) - \lambda d(a_1, a_1^{plan}) \right) \\
\text{s.t.} \quad & c_0 + a_0 = y_0; \quad c_1 = R a_0;
\end{aligned}
$$

The savings plan is formed at the beginning of each period. We already know a_0^{plan} from the problem without dissaving-aversion in t_1. The formation of a_1^{plan} is trivial as it is always optimal to consume everything in the final period, i.e. $a_1^{plan} = 0$. Dissaving-aversion in t_1 introduces two new Euler conditions, as marginal utility tomorrow now also depends on the difference between planned savings and actual savings tomorrow.

$$
\begin{aligned}
u'(c_0) &= \beta R u'(c_1) \quad \text{if} \quad a_0 \geq a_0^{plan} \text{ and } a_1 \geq a_1^{plan} \\
(1-\lambda) u'(c_0) &= \beta R u'(c_1) \quad \text{if} \quad a_0 < a_0^{plan} \text{ and } a_1 \geq a_1^{plan} \\
u'(c_0) &= \beta R (1-\lambda) u'(c_1) \quad \text{if} \quad a_0 \geq a_0^{plan} \text{ and } a_1 < a_1^{plan} \\
(1-\lambda) u'(c_0) &= \beta R (1-\lambda) u'(c_1) \quad \text{if} \quad a_0 < a_0^{plan} \text{ and } a_1 < a_1^{plan}
\end{aligned}
$$

Because it is always optimal to consume all savings in t_1, and the optimal savings plan in t_1 is always $a_1^{plan} = 0$, conditions three and four are irrelevant. Note that $a_1 < a_1^{plan} = 0$ would imply negative assets at death. As such, it is equivalent to the problem without dissaving-aversion in t_1.

B.4 Proofs

Derivation of MPCs in the mental accounting model:

The consumption allocation is given by:

$$
c_0 = \begin{cases} \frac{y_0}{1+\beta} & \text{if } c_0 \leq c_0^{plan} \\ \frac{y_0}{1+\frac{\beta}{1-\lambda}} & \text{if } c_0 > c_0^{plan} \end{cases}
$$

The MPC is given by:

$$MPC = \frac{\Delta c_0}{\Delta y_0} = \frac{\tilde{c}_0(y_0 + \epsilon y_0) - c_0(y_0)}{\epsilon y_0}$$

Note that the MPC formula consists of two distinct consumption functions, $c_0(\cdot)$ and $\tilde{c}_0(\cdot)$, which differ in the savings plan under which the consumption decision is made. For example, $\tilde{c}(y_0 + \epsilon y_0)$ denotes the consumption allocation under the savings plan $a_0^{plan}(y_0)$, while $c(y_0 + \epsilon y_0)$ denotes the consumption allocation under the savings plan $a_0^{plan}(y_0 + \epsilon y_0)$.

A positive shock $\epsilon > 0$ increases planned consumption c_0^{plan} by ϵy_0. Unless the household increases consumption by more than ϵy_0 (which implies a $MPC > 1$) consumption is always weakly below planned consumption. Because it is never optimal to increase consumption by more than ϵy_0 due to consumption smoothing, consumption is indeed always weakly below planned consumption. Hence:

$$MPC^{+} = \left(\frac{y_0 + \epsilon y_0}{1+\beta} - \frac{y_0}{1+\beta}\right)\frac{1}{\epsilon y_0} = \frac{1}{1+\beta}$$

A negative shock $\epsilon < 0$ decreases planned consumption c_0^{plan} by ϵy_0. Unless the household decreases consumption by more than ϵy_0 (which implies a $MPC > 1$) consumption is always weakly above planned consumption. Because it is never optimal to decrease consumption by more than ϵy_0 due to consumption smoothing, consumption is indeed always weakly below planned consumption. Hence:

$$\begin{aligned} MPC^{-} &= \min\left\{\left(\frac{y_0 + \epsilon y_0}{1 + \frac{\beta}{1-\lambda}} - \frac{y_0}{1+\beta}\right)\frac{1}{\epsilon y_0}, 1\right\} = \min\left\{\left(\frac{1+\epsilon}{1 + \frac{\beta}{1-\lambda}} - \frac{1}{1+\beta}\right)\frac{1}{\epsilon}, 1\right\} \\ &= \min\left\{\frac{1}{1+\beta}\left(\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1 + \frac{\beta}{1-\lambda}} - \frac{1}{\epsilon}\right), 1\right\} \end{aligned}$$

Proposition 1 (MPC asymmetry):

Proof. We want to show that $\min\left\{\frac{1}{1+\beta}\left(\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon}\right), 1\right\} > \frac{1}{1+\beta}$ for $\epsilon \in (-1, 0)$. With regards to the first expression, dividing both sides by $\frac{1}{1+\beta}$ yields $\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon} > 1$. From there, $\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} \leq 1$, which is true for any $\lambda \in (0, 1]$. With regards to the second expression, $1 > \frac{1}{1+\beta}$ for $\beta > 0$. □

Corollary (Shock size):

Proof. First, we want to show that the derivative of the first term in MPC^{-} with respect to ϵ is positive for $\epsilon \in (-1, 0)$.

$$\frac{\partial MPC^-}{\partial \epsilon} = \frac{\partial \frac{1}{1+\beta}\left(\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon}\right)}{\partial \epsilon} = \frac{1+\beta}{1+\frac{\beta}{1-\lambda}}\frac{\epsilon-(1+\epsilon)}{\epsilon^2} + \frac{1}{\epsilon^2} = \frac{1}{\epsilon^2} - \frac{1}{\epsilon^2}\underbrace{\frac{1+\beta}{1+\frac{\beta}{1-\lambda}}}_{\leq 1} > 0$$

for $\lambda \in (0, 1]$ and $\beta > 0$. Second, $MPC^+ = \frac{1}{1+\beta}$ and as such does not depend on the income shock ϵ.

□

Proposition 2 (MPC out of wealth):

Proof. Introduce initial wealth w to the problem and assume, for simplicity, $y_0 = 0$. Furthermore, assume that a_0^{plan} changes one-to-one as initial wealth changes. The consumption allocation is then given by:

$$c_0 = \begin{cases} \frac{w}{1+\beta} & \text{if } c_0 \leq c_0^{plan} \\ \frac{w}{1+\frac{\beta}{1-\lambda}} & \text{if } c_0 > c_0^{plan} \end{cases}$$

A positive shock $\epsilon > 0$ increases planned savings a_0^{plan} by ϵw and leaves planned consumption c_0^{plan} unchanged. For any increase in consumption, consumption is therefore always above planned consumption. Furthermore, consumption will never drop in response to a positive income shock due to consumption smoothing. This yields the following MPC^+ out of wealth:

$$\begin{aligned} MPC^{+,wealth} = \frac{\Delta c_0}{\Delta w} &= \max\left\{\left(\frac{w(1+\epsilon)}{1+\frac{\beta}{1-\lambda}} - \frac{w}{1+\beta}\right)\frac{1}{\epsilon w}, 0\right\} \\ &= \max\left\{\left(\frac{1+\epsilon}{1+\frac{\beta}{1-\lambda}} - \frac{1}{1+\beta}\right)\frac{1}{\epsilon}, 0\right\} \\ &= \max\left\{\frac{1}{1+\beta}\left(\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon}\right), 0\right\} \end{aligned}$$

We want to show that $MPC^{+,wealth} < MPC^+$. With regards to the first expression, we can show that:

$$\frac{1}{1+\beta}\left(\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon}\right) < \frac{1}{1+\beta} \rightarrow \frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon} < 1 \rightarrow \frac{1+\beta}{1+\frac{\beta}{1-\lambda}} < 1$$

for any $\lambda \in (0, 1]$, $\epsilon \in (0, 1)$ and $\beta > 0$. With regards to the second expression, trivially $0 < \frac{1}{1+\beta}$.

A negative shock $\epsilon < 0$ decreases planned savings a_0^{plan} by ϵw and leaves planned consumption c_0^{plan} unchanged. For any decrease in consumption, consumption is therefore always below planned consumption. This yields the following MPC^{-} out of wealth:

$$MPC^{-,wealth} = \frac{\Delta c_0}{\Delta w} = \left(\frac{w(1+\epsilon)}{1+\beta} - \frac{w}{1+\beta}\right)\frac{1}{\epsilon w} = \frac{1}{1+\beta}$$

We want to show that $MPC^{-,wealth} < MPC^{-}$.

$$\frac{1}{1+\beta} < \frac{1}{1+\beta}\left(\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon}\right)$$

The proof of Proposition 1 shows that this holds for any $\epsilon \in (-1, 0)$ and $\lambda \in (0, 1]$. □

Proposition 3 (MPC out of income news):

Proof. Introduce income y_1 to the initial problem and assume, for simplicity, $y_0 = 0$. Furthermore, assume that a_0^{plan} does not respond to changes in y_1. The consumption allocation is then given by:

$$c_0 = \begin{cases} \frac{y_1}{R(1+\beta)} & \text{if } c_0 \leq c_0^{plan} \\ \frac{y_1}{R(1+\frac{\beta}{1-\lambda})} & \text{if } c_0 > c_0^{plan} \end{cases}$$

A positive shock $\epsilon > 0$ to future income y_1 leaves both planned consumption c_0^{plan} and planned savings a_0^{plan} unchanged. For any increase in consumption, consumption is therefore always above planned consumption. Furthermore, consumption will never drop in response to a positive news shock due to consumption smoothing. This yields the following MPC^{+} out of income news:

$$\begin{aligned} MPC^{+,news} = \frac{\Delta c_0}{\Delta y_1} &= \max\left\{\left(\frac{(1+\epsilon)y_1}{R(1+\frac{\beta}{1-\lambda})} - \frac{y_1}{R(1+\beta)}\right)\frac{1}{\epsilon y_1}, 0\right\} \\ &= \max\left\{\left(\frac{1+\epsilon}{1+\frac{\beta}{1-\lambda}} - \frac{1}{1+\beta}\right)\frac{1}{R\epsilon}, 0\right\} \\ &= \max\left\{\frac{1}{1+\beta}\left(\frac{1+\epsilon}{R\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{R\epsilon}\right), 0\right\} \end{aligned}$$

We want to show that $MPC^{+,news} < MPC^{+}$. With regards to the first expression, we can show that:

$$\frac{1}{1+\beta}\left(\frac{1+\epsilon}{R\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{R\epsilon}\right) < \frac{1}{1+\beta} \rightarrow \frac{1+\epsilon}{R\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{R\epsilon} < 1 \rightarrow \frac{1+\beta}{1+\frac{\beta}{1-\lambda}} < \frac{1+R\epsilon}{1+\epsilon}$$

for any $\lambda \in (0, 1]$, $\epsilon \in (0, 1)$, $\beta > 0$ and $R \geq 1$. With regards to the second expression, trivially $0 < \frac{1}{1+\beta}$. Following a similar logic, one can also show that $MPC^{+,news} < \frac{1}{R(1+\beta)}$ which is the MPC out of news in a model without dissaving aversion.

A negative shock $\epsilon < 0$ to future income y_1 leaves both planned consumption c_0^{plan} and planned savings a_0^{plan} unchanged. For any decrease in consumption, consumption is therefore always below planned consumption. This yields the following MPC^- out of income news:

$$MPC^{-,news} = \frac{\Delta c_0}{\Delta y_1} = \left(\frac{y_1(1+\epsilon)}{R(1+\beta)} - \frac{y_1}{R(1+\beta)} \right) \frac{1}{\epsilon y_1} = \frac{1}{R(1+\beta)}$$

We want to show that $MPC^{-,news} < MPC^-$:

$$\frac{1}{R(1+\beta)} < \frac{1}{1+\beta} \left(\frac{1+\epsilon}{\epsilon} \frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon} \right)$$

The proof of Proposition 1 shows that this holds for any $\epsilon \in (-1, 0)$, $\lambda \in (0, 1]$ and $R \geq 1$. □

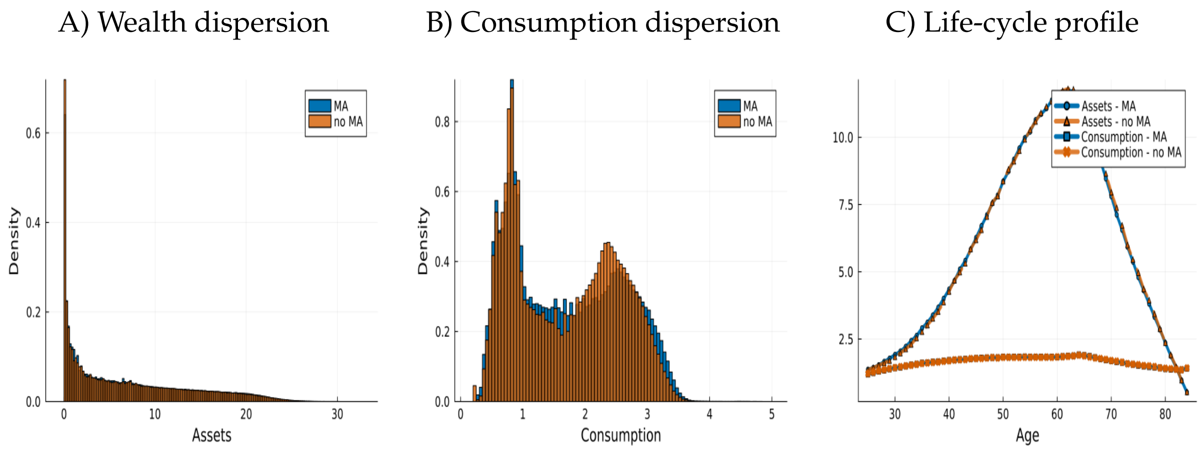
C Additional model results

This section presents additional results from the quantitative model. Table C1 compares model and data moments. Figure C1 compares the dispersion and life-cycle profile of consumption and wealth across the mental accounting and the standard model. Figure **??** shows MPC asymmetries across the distribution of wealth from a model in which the strength of the dissaving-aversion motive λ is constant across households and set to the average λ in the baseline model. Figure **??** shows MPC asymmetries from a model in which the savings plan is defined as $a^{plan} = (1+r)a$. This formulation of the savings plan is simpler and states that accessing wealth is always costly. All other elements are unchanged compared to the baseline model. Figure **??** shows MPC asymmetries from a model without mental accounting into which I introduce an asymmetric portfolio adjustment cost, i.e. households pay a fixed cost κ if $a' < (1+r)a$. The figure shows MPCs from two models, one with a relatively low (one-tenth of average monthly income) and one with a relatively high (one-half of average monthly income) adjustment cost. Figure C3 plots the difference between the benchmark saving rule and the simpler rule of thumb $a^{plan} = (1+r)a$ for various ages, levels of wealth and income.

Table C1: Model moments versus data moments

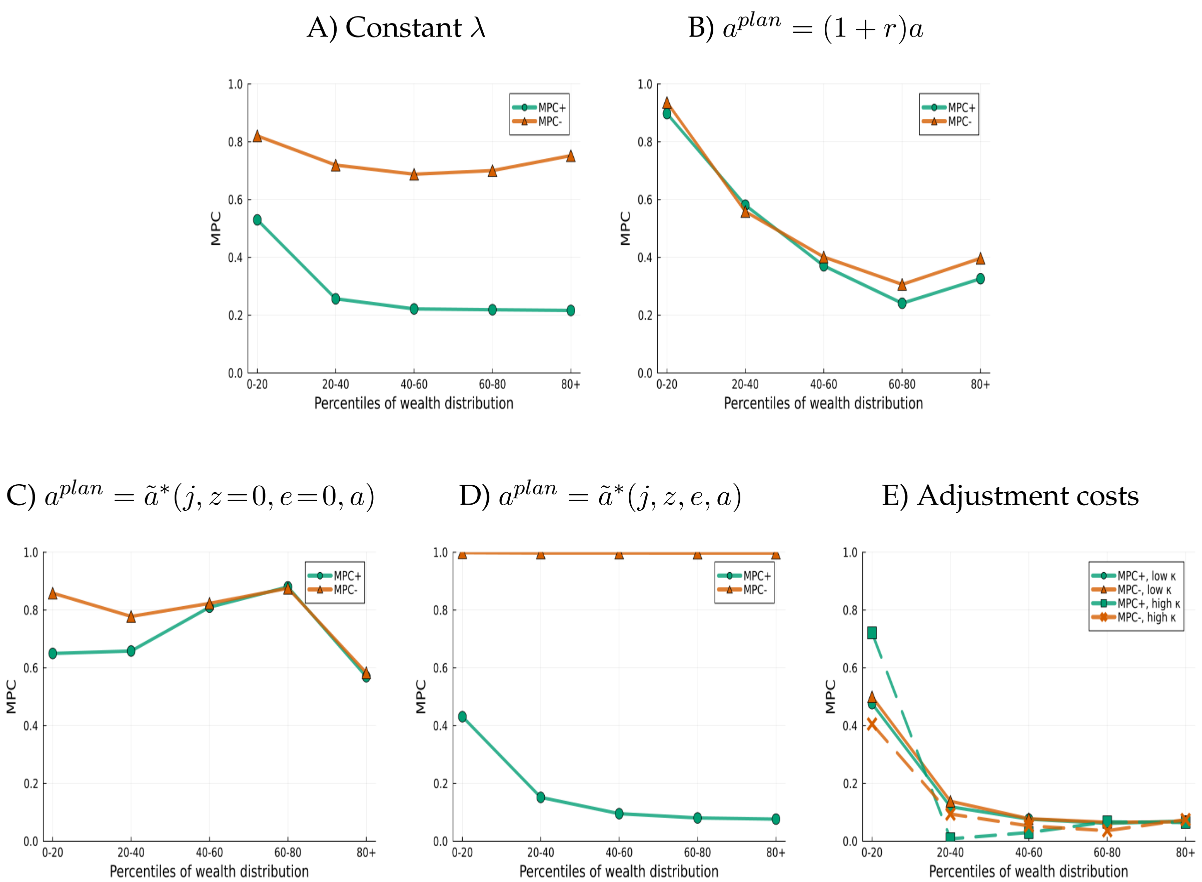
	Data	Model
Average wealth-to-income ratio	4.28	4.28
Average MPC out of losses	0.73	0.73
Ratio of households with savings plan/dissaving-aversion ratio between bottom and top quintile of wealth distribution	1.29	1.29

Figure C1: Consumption and savings in the mental accounting model



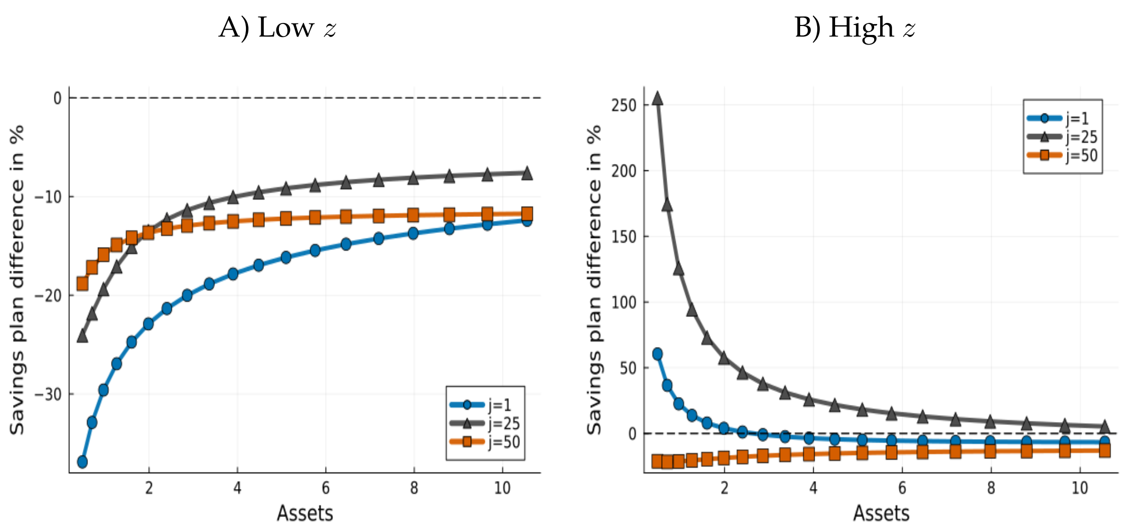
Notes: MA refers to the model with mental accounting preferences while no MA refers to the one without.

Figure C2: MPCs under alternative model specifications



Notes: This figure reports MPCs from a transitory 10% income shock for different model specifications. Panel A considers a model with no heterogeneity in λ across households, where $\lambda = \bar{\lambda}$. Panel B considers a model with savings rule $a^{plan} = (1+r)a$. Panel C and D consider a model with savings rule $a^{plan} = \tilde{a}^*(j, z = 0, e = 0, a)$, and $a^{plan} = \tilde{a}^*(j, z, e, a)$, respectively. Panel E considers a model without mental accounting, but with asymmetric portfolio adjustment cost, where households pay a fixed cost κ if $a' < (1+r)a$.

Figure C3: Comparison of saving rules: a^{plan} versus $(1+r)a$



Notes: This figure reports the percentage difference between a^{plan} and $(1+r)a$ for households of different ages and wealth levels, where the transitory income shock is fixed at the average. The left panel reports the difference for a household with a low, the right panel for a household with a high persistent income realization.

D Other Theories

This section discusses briefly (and non-exhaustively) other common models of consumption behaviour in the context of MPC asymmetries.

D.1 Standard extensions

Most standard extensions generate larger MPCs and MPC asymmetries by generating a higher share of liquidity-constrained households, i.e. by shifting households along the wealth distribution. Kaplan and Violante (2022) provides an excellent overview of this literature. These extensions do not address, however, why households that are not liquidity-constrained respond asymmetrically to changes in income. In what follows, I discuss each extension in more detail.

Risk aversion: The effect of changes in risk aversion on MPC asymmetries is theoretically ambiguous and quantitatively small. Higher risk aversion concavifies the consumption function, but at the same time shifts households away from the borrowing constraint due to a stronger precautionary savings motive. These forces have off-setting effects on the MPC and MPC asymmetry and are therefore relatively small, as discussed in Kaplan and Violante (2022).

Discount-factor heterogeneity: Heterogeneity in the discount factor (e.g. Aguiar et al. (2020) for a recent example) primarily affects the distribution of wealth, but has little bearing on MPC asymmetries. It shifts a larger share of (impatient) households closer to the borrowing constraint and generates a set of (patient) households with large wealth holdings. As such, it suffers from the missing-middle problem, i.e median wealth that's substantially below average wealth in excess of what the data suggest (as discussed in Kaplan and Violante (2022)). Apart from these shifts along the wealth distribution, discount factor heterogeneity only affects the level, but not the asymmetry of MPCs.

Return rate heterogeneity: Heterogeneity in returns generates similar results as discount-factor heterogeneity (Kaplan and Violante, 2022). Because a few high-return households hold most of the wealth in the economy, this pushes down the discount factor that is necessary to match average wealth in the economy. A lower discount factor increases the MPC, but does not per se introduce asymmetries.

Two-asset model: A model featuring both a liquid and illiquid asset in the spirit of Kaplan and Violante (2014) generates a larger share of liquidity-constrained households by introducing wealthy hand-to-mouth households. This roughly triples the share of liquidity-constrained households to one-third of the population (Kaplan et al., 2014). It does not provide an explanation for why the remaining two-thirds of households which are unconstrained would respond asymmetrically to changes in income. One could hypothesize that for the majority of households liquid resources are not sufficient to fully absorb the income loss, but this seems to be at odds with the data.

Consumption adjustment costs: Fuster et al. (2021) introduces a fixed utility cost to adjusting consumption and shows that it generates a larger sign asymmetry than a model without adjustment costs. However, this asymmetry is quantitatively small. The symmetric adjustment cost primarily addresses the extensive margin of consumption adjustment and increases the share of households that do not adjust consumption in response to a change in income. This affects both the response to positive and negative income shocks. A large shock of 10% of annual income is likely to be large enough to induce most households to pay the fixed cost and adjust consumption as the benefits of consumption smoothing outweigh the cost of consumption adjustment.

Consumption commitments: Chetty and Szeidl (2007) introduces a model that features consumption commitments. This introduces 'sticky' consumption and if anything, lowers MPCs out of losses. Intuitively, the consumption loss is concentrated on one good, which for the same reduction in total consumption implies a larger utility loss than if that loss were distributed across both goods.

D.2 Behavioural explanations

Hyperbolic discounting: Hyperbolic discounting, as for example studied in Laibson et al. (2021), increases MPCs, but does not generate meaningful asymmetries as it amplifies both the response to gains and losses. In the simple two-period framework from Section 4, the MPC with hyperbolic discounting would be given by:

$$MPC = \frac{1}{1 + \delta\beta}$$

where δ denotes the hyperbolic discount factor. Compared to a standard model, present bias increases MPCs by discounting future consumption at a higher rate, but it equally does so for gains and losses.

Rational inattention: Reis (2006) introduces a theory of inattentive households in which households only sporadically update their consumption plans due to a cost to processing information. Inattention introduces stickiness to consumption plans and lowers MPCs out of unexpected shocks, for both gains and losses. Alternatively, one can introduce households that plan savings instead of consumption. This increases MPCs out of both gains and losses as now most of the income change is absorbed through consumption instead of savings. Neither specification, sticky consumption plans nor savings plans generates meaningful asymmetries, however.

Temptation preferences: Temptation preferences introduce a demand for commitment and are similar in spirit to hyperbolic discounting with sophisticated agents. Attanasio et al. (2020) uses such preferences to generate demand for illiquid assets. By locking away their wealth in housing, which is associated with a fixed cost, households can reduce the utility cost of temptation. As such, temptation preferences present one way to generate a large share of wealthy hand-to-mouth households without assuming excessively large returns on illiquid assets. Given that temptation preferences introduce an element of present bias, they tend to increase MPCs for both gains and losses, similar to hyperbolic discounting. Moreover, a larger share of wealthy hand-to-mouth households implies a larger share of households with asymmetric MPCs. But similarly to the two-asset model in Kaplan and Violante (2014), it does not explain why unconstrained households have asymmetric MPCs.

Expectations-based reference-dependence and loss aversion: Pagel (2017) studies a life-cycle model with expectations-based reference-dependent preferences, building on previous work by Kőszegi and Rabin (2009). Within this framework, household's period utility not only consists of the standard utility from consumption, but additionally of gain-loss utility, i.e. the deviation of consumption relative to a reference point. This reference point is given by the household's previous expectations about both present and future consumption. The preference structure generates excess smoothness and sensitivity in consumption. However, because unexpected losses in present consumption are more painful than expected losses in the future, households delay unexpected losses in consumption until expectations have adjusted in the future. This lowers the MPC out of losses and therefore does not address the MPC asymmetry discussed in this paper.