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Abstract

Using detailed micro data, we document that households often use "stimulus" checks to pay down debt, especially those with low net wealth-to-income ratios. To rationalize these patterns, we introduce a borrowing price schedule into an otherwise standard incomplete markets model. Because interest rates rise with debt, borrowers have increasingly larger incentives to use an additional dollar to reduce debt service payments rather than consume. Using our calibrated model, we then study whether and how this marginal propensity to repay debt (MPRD) alters the aggregate implications of fiscal transfers. We uncover a trade-off between stimulus and insurance, as high-debt individuals gain considerably from transfers, but consume relatively little immediately. We show how this mechanism can lower short-run fiscal multipliers but sustain aggregate consumption for longer.

Key words: marginal propensity to consume, consumption, debt, fiscal transfers

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1 Introduction

Households frequently use stimulus checks to pay down existing debt. For example, after receiving the 2008 rebates as part of the Economic Stimulus Act, 52% of households reported that they used the money to mostly pay down debt, while only 20% reported that they mostly spent it (Sahm, Shapiro and Slemrod (2010)). However, despite the disproportionate use of these checks for debt repayment, both academic and public discussions have instead focused on their role in stabilizing aggregate demand through their impacts on spending.[1] Indeed, this is why these transfers have come to be called "stimulus checks," and why their success is often measured by the extent to which they are immediately spent.

In this paper, we present new empirical evidence on fiscal transfers: most households, especially those with low net wealth-to-income ratios, report using cash windfalls to pay down debt, rather than spending immediately to consume. We show that a standard consumption-savings model rationalizes these patterns if interest rates rise with debt, so that debt reduction incentives lean against the typical consumption smoothing ones. In this environment, we demonstrate that a trade-off between stimulus and insurance motives for cash transfers arises - both across households and over time - as borrowers use transfers to pay down debt, pushing consumption to the future. We then illustrate that this tension can change both the evaluation and the design of expansionary fiscal policy.

Our empirical evidence uses micro data on the usage of stimulus checks during the COVID-19 pandemic that was collected as part of the New York Fed's Survey of Consumer Expectations (SCE). While there is an extensive empirical literature estimating marginal propensities to consume out of transitory income shocks, empirical evidence on debt responses is much more sparse, most likely due to data limitations.[2] We make progress by eliciting responses directly from surveyed households in the SCE.[3] We document three main facts. First, and consistent with previous studies, households used a third of their transfers to pay down debt, which is more than the average marginal propensity to consume (MPC) that usually takes center stage. Second, households with low net liquid wealth-to-income ratios are *more* likely to pay down debt and more likely to improve their net asset positions. Third, and relatedly, households with lower net wealth-to-income ratios have lower MPCs.

[1] For example, Bush described the 2008 checks as a "booster shot," stating "It's clear our economy has slowed. But the good news is we anticipated this and took decisive action to bolster the economy by passing a growth package that will put money into the hands of American workers and businesses."

[2] One notable exception is Agarwal, Liu and Souleles (2007), who estimate debt responses to 2001 tax rebates in the United States. Consistent with our mechanism, they find that consumers initially used the checks to pay down debt which stimulated spending in the medium-run.

[3] Coibion, Gorodnichenko and Weber (2020) adopt a similar approach, using another survey of U.S. households. We discuss in Section 2 how our results relate to theirs.

Standard incomplete markets models have difficulty generating these cross-sectional relationships. Canonically, households with lower net liquid wealth-to-income ratios are more constrained, and thus have higher MPCs (Kaplan and Violante (2022)). We show that the simple—and empirically plausible—introduction of a debt price schedule into the standard model can reconcile it with the facts we document. In a tractable two-period framework, we first show how this change modifies the Euler Equation and introduces a debt service-reduction motive, akin to the Generalized Euler Equation that commonly appears in endogenous default models (Arellano et al. (2019)). When households' net asset position is negative and the interest rate is rising in debt, the consumption function can become convex in assets, rather than concave as is standard in incomplete market models (Carroll and Kimball (1996)). This means that the consumption function can become flatter the more indebted a household is. As a consequence, MPCs in that region are low and increasing in assets. We prove analytically conditions that sustain this result. We also relate our debt-price schedule to a borrowing wedge (Achdou et al. (2022)) in terms of its predictions for the shape of the consumption function, both qualitatively and quantitatively.

We then calibrate a quantitative infinite horizon version of the model to match our empirical evidence. The debt pricing schedule creates a strong savings motive, even among those with negative net assets. Rather than facing a hard borrowing constraint, raising MPCs towards one, high levels of debt generate a high marginal propensity to repay debt (MPRD). There are fewer households at the highest levels of debt and those have lower MPCs. We demonstrate that the pricing schedule the model requires to generate these patterns is empirically plausible in various ways.

With our calibrated quantitative model, we next ask how the introduction of a debt-price schedule matters for fiscal stimulus policies. First, it divorces the welfare value of transfers from the instantaneous consumption response. In a standard incomplete markets model, those who have the highest MPC out of the rebate also gain the most from it. In our setting, some households have high welfare gains despite having a small MPC upon receipt; in other words, the insurance value of transfers no longer perfectly aligns with their stimulus value, and these two benefits may be in conflict.

Second, and relatedly, when the interest rate is non-constant the inter-temporal MPC is quite different, both in the aggregate and across the distribution of households. Households with high MPRDs delay the consumption effect of the stimulus, flattening and extending out the impulse response. At the same time, there is an increase in the upon–impact spending of households with little debt, relative to the workhorse model with exogenous liquidity constraints. Depending on the distribution of these responses, non-constant interest rates can be associated with more persistent aggregate spending effects.

Against this backdrop, our mechanism implies that policymakers may face non-trivial trade-offs when targeting transfers, at least in partial equilibrium. For instance, they may wish to allocate transfers differently when favoring welfare over initial stimulus, or long–run rather than short–run fiscal multipliers. Using our calibrated model, we conclude that the stimulus of 2020 generated larger welfare gains compared with what would be gauged by a constant-interest rate incomplete markets model.

The paper is organized as follows. In Section 2 we present empirical facts on the MPRD and the MPC using household data from the U.S.. Sections 3 shows how debt-sensitive interest rates can rationalize these facts with an illustrative two-period model. In Section 4 we extend this to a calibrated, quantitative model and investigate aggregate and distributional effects of stimulus payments. Finally, we conclude.

2 Empirical facts on households' responses to stimulus checks

In this section we document three main facts regarding the way households responded to the lump-sum transfers that were given as part of the CARES Act. The CARES Act was a large stimulus package passed by the U.S. Federal government on March 27^{th}, 2020. As part of this package, all qualifying adults received a one-time transfer of up to \$1200, with \$500 per additional child.[4] We discuss the external validity of the facts we document using results from other transfer episodes in the U.S. and other data sets.

2.1 Data

Our data come from a special survey module fielded in June 2020 as part of the New York Fed's Survey of Consumer Expectations (SCE). The SCE is a monthly internet-based survey of a rotating panel of approximately 1300 heads of household from across the United States. As the name of the survey indicates, its goal is to elicit expectations about a variety of economic variables, such as inflation and labor market conditions. Respondents participate in the panel for up to twelve months, with a roughly equal number rotating in and out of the panel each month. Respondents may also be asked to participate in additional modules every month and receive extra incentives when they do. The special module used in the main analysis that follows was fielded to the respondents who rotated out of the SCE. However, we also use the main panel of respondents to show that our results are not specific to the pandemic, and also hold in a hypothetical setting, that is using survey responses to

[4]For further details on the episode, we defer to Coibion et al. (2020).

hypothetical questions about how individuals would spend windfalls.[5] The characteristics of both samples can be found in Tables B.1 and B.2 in Appendix B.

Our analysis primarily focuses on questions about the receipt and usage of the stimulus checks.[6] The survey first asks whether the respondent's household has received a stimulus payment (either by direct deposit or via check) and, if so, how much in total they received. Around 89% of the respondents in our sample received the stimulus payments by the time of their interview, with the average (median) payment received being $2080 ($2400).[7] The respondents who reported receipt of the stimulus checks were then asked a question regarding the allocation of this payment in the following form:

Please indicate what share of the government payment you have already used to or expect to use to ...

Save or invest	__________	*percent*
Spend or donate	__________	*percent*
Pay down debts	__________	*percent*
Total	100	*percent*

where the responses add up to 100.[8] In the rest of this section, we refer to the "Save or invest" allocation as the marginal propensity to save (MPS), the "Spend or donate" allocation as the marginal propensity to consume (MPC),[9] and the "Pay down debt" allocation as the marginal propensity to repay debt (MPRD). We also define the marginal propensity to adjust the net asset position (MPA) as MPA = MPRD + MPS. We return to a detailed discussion of how these concepts line up with our model measures once we have presented the model. Finally, in what follows, we focus only on those who already reported receiving a payment

[5]See Manski (2004) for details on stated-choice experiments and how they might map to actual decisions, Stantcheva (2022) for a recent review of different design considerations for hypothetical scenarios, and Fuster, Kaplan and Zafar (2021) for an example of using hypothetical scenarios to elicit MPCs.

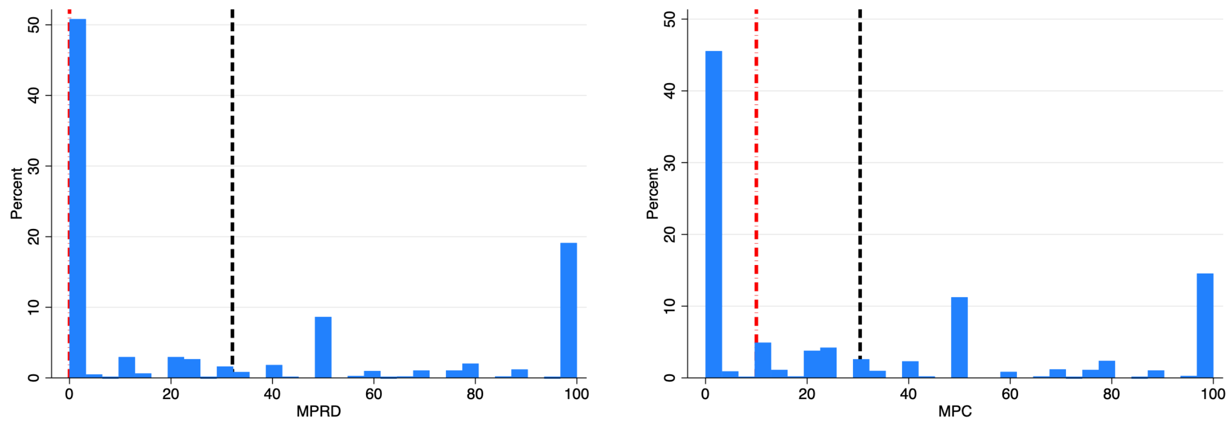
[6]The checks mailed out as part of the CARES Act were formally referred to as Economic Impact Payments, but we will refer to them throughout as stimulus checks.

[7]Figure B.1 in Appendix B shows the distribution of the reported stimulus amount received among respondents who reported already having received the money. The distribution is clearly bunched at the two focal points of $1200 and $2400, the equivalent amounts for single and joint filing qualified adult households with no children, respectively. Figures B.2a-B.2b show the median reported stimulus conditional on current marital status, income, and presence of children.

[8]The respondents see the running total of their answers and receive an error message if they try to move on to the next question before the total is equal to 100.

[9]The follow-up questions ask the respondents to split the "Spend or donate" allocation into separate "Spend" and "Donate" allocations. All of our results hold when we define the MPC using only the "Spend" allocation.

Figure 1: Histograms of MPRD and MPC



(a) MPRD (b) MPC

Notes. Panel (a) shows the histogram of self-reported MPRDs (the share of government payment used to pay down debts) for the full sample of check recipients. Panel (b) shows the histogram of self-reported MPCs (the share of government payment used to spend or donate). Appendix Figure B.4 repeats this figure for the MPS and MPA. The black dashed line in each panel corresponds to the mean while the red dash-dotted line corresponds to the median.

at the time of the survey and consider their allocation of the payment (1423 observations).

Fact 1: The average MPRD across households (32%) is as large as the average MPC across households (30%).

Based on the survey responses, we find that, on average, households used one third of their checks to pay down their debt. The histogram for the MPRD presented in Figure 1a shows that around 50% of the respondents do not use their checks to pay down any debt, making the median MPRD zero, while around 19% of the respondents report using all of their stimulus checks to repay their debt, leading to a bimodal distribution. Restricting attention to households with negative net liquid wealth (Appendix Figures B.3a-B.3b), the average MPRD increases to 48 cents per stimulus dollar, while the average MPC falls to 24 cents.[10]

While the MPC has been the focus of the very large literature on consumption-saving choices (Kaplan and Violante (2022)), the MPRD has received relatively less attention, despite the fact that its magnitude is as large as the MPC. Importantly, its similarity in magnitude is evident in different stimulus episodes and in different data sets. Table 1 compiles a comprehensive list of empirical papers that have a concept of both an MPC and an

[10]Some households report both paying down debt and saving at the same time (see Appendix Figure B.4b). We return to this issue in our discussion of Fact 2.

Table 1: MPCs and MPRDs in Various Studies

Study	Date	Source	MPC	MPRD
This paper (Koşar et al. (2023))	6/20	SCE	.30	.32
Armantier et al. (2020, 2021)	6/20, 7/20, 3/21	SCE	.25-.29	.34-.37
Coibion et al. (2020)*	7/20	Nielsen	.15	.52
Coibion et al. (2020)	7/20	Nielsen	.42	.30
Sahm et al. (2010)*	11/08-12/08	Michigan	.22	.55
Shapiro and Slemrod (2009)*	2/08-6/08	Michigan	.20	.48
Hisnanick and Kern (2018)*	9/08-12/08	SIPP	.28	.53
Boutros (2020)*	07/20	Pulse	.75	.14
Parker et al. (2022)*	6/20-7/20	CEX	.56	.18
Shapiro and Slemrod (2003)*	8/01-10/01	Michigan	.22	.46

Notes. Table reports different papers (column 1), the stimulus episode they study (column 2), the data source (column 3), and statistics related to consumption (column 4) as well as debt repayment (column 5). Papers with an * refer to population shares that report mostly using the checks for consumption/debt repayment. Papers without an * correspond to MPCs/MPRDs.

MPRD,[11] listing alongside them their stimulus episode and data source. Fact 1 above is evident in all other stimulus episodes, and is not a unique feature of the checks sent out as part of the CARES Act.

Our findings are also consistent with a similar empirical investigation by Coibion et al. (2020), who instead ask consumers in the Nielsen Homescan panel how they used the same fiscal stimulus payments we study. They also find that, on average, 30 percent of the stimulus money was used to pay down debt. However, they find a higher average MPC than we do in the SCE.[12] Using the qualitative question in the Consumer Expenditure Survey (CEX), Parker et al. (2022) also finds that a non-trivial fraction reports mostly using their checks for debt repayment.

Earlier studies on the 2001 and 2008 tax rebates, instead, do not generally estimate the

[11]The listed papers with an asterisk use a question wording which corresponds less directly to an MPC or MPRD since they do not give quantitative shares. Instead, the question wording is "[will] you mostly use the check to increase spending, mostly to increase saving, or mostly to pay off debt?" However, Parker and Souleles (2017) show that both "reported preference" types of measures are informative of the average propensities estimated from the "revealed preference" approach which estimates MPCs directly from consumption data. Moreover, Coibion et al. (2020) show that the qualitative and quantitative answers in a single survey are consistent. For a discussion relating micro-level revealed-preference estimates to semi-structural approaches, see Commault (2022).

[12]This higher MPC may reflect differences in sample composition and question wording, because of different timing of the surveys used. Specifically, the data we use is from the June SCE, relatively soon after households received their payments, while Coibion et al. (2020) use survey responses from July. For this reason, the higher average MPC suggests that some of these payments were temporarily held as savings – or debt repayments – in June, and subsequently used for consumption later on.

share of transfers used by households to spend, save, or pay down debt, but rather estimate what fraction of households reporting that they "mostly" used the rebate for either of the three options. Nonetheless, a key takeaway from these studies is that a large fraction of households self-report using the rebate to pay down debt. Sahm et al. (2010) find that 55% of households report mostly paying down debt with the 2008 stimulus checks, and Shapiro and Slemrod (2009) find that 48% mostly paid down their debt using an earlier sample covering the same stimulus episode. Hisnanick and Kern (2018) use data from the Survey of Income and Program Participation (SIPP) covering the 2008 payment and also find that more than 50% report mostly paying down debt. Taken together the evidence suggests that paying down debt with government stimulus/rebate checks is a general finding that is not specific to the checks sent out during COVID.[13]

Fact 2: The MPRD is higher for those with lower net wealth-to-income ratios.

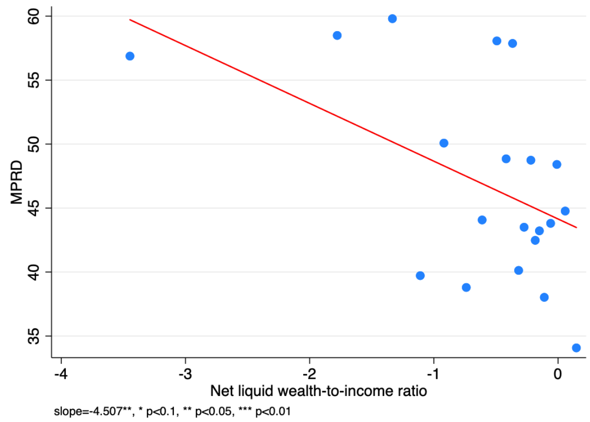
As shown in Figure 2a, MPRDs decrease with net liquid wealth-to-annual household income ratios, hereafter called net wealth-to-income. In the figure we control for various household characteristics, but raw correlations still show the same qualitative relationship. We focus on households with negative net liquid wealth balances because those will be the focus of our theoretical mechanism outlined in the following sections. However, all our facts hold for the entire population of households, as we show in Appendix B. Further, we use the ratio, net liquid wealth-to-income, as our measure of indebtedness because scaling by income removes permanent income differences that scale consumption and wealth; but again, the results do not depend on this.[14] In Appendix Table B.3, we report a regression which formalizes the negative relationship between the MPRD and net wealth-to-income ratios; a one standard deviation increase in net wealth-to-income is associated with a 27.6% decline in the MPRD (from an average of 0.32 to 0.23), keeping everything else constant, and the correlation is significant at the 1% level.

As noted earlier, a significant fraction of households report both paying down debt and saving at the same time, resulting in 45% of respondents using the entirety of their check

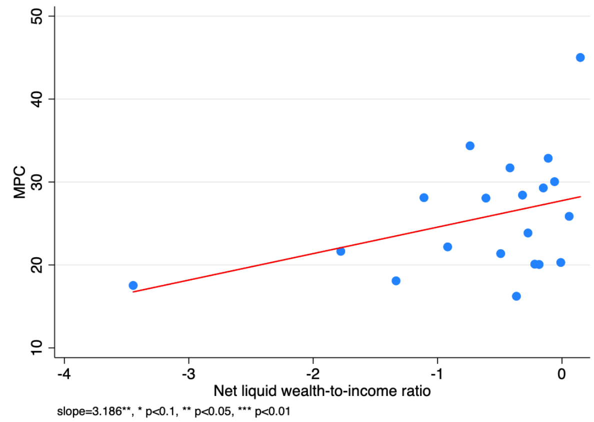
[13] Outside of the U.S., Crossley et al. (2021) elicit an average MPC of 11% out of a £500 unanticipated, hypothetical shock in the UK, while 22% of the sample report they would pay down debt with the unspent portion of the payments. Fagereng et al. (2021) estimate that, within one year of winning the lottery, Norwegian households used 7% of the prize for debt repayments.

[14] Net liquid wealth is defined as the sum of savings and investments (such as checking and savings accounts, CDs, stocks, bonds, mutual funds, Treasury bonds, excluding retirement), additional savings or assets (such as cash value in a life insurance policy, a valuable collection for investment purposes, or rights in a trust or estate), shares in farms and businesses, value of vehicles and additional real estate or land or home value, retirement accounts less outstanding loans on home and all other outstanding debt. Our results are robust to using different measures of household balance sheets, such as levels of net liquid wealth, gross unsecured debt, or debt-to-income ratios as shown in B.4.

Figure 2: MPRDs, MPCs, and net liquid wealth-to-income ratio



(a) MPRD



(b) MPC

Notes. Panel (a) shows a bin scatter of the self-reported, residualized MPRD against the residualized net-liquid wealth to income ratio. Panel (b) shows a bin scatter of the self-reported, residualized MPC by residualized net liquid wealth-to-income ratio. The controls include having a child under age 6, having a child under age 18, marital status, gender, race and age group of the household head, whether the household head lost their job between March 2020 and June 2020, and whether the household experienced a decline in income between March 2020 and June 2020. Figures B.5a-B.5b in Appendix B repeat this analysis for the MPS and MPA. Appendix figures B.7 and B.6 show the analysis for all households, with and without residualization.

to improve their asset positions. The same negative correlation is also present when we look at the relationship between MPAs and net wealth-to-income ratios. Importantly, this relationship is primarily driven by the MPRD rather than the MPS, as can be seen in Figure B.5. While MPRDs decrease with our net wealth-to-income measure, MPSs in fact have a positive association with net wealth-to-income; even still, the negative relationship between the MPA and net wealth-to-income holds.[15]

A limited number of papers have explored what drives heterogeneity in the propensity to pay down debt, with findings consistent with our results. Coibion et al. (2020) find that individuals identified as liquidity constrained are significantly more likely to pay down debt, although their data has no information on the stock of wealth or debt. Hisnanick and Kern (2018) find that households in the bottom income quintile were more likely to use the rebate to mostly pay down debt than richer households. Fagereng et al. (2021) find that Norwegian households in the top quartile of the distribution of liquid assets use a smaller fraction of the lottery prize to repay debt than illiquid households.

[15] In fact, the relationship is stronger for those on the negative end of the liquid wealth-to-income distribution, as shown in the bottom panel of Table B.3 in Appendix B.

Fact 3: The MPC is lower for those with lower net wealth-to-income ratios.

As the MPC is the mirror image of the MPA based on the design of the survey, it follows that we find a *positive* and statistically significant relationship between the MPC and net wealth-to-income ratio (Figure 2b). Appendix Table B.3 shows that, when controlling for a host of observable characteristics, a one standard deviation increase in net wealth-to-income is associated with a 14% *increase* in the MPC. Similar to our findings for both the MPA and MPRD, the bottom panel of Appendix Table B.3 shows that the relationship between the MPC and net wealth-to-income is stronger for the respondents with negative net liquid wealth. Standard incomplete markets models generally would predict the opposite relationship, as those with lower net liquid wealth-to-income ratios are more constrained, and should thus have higher MPCs (Kaplan and Violante (2022)). We return to this perhaps counter-intuitive result in Section 3, showing how our model is able to rationalize this correlation.

While most empirical papers find a *negative* and significant relationship between MPCs and liquid assets (e.g., Ganong et al. (2020), Fagereng et al. (2021)), some find the opposite or no correlation at all (see Kueng (2018) and Sahm et al. (2010)). The empirical evidence on the relationship between MPCs and debt (and/or negative net wealth balances) - the correlation most related to our analysis - is limited. Fagereng et al. (2021) find no significant relationship between MPCs and debt levels when controlling for other household characteristics. Crawley and Kuchler (2023) show that MPCs increase with net wealth for Danish households with negative balances, thus in line with our findings, and then decrease for positive net wealth.[16]

External validity. The facts we have presented thus far are not specific to the COVID-19 episode. The SCE panel also contains pre-COVID information on the response to a hypothetical transitory income shock. Specifically, we use the Household Spending module that has been collected every 4 months since August 2015. As part of this module, households were asked to think about a hypothetical 10% increase in income, and to report which fraction of it they would use to spend, save, or pay down debt. In this setting too, with data from before 2020, Appendix Figures B.8 and B.9 show that (i) MPRDs are large, (ii) MPRDs are increasing in gross unsecured debt-to-income ratios, and (iii) MPCs are decreasing with

[16] We also find a positive and statistically insignificant relationship between the MPC and annual household income when we control for other observable household characteristics (see Table B.4 in Appendix B). This is in line with Sahm et al. (2010) and Shapiro and Slemrod (2009), who find a weakly positive and insignificant relationship between income and the likelihood of reporting having mostly spent the rebate. For the same 2008 tax rebate episode in the U.S., Lewis, Melcangi and Pilossoph (2021) and Kueng (2018) estimate a statistically significant positive correlation between income and estimated spending propensities.

them.[17,18]

In summary, the existing empirical evidence on MPCs and MPRDs is far from conclusive. Our analysis makes progress in documenting household heterogeneity in response to fiscal transfers. Next, we set out to show what theoretical mechanisms can be consistent with our empirical findings.

3 Explaining the empirical facts

In this section we present a simple yet natural twist on a standard consumption-savings model to illustrate one intuitive mechanism that can generate the facts from the previous section. In a nutshell, borrowing constraints and income uncertainty typically work against the empirical evidence shown in Facts 1-3, making the consumption function more concave and giving low-asset (more constrained) households a higher MPC than high-asset (unconstrained) ones. We show that a simple and empirically relevant alteration to this model via a non-constant price schedule of debt can overturn these channels and make the model consistent with the empirical findings. We then use the framework to explore the implications for fiscal policy.

To begin, we fix ideas using an illustrative two-period model without income risk to clarify when the consumption function becomes convex. Then, we present a richer model that we use for our quantitative exploration and counterfactuals. In both, we assume there is a single, non-defaultable asset, so that paying down debt and saving are not distinct actions. Therefore, the main empirical counterpart to the model is the MPA, rather than the MPRD and MPS separately. However, our empirical facts have already been shown to carry over to the MPA, and are driven mainly by the MPRD.

3.1 An illustrative two-period model

Households live two periods $t = 1, 2$ and use a single asset, a_2, to move consumption between periods. We assume that households choose a terminal asset level a_3 equal to zero and are born with $a_1 = 0$ assets. Income is exogenous and equal to y_1 in the first period and y_2 in the second. We abstract from income risk to cleanly highlight our main mechanism, but reintroduce income risk in the full quantitative model in the next section. Households derive utility from consumption, with a utility function given by $u(\cdot)$, with positive first derivative and negative second derivative. They discount the future at a factor β and face a debt

[17] Using the SCE Credit Access module, we construct a measure for gross unsecured debt, but we do not have information on the assets of the respondents in the SCE panel.

[18] Boutros and Mijakovic (2023) use the same data to report average MPRD and MPC and show how MPRD, MPC, and MPS vary with the level of liquid assets and liquid debt.

price schedule $q(a_2)$, which we assume to be exogenous and continuously differentiable.[19] Specifically, $q(a_2) = \frac{1}{1+r}$ for all $a_2 \geq 0$, while for $a_2 < 0$ we will have $q(a_2) \leq \frac{1}{1+r}$ and $\frac{\partial q(a_2)}{\partial a_2} \geq 0$. When the latter inequalities are strict, the pricing function represents a borrowing premium that changes with debt as in any model with endogenous default risk.

The problem the household solves is then:

$$\max_{a_2} \quad u\left(y_1 - q(a_2)a_2\right) + \beta u\left(y_2 + a_2\right) \tag{1}$$

where we have made use of the first period budget constraint $c_1 + q(a_2)a_2 = y_1$ and second period consumption is just available resources $y_2 + a_2$.

Constant Prices. When interest rates are constant, $q\left(a_2\right) = q = \frac{1}{1+r}$ everywhere, and therefore $\frac{\partial q(a_2)}{\partial a_2} = 0$. The optimal choice of consumption and savings is determined by the standard Euler Equation which boils down to:

$$\frac{\partial u\left(c_1\right)}{\partial c_1} = \beta \frac{\frac{\partial u(c_2)}{\partial c_2}}{q\left(a_2\right)} = \beta\left(1+r\right)\frac{\partial u\left(c_2\right)}{\partial c_2}$$

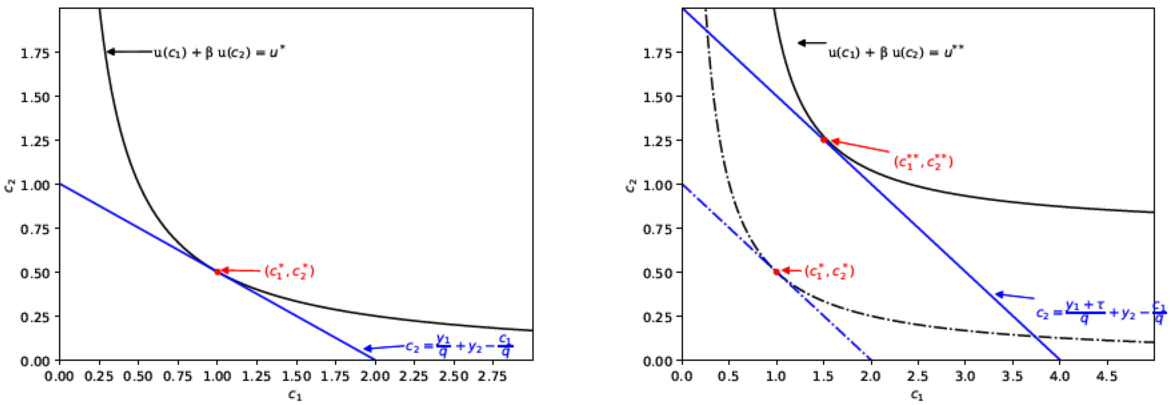
in which the household is indifferent between consuming another unit today - valued at the marginal utility of consumption today - and buying a bond at price $\frac{1}{1+r}$ to consume another unit tomorrow, valued at the marginal utility of consumption tomorrow (appropriately discounted). In this risk-free framework, it is a standard result that a_2 will be linear in cash-on-hand y_1 (see Friedman (1957) and Appendix A). Therefore, $\frac{\partial q(a_2)}{\partial a_2} = 0$ implies that both $\frac{\partial a_2}{\partial y_1}$ and MPCs ($\frac{\partial c_1}{\partial y_1}$) are constant in cash-on-hand.

The left-hand panel of Figure 3 depicts this in $\{c_1, c_2\}$ space graphically for some endowments y_1, y_2 and prices q. The inter-temporal budget constraint is represented by a straight line with slope $-\left(1+r\right)$. Starting from some initial y_1, the optimal consumption bundle is the point of tangency between the indifference curve and the budget set.

As we increase y_1 to $\bar{y}_1$, as depicted in the right-hand panel, the horizontal intercept shifts by $\tau = \bar{y}_1 - y_1$, while the vertical intercept shifts by $\tau\left(1+r\right)$. Importantly, the slope of the budget line is unchanged. The income effect implies that consumption in both periods rises while there is no substitution effect because the interest rate is unchanged. Since consumption goes up in the second period, this implies that savings increase, so that some of the increase in income is used for increased savings/ less borrowing. When preferences are HARA, the MPC is independent of the initial cash-on-hand and is equal to $\frac{1}{1+\beta}$.

[19] Section 4.1.1 discusses how such a function relates to empirical evidence and theoretical proposals.

Figure 3: Optimal Consumption in Constant q Model



(a) Optimal Consumption

(b) Income windfall

Notes. The solid blue line in the left panel depicts the inter-temporal budget constraint, while the curved black line the indifference curve. In the right panel, an increase in y_1 shifts the budget constraint and the indifference curve right from the dash–dotted lines to the solid.

Non-Constant Prices. Allowing for non-constant prices can change how the MPC varies with y_1. When $\frac{\partial q(a_2)}{\partial a_2} > 0$, the Euler equation becomes:

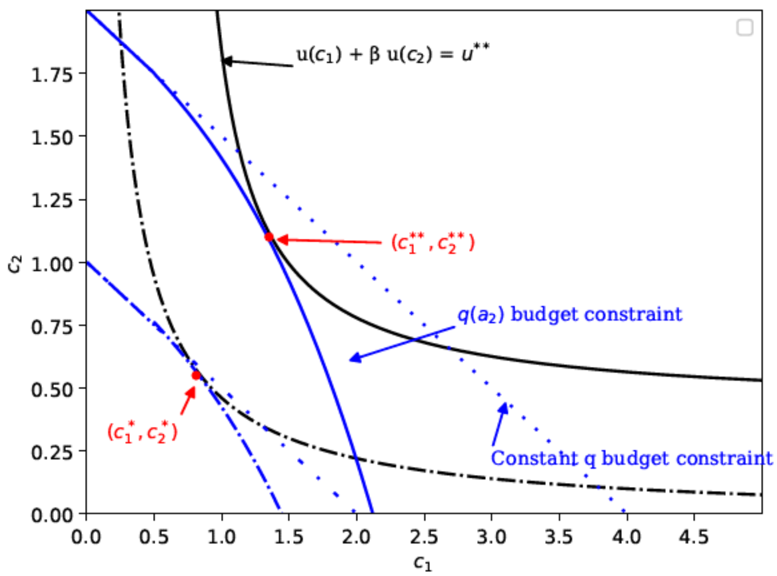
$$\frac{\partial u\left(c_1\right)}{\partial c_1} = \beta \frac{\frac{\partial u(c_2)}{\partial c_2}}{q\left(a_2\right) + \frac{\partial q(a_2)}{\partial a_2} a_2}$$

Now, the household is indifferent between consuming another unit today, again valued at the marginal utility of consumption today - and buying a bond at price $q\left(a_2\right) + \frac{\partial q(a_2)}{\partial a_2} a_2$ to consume another unit tomorrow, valued at the marginal utility of consumption tomorrow (appropriately discounted). The key difference is that the price of the bond changes with the level of borrowing, and the new effective price takes that change into account.

Allowing the bond price to change with the level of borrowing changes both the optimal level of consumption and borrowing, but also its shape over y_1 space. Specifically, it can make c_1 *convex* in y_1, and a_2 *concave* in y_1.[20] As depicted in Figure 4, in this model, as we increase y_1 to some $\bar{y}_1$, two things happen. First, this increases the range of c_1 for which savings are positive (where the slope of the budget constraint is $-(1+r)$); second, the slope of the budget set where there is borrowing becomes more vertical, indicating it is relatively cheaper to consume tomorrow relative to today. This substitution channel is absent in the constant q environment, so for a given income level, the MPC will be larger in the non-constant $q\left(\cdot\right)$ model relative to the constant q model; moreover, it will increase

[20]Notice this is the opposite effect of income uncertainty, which makes the consumption function concave as shown in Carroll and Kimball (1996).

Figure 4: Optimal Consumption in Non-Constant $q(\cdot)$ Model



Notes. The blue dotted lines show the constant q budget constraints of Figure 3. The dash-dotted blue curve shows the budget constraint for non-constant $q(\cdot)$, which shifts rightward and rotates (solid blue) when y_1 increases. Black lines are indifference curves. Red dots indicate tangency points between indifference curves and budget constraints.

in cash on hand, as that substitution effect increases at higher levels of y_1. The following proposition states this result formally for the specific bond price function which we use in our quantitative analysis.

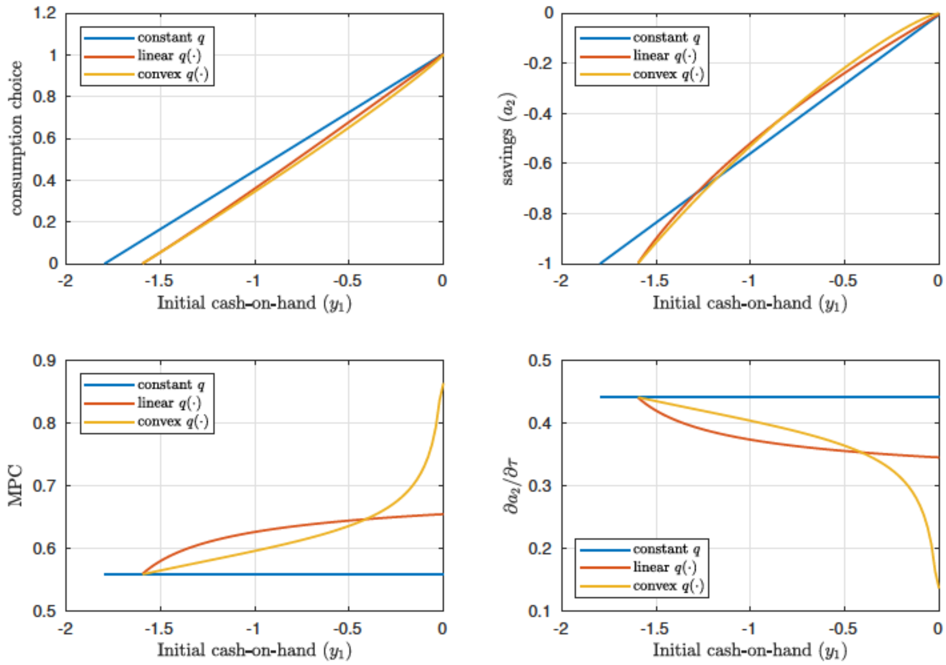
Proposition 1. *Under log utility, without income uncertainty, and assuming* $q(a_2) = \frac{1}{1+r}$ *for* $a_2 \geq 0$ *and* $q(a_2) = \frac{1}{1+r} - \phi_1 (-a_2)^{\phi_2}$ *for* $a_2 < 0$*, where* $\phi_1 > 0$ *and* $0 < \phi_2 \leq 1$*, the* $MPC = \frac{\partial c_1}{\partial y_1}$ *is increasing in cash-on-hand* y_1*.*

Proof. See Appendix A. □

Non-Linearity in the Price Function The second derivative of $q(\cdot)$ can have an important quantitative effect on the shape of the MPC across y_1 space. Specifically, the change in the steepness of the budget set in response to changes in y_1 depends on the level of income if $q(\cdot)$ is non-linear. Differentiating the budget constraint, we can see that MPCs depend on two terms: how $q(\cdot)$ changes with a_2 (i.e., price effect) and how a_2 changes with income (i.e., choice effect).

Ceteris paribus, the MPC function is higher with a stronger price effect ($\frac{\partial q(a_2)}{\partial a_2} > 0$); this is also evident when looking at the Euler equation, where the effective interest rate

Figure 5: Household choices with different $q(\cdot)$ functions



becomes $(q(a_2) + \frac{\partial q(a_2)}{\partial a_2} a_2)^{-1}$. More importantly, MPCs can be upward sloping in cash on hand, depending on the combined "price" and "choice" effect. In Figure 5, we show that the savings function, the a_2 choice, goes from linear to concave when $\frac{\partial q(a_2)}{\partial a_2} > 0$, and thus the consumption function becomes increasingly convex. This is already true if $q(\cdot)$ is linear. With a convex $q(\cdot)$ this effect is even stronger and, as a result, the MPC increases by even more.

Borrowing wedges Recent versions of standard incomplete market models often incorporate a wedge between the interest rate faced by savers and borrowers (see, for instance, Kaplan et al. (2018)). With deterministic income as in the simple model of this section, this feature would not affect MPCs except locally around zero assets. However, it can generate MPCs that are increasing in net assets for borrowers over a larger portion of the negative asset space, as proven by Achdou et al. (2022) (see their Appendix G.3) with income risk. In that setup, income uncertainty makes the wedge work similarly to a soft borrowing constraint, as agents place a non-zero probability on being at the asset kink in the future. Our debt price function generalizes that setup, which allows the model to flexibly fit the empirical pattern of debt and MPCs regardless of the stochastic process for income. Indeed, extreme convexity of our $q(\cdot)$ function resembles a borrowing wedge near zero assets, as it also creates a discontinuity in the derivative of the interest rate. We discuss later how convexity also improves the quantitative fit of the model, generating empirically plausible interest rate profiles.

3.2 Full Quantitative Model

In this section we extend the intuition outlined with the two-period model to a standard, infinite-horizon, incomplete-markets model of consumption and savings. The economy is populated by a continuum of infinitely lived households indexed by their net asset holdings a and their exogenous income y.[21] Households can borrow at a price schedule $q(\cdot)$, whose features we describe below.

Our characterization of the evolution of households' income follows Krueger et al. (2016) and, more generally, a large empirical literature in labor economics. Log labor income y follows:

$$y = z + \epsilon \tag{2}$$

where z is the persistent component of income and ϵ is the transitory component of income. The persistent component of log income follows $z' = \rho z + \eta$. Innovations to z, denoted with η, as well as transitory shocks ϵ, have mean zero and are normally distributed with variances σ_η^2 and σ_ϵ^2, respectively. We denote by $F(\cdot)$ the CDF of ϵ and $\pi(z'|z)$ the conditional probability of z' given z. η and ϵ are orthogonal to each other and independently distributed over time and across households. Finally, households can receive a lump-sum transfer τ from the government.

Households begin the period with their net asset position a and income y. Households can have a negative net asset position $a < 0$, which we assume to be bounded below by the natural debt limit a_{ndl}. Every period, households choose consumption of a nondurable good c, from which they derive utility $u(c)$, and next period assets a'. New assets are purchased at a price $q(\cdot)$. As we discussed previously, in the standard incomplete markets model $q = \frac{1}{1+r}$ for all households, where r is the risk-free rate. We nest this case with a generic formulation for the asset price:

$$q = \begin{cases} \max\left[\frac{1}{1+r} - \phi_1 \left(-a'\right)^{\phi_2}, 0\right] & \text{if } a' \le 0 \\ \frac{1}{1+r} & \text{if } a' > 0 \end{cases} \tag{3}$$

When $\phi_1 > 0$, larger borrowed amounts are associated with worse prices (higher interest rates). The household problem can be summarized as follows:

[21] We omit time subscripts and denote next period variables with the superscript $'$.

$$
\begin{aligned}
V(a,z,\epsilon) = &\max_{c>0,a'>a_{ndl}} u(c) + \beta E_{z',\epsilon'} V(a',z',\epsilon') \\
\text{subject to}: & \\
&c + q(a')a' - a = e^{z+\epsilon} + \tau \\
&z' = \rho z + \eta
\end{aligned}
$$

Household decisions To understand the role played by the price schedule $q(\cdot)$, and how it alters the inter-temporal trade-off faced by households, we look at the generalized Euler Equation in the infinite horizon model:

$$
\frac{\partial u(c)}{\partial c}\left\{\frac{\partial q(a')}{\partial a'}a' + q(a')\right\} = \beta E_t \frac{\partial u(c')}{\partial c'} \tag{4}
$$

The intuition is the same as in the two-period model. When prices are constant ($\frac{\partial q(\cdot)}{\partial a'} = 0$), we obtain the standard incomplete-markets Euler equation according to which a household equates the marginal utility gain of consuming a dollar today, to the gain of not consuming it, saving, and consuming tomorrow the interest-accrued dollar. With an interest rate schedule of debt, this condition is affected in two ways. First, borrowing households will have fewer available units to consume as $q(\cdot)$ declines. Second, savings decisions (i.e., a') affect the pricing schedule and therefore change the amount of available resources.

Put differently, the Euler Equation now includes an additional term, $\frac{\partial u(c)}{\partial c}\frac{\partial q(a')}{\partial a'}a'$, that was not present in the constant interest rate framework. In levels, this term acts like a higher interest rate, but it also changes at different levels of c and a'. Since both of these are monotone in cash-on-hand, as resources increase, marginal utility declines and the additional $\frac{\partial q(a')}{\partial a'}a'$ is less important. Again, this makes our consumption function convex, with a deviation from the constant $q(\cdot)$ consumption function that is declining in cash-on-hand.

A natural consequence is that a non-constant price schedule of debt will alter the distribution of marginal propensities to consume and, in particular, how they correlate with net asset positions. Households with a high marginal utility of consumption can face lower prices $q(\cdot)$ and positive $\frac{\partial q(a')}{\partial a'}$. For borrowers (ie, $a' < 0$), both margins increase the household's effective discount factor. As such, they decrease the motive to bring forward consumption. Other things equal, this reduces their incentive to immediately spend transitory transfers (i.e., it lowers their instantaneous marginal propensity to consume).[22]

[22] Another way to think about this effect is that the non-constant interest rate schedule gives low asset households an additional marginal value of increasing assets, akin to the description of "saving-constrained" households in Miranda-Pinto et al. (2020).

Responses to transitory income shocks We now describe households' responses to a transitory income shock like a tax rebate, τ. In what follows, we consider these innovations τ as local perturbations of income. We differentiate the budget constraint with respect to the τ component of income:

$$\frac{\partial c}{\partial \tau} + \frac{\partial q(a')}{\partial a'}\frac{\partial a'}{\partial \tau}a' + q(a')\frac{\partial a'}{\partial \tau} = 1 \tag{5}$$

The well-known marginal propensity to consume (MPC) is defined as usual:

$$\text{MPC} := \frac{\partial c}{\partial \tau}$$

while the marginal propensity to adjust the net asset position is:

$$\text{MPA} := \frac{\partial q(a')}{\partial a'}\frac{\partial a'}{\partial \tau}a' + q(a')\frac{\partial a'}{\partial \tau}$$

As in the data, the MPC and the MPA must sum to 1 at the household level.

4 Quantitative exploration

4.1 Calibration

We assume one model period is one quarter. The parameters governing the income process come from Krueger et al. (2016). Utility from consumption follows a CRRA specification, with risk aversion parameter γ equal to 1 (log utility). The quarterly risk-free interest rate, r, is set to match a 3 percent annual rate.

The three remaining parameters, β, ϕ_1, and ϕ_2 are chosen by targeting three moments from the SCE: (i) the share of households with negative net liquid assets, (ii) the MPC of households in the bottom quintile of net liquid wealth-to-income, $\frac{a}{\overline{y}}$, conditional on negative net liquid assets, and (iii) the MPC in the top quintile, also for negative asset holders.[23] All of these are taken from our SCE data sample used in Section 2. The first target is somewhat larger than the share of households with negative liquid wealth in Kaplan, Moll and Violante (2018). There are a range of estimates in the literature, partly due to an ongoing debate on whether to use net worth or gross unsecured debt, and whether to use liquid or total assets as the calibration target.[24] Our liquid wealth calibration implies a relatively low value of β,

[23]To align the model with the data, $\overline{y}$ is annual income, hence the sum of income in the current quarter and the previous three quarters for a given household. As in the data, we scale assets by income to remove permanent (or persistent) differences in income that scale both asset and consumption choices.

[24]For instance, 39% of US households in the 2016 SCF carried a balance on their credit card, as reported by Exler and Tertilt (2020).

Table 2: Calibration

Internally calibrated parameters		
β	0.97	
ϕ_1	0.05	
ϕ_2	0.10	
Pre-defined parameters		
r	0.0074	
γ	1	
ρ	0.9923	
σ_η	0.0985	
σ_ϵ	0.2285	
Targeted moments	Data	Model
Share of Households with $a < 0$	0.386	0.372
MPC (bottom quintile of $\frac{a}{y}$, $a < 0$)	0.197	0.177
MPC (top quintile of $\frac{a}{y}$, $a < 0$)	0.292	0.274

0.97 quarterly, because the relevant concept of wealth for our model excludes many illiquid assets and secured debts.

The remaining two targets ensure that our model matches our second and third empirical facts documented in Section 2: the MPC (MPA) is higher (lower) for those with less negative net wealth to income ratios. The model also does well along other, not targeted dimensions. For example, the MPC of the median negative asset holder is 0.25 in the model and 0.23 in the data, whereas the average MPC of debtors is 0.25 in the model and 0.24 in the data.

4.1.1 Calibration-implied $q(\cdot)$ function

Given the model calibration, we consider whether the debt price schedule delivered by the model is empirically plausible. This is a somewhat difficult question to answer directly, since there is little empirical evidence on the relationship between $q(\cdot)$ and debt.

To start, we first investigate whether the households in our model face empirically plausible interest rates. The mean annualized interest rate faced by households with debt in our model is 20.8%, varying from risk-free 3% to 28.1%. The median interest rate, 21.5%, is broadly in line with estimates by Galenianos and Gavazza (2022). Our calibration delivers a dispersion of interest rates slightly lower than what estimated by Galenianos and Gavazza (2022), with ten percent of households facing an interest rate of 24% or more.

We can also construct actuarially fair default probabilities, $q(a) = \frac{1}{1+r}(1 - Pr[\text{default}](a))$, assuming that the $q(\cdot)$ function arises from lenders' pricing default risk. Our implied quarterly default probabilities are as high as 5.3% in the negative asset region, and we have an average default probability among negative asset holders of 3.9%, or 1.4% overall. Once annualized, this is higher than the bankruptcy rates considered by Chatterjee et al. (2007) and Athreya et al. (2018), but lower than delinquency rates. Our maximum annualized default probability (19.6%) is basically equivalent to the upper bound considered by Dempsey and Ionescu (2021) in their empirical investigation.

Moreover, the household finance literature typically focuses on the relationship between discount prices $q(\cdot)$ and default probabilities (which we have shown above to produce reasonable magnitudes), while we instead need their relationship with debt levels. For instance, standard default models generate a linear and decreasing (increasing) relationship between default probabilities and $q(\cdot)$ (borrowing rates). In a recent paper, Dempsey and Ionescu (2021) find that, in the data, the relationship between default probabilities and interest rate spreads is in fact increasing and concave (rather than linear), and thus borrowing premia are needed in addition to standard default premia to generate empirically consistent patterns. While their implied discount prices $q(\cdot)$ are convex in (minus) loan sizes in their model as in ours, a convex relationship between $q(\cdot)$ and net assets can also be generated in a standard default model with actuarial fair pricing of debt. The canonical model of this, Chatterjee et al. (2007), shows this feature in their Figures 5 and 6, in which default probabilities are decreasing and concave in net assets yielding a debt price schedule that looks similar to ours.

Finally, as noted earlier recent papers (e.g., Kaplan et al. (2018)) also featured borrowing "wedges" that made MPCs increasing in net assets for borrowers in at least part of the asset space. The wedge is a constant increase in interest rate for borrowers and creates a local convexity in the consumption function near zero net assets. In our calibrated model, a wedge of their size (a 6 percentage point wedge in the annual interest rate) generates MPCs that are slightly decreasing in net assets among borrowers and do not quantitatively fit our empirical estimates. If we recalibrate the model targeting the same empirical moments of Table 2 with a wedge, a better fit can be achieved with a wedge of 12 percentage points. However, that magnitude is implausibly large when compared with estimates by Davis et al. (2006), and the fit is still worse than the one generated by our interest rate schedule. In sum, while other mechanisms can qualitatively generate MPC patterns like those we highlight, we see our $q(\cdot)$ function as a usefully flexible generalization of empirically plausible debt price schedules.

4.2 Stimulus through insurance

In this section we show how accounting for the documented empirical facts through a non–constant debt price schedule can alter the expected effects of fiscal policy. We perform three exercises. First, we show that, when interest rates are debt-sensitive, stimulus and insurance motives do not align well across households. As a result of this, transfers would be allocated differently depending on whether the planner wished to maximize aggregate spending or aggregate welfare. This tradeoff materializes also when comparing short-run and long-run fiscal multipliers: debt-sensitive interest rates lower upon-impact consumption responses of the poorest households, while making them more persistent over time. Conversely, they increase MPCs of households with little debt, but steepen their dynamic profile. In our second exercise, we show how these two effects aggregate up in the economy and unfold over time. We show that, crucially, a non-constant debt-price schedule amplifies the consumption effects of fiscal policy.

Finally, we compute the average welfare and consumption gains stemming from the Economic Impact Payments (EIP) by allocating the payments in the model as they had been in allocated as part of the program in 2020. As in Kaplan and Violante (2014), our analysis is in partial equilibrium, and thus interest rates are exogenous. This is consistent with our liquid wealth calibration, which excludes much of the US capital stock, but focuses on the assets most relevant to the interest rate schedule we infer, and which are most likely to be affected by households' MPRD. Hence, the aggregate response reflects heterogeneity in household responses towards the bottom of the distribution.[25]

4.2.1 Stimulus vs insurance across households

To compute welfare in this model, we solve for a consumption variation function $\kappa(\cdot)$ that renders agents indifferent between receiving the rebate and not receiving the rebate. This amounts to solving for the $\kappa(a, \varepsilon, z)$ such that:

$$V(a+\tau, \epsilon, z) = \sum_{t=0}^{T} \beta^t u(c_t^\tau) = \sum_{t=0}^{T} \beta^t u((1+\kappa(a, \varepsilon, z))c_t)$$

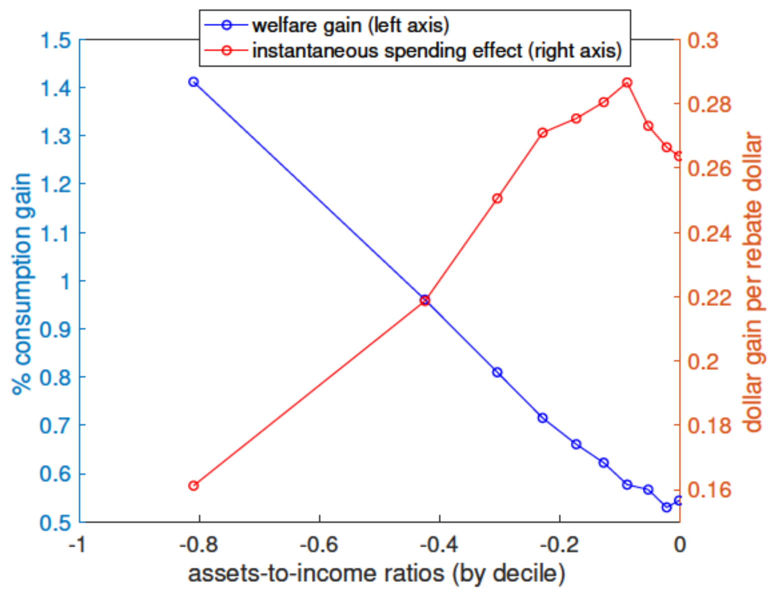
where $\{c_t^\tau\}_{t=0}^T$ is the sequence of optimal consumption choices starting from date $t = 0$ and asset level $a + \tau$ and $\{c_t\}_{t=0}^T$ is the sequence of consumption choices starting from a. With log utility this becomes fairly straightforward to compute:

$$\kappa(a, \varepsilon, z) = \exp\{(1-\beta)(V(a+\tau, \varepsilon, z) - (V(a, \varepsilon, z))\} - 1$$

We show this graphically in Figure 6, depicting the $\kappa(\cdot)$ (multiplied by 100) in blue. In addition, we also plot the upon-impact spending responses to the rebate in red. Given

[25] Our setup also abstracts from how stimulus checks are financed by the government and from the credit sector to whom debt service would be paid.

Figure 6: Stimulus vs insurance across households



Notes. We bin the stationary distribution of households' assets-to-income ratios, conditional on $a < 0$, by 10 deciles of equal mass. For each decile, we plot the average welfare gain due to the transfer, in blue, and the dollar-for-dollar spending effect of the transfer upon impact, in red. Portions of the line where there are more points, i.e. deciles are closer together, imply there is more mass.

the focus of our paper, we show only negative asset holders. Throughout this section, we consider a uniform, transitory, and unexpected lump-sum transfer equal to 10% of average quarterly income.[26] In line with the empirical analysis and our calibration, we rescale assets by household income. To better visualize the pattern , we bin households by 10 quantiles of their asset–to–income ratios, and, for each quantile, we compute the average welfare gain and spending propensity.

In Figure 6 welfare and instantaneous spending gains are starkly negatively related. As debt decreases, households spend a larger fraction of the rebate today, but also have marginally decreasing welfare gains. This holds regardless of binning; across 50 quantiles of negative asset–income ratios, for instance, the correlation between welfare gains and short-run spending effects is -0.93. This underscores how debt-sensitive interest rates create a clear trade-off between stimulus and insurance. If instead we consider an alternative model in which households face a constant interest rate, spending and welfare gains co-move, with a correlation across quantiles of $+0.76$.[27] Therefore, debt-sensitive interest rates imply that

[26] This is approximately equivalent to $1200, which was the payment size received by an individual with no dependent children.

[27] For this environment, we assume that households face an exogenous borrowing limit equivalent to the one generated in our baseline model. The equivalent of Figure 6 for this model can be found in Appendix C.

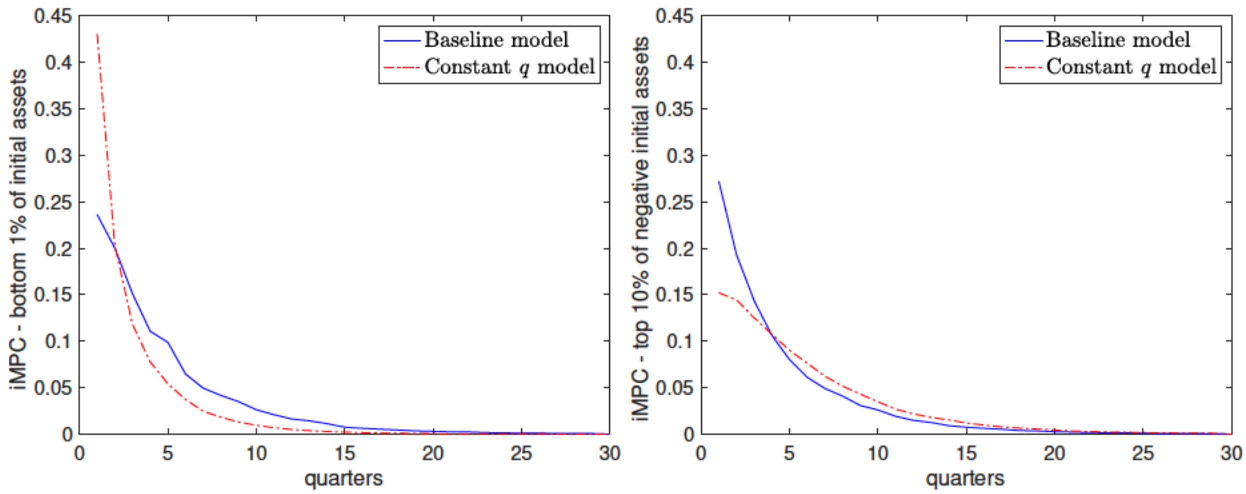
policymakers may wish to design fiscal policies differently depending on their objective. This consideration also underscores a trade-off between short- and long-run fiscal multipliers, which we investigate next.

4.2.2 The aggregate effects of fiscal policy

While debt-sensitive interest rates make MPCs increasing in net assets for debtors, they also alter the dynamics of spending responses. Figure 7 plots inter-temporal MPCs – i.e., the dollar-for-dollar consumption response over time to a transitory cash transfer in the first period. In the left panel, we average across households in the bottom first percentile of the asset distribution when the transfer is paid out, while in the right panel we look at the 10% of households with smallest debt balances. As done before, we compare our calibrated model with an alternative in which households exogenously face the same borrowing limit, but interest rates do not vary. For now, we also maintain all the relevant parameters fixed as in our calibration, to ensure maximum comparability. When q is constant, the poorest behave as standard liquidity-constrained households, consuming most of the rebate in the very first quarters. In our baseline model, instead, there is an extra incentive to use the transfer to pay down debt. The instantaneous MPC is nearly half as much as in a model with constant interest rates, but these households keep spending more for longer. In fact, their cumulative spending response exceeds the amount of rebate dollar after three years, thanks to endogenous improvements in the price of debt $q(\cdot)$. The right panel, instead, shows that households with little debt respond more upon impact in our baseline model than with constant interest rates. This is driven by the force shown in Figure 5, in which the very steep interest rate schedule in that region of assets raises the level of the MPC.

The aggregate spending effect of fiscal transfers depends on the combination of these offsetting forces. In addition, keeping β fixed at our baseline calibration in the model with constant q generates an excessively high share of households with negative net assets. Hence, we consider an alternative calibration for the constant q model, in which β is set to 0.9875 to match the empirically measured share of households with negative net liquid wealth. Figure 8 shows the aggregate consumption effects in our baseline model and in the two calibrations for the alternative model. Holding β constant, debt–sensitive prices lower aggregate spending upon impact and they make it more persistent, as households that paid down debt can sustain higher consumption for a longer period. Cumulatively, the increase in aggregate spending is equalized in the two models after about 2 years, as shown in the right panel of Figure 8; thereafter, improvements in debt positions and resulting lower interest rates imply that the cumulative aggregate spending is 8 percentage points higher than the aggregate size of transfers. In other words, a non-constant debt-price schedule amplifies the consumption

Figure 7: Heterogeneous intertemporal MPCs



Notes. In the constant q model, showed with dash-dotted red lines, households exogenously face the same borrowing limit as in the baseline model, but interest rates do not vary.

effects of fiscal policy relative to an environment with a constant debt-price schedule. This is even more evident when comparing our baseline model with the recalibrated version of a setup with constant interest rates.

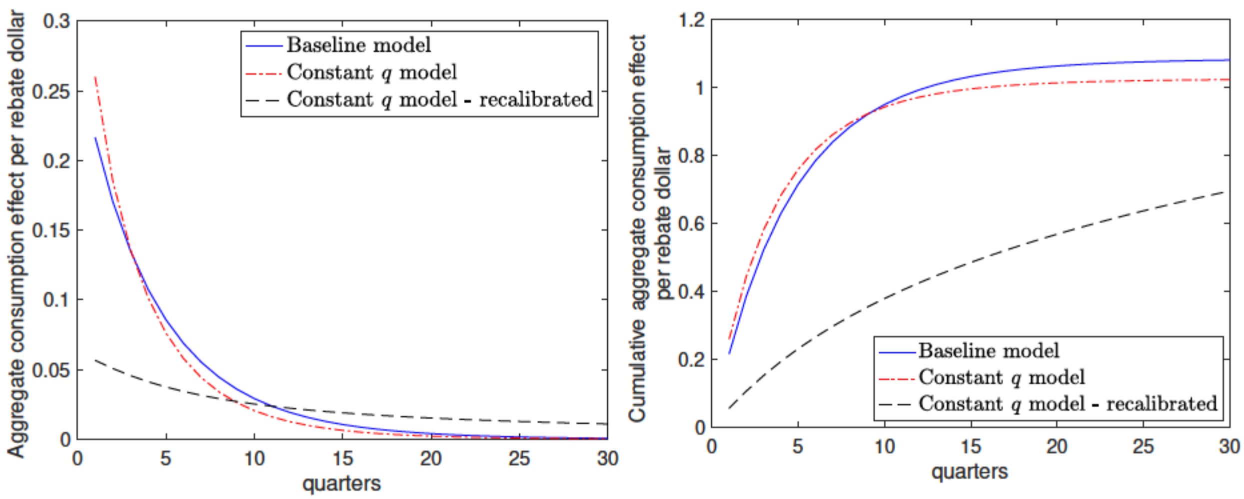
Auclert et al. (2018) discuss how inter-temporal MPCs can be used to discipline heterogeneous agent macro models. Our model generates consumption responses in the first two years that are quantitatively similar to their analysis: in particular, not only a bit more than 50% of the rebate is spent in the first year, but also a fairly large fraction is spent in the following year.[28] In addition, our analysis suggests that debt-sensitive prices not only matter for the short-run persistence of inter-temporal MPCs, but also for the amplification of fiscal policy more years out. Our mechanism is thus also consistent with empirical evidence by Agarwal et al. (2007), who estimate debt responses to 2001 tax rebates in the United States. They find that consumers initially used the checks to pay down debt, stimulating an increase in spending in the medium-run.

4.2.3 Stimulus and insurance effects of Economic Impact Payments in the model

To measure the effects of the 2020 EIP, we assign realistically sized transfers to the households in the model, as dictated by the fiscal package. For simplicity, we assume that each model agent is a single earner household without kids. For these individuals, if their adjusted gross

[28]Our first year response (63%) is on the upper end of the estimates they report using Italian data and Norwegian estimates by Fagereng et al. (2021), and our second year response is also slightly higher at 25 cents rather than 16.

Figure 8: Aggregate spending effects of a transfer



Notes. In the constant q model, $\beta = 0.97$ in the version plotted with a dash–dotted red line, while the recalibration with $\beta = 0.9875$ is shown with dashed black.

income was less than or equal to $75,000 in 2019, they received a payment of $1,200, which we approximate with 10% of average quarterly income. In accordance with data from the IRS, Statistics of Income Division (November 2021) on the distribution of single filers' income in 2019, we allocate the $1200 check to the first 88 percentiles of the income distribution. Agents in the top 6.5% of the income distribution receive no payment since their income exceeds $100,000 per year and they are thus ineligible. For the intermediate incomes, we phase out payments approximating how they were phased out in the program.[29]

In response to this expansionary fiscal policy, in the baseline model welfare rises by 0.52%. This is equivalent to the welfare response with constant interest rates and fixed β, due to the large fraction of households in debt, but much higher than the recalibrated alternative (0.20%). This difference comes mostly from the third of households with negative asset positions, thus suggesting that the standard incomplete markets model is substantially understating welfare gains among those in debt, for whom the MPRD is greatest and who gain the most from the decline in debt service they have to pay.

There are, however, also differences in the response of households with positive assets. This is because these households may get a negative shock in the future, find themselves in debt and then have to face the $q(\cdot)$ function. The transfer lets these households build a buffer stock away from that event, giving them some welfare gain above that which is predicted by the constant interest rate model.

[29] In implementation, we consider 7 payment sizes between $1200 and 0.

As a flip side of the considerations on welfare, the model also predicts a smaller consumption response to the EIP payments, when β is held constant, consistent with what showed earlier. Specifically, the baseline model sees an average instantaneous increase in consumption of only 21 cents per rebate dollar, instead of 25 cents in a model with constant interest rates; however, the latter drops to 6 cents when recalibrating the discount factor.

In summary, the $q(\cdot)$ function has heterogeneous effects on welfare and consumption gains from fiscal transfers, making high debt households extend out their consumption response while increasing instantaneous MPC of others. Once accounting for the distribution of households, our model generates larger consumption and welfare gains than what would be gauged by a constant-interest rate incomplete markets model.

5 Conclusions

We provide new empirical evidence for an underappreciated fact: most households use fiscal transfers to pay down debt. In addition, we find that these MPRDs are largest among households with more negative net wealth-to-income ratios. Conversely, these households spend relatively little of their rebate checks upon impact.

A standard heterogeneous-agent, consumption-savings model can be consistent with these facts if borrowing rates increase with household debt. We analytically characterize the conditions underlying this result. A full quantitative model replicates the empirical facts and is used as a laboratory to show how our novel mechanism substantially alters the effects of fiscal stimulus. In particular, a tradeoff may arise between immediate spending stimulus and longer–run welfare gains. As such, policymakers can maximize the former or the latter targeting different sets of households.

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A Proofs

Proof. First, we rewrite the Euler equation in the form of an elasticity of the interest rate:

$$\frac{\partial u(c_1)}{\partial c_1}(1+\frac{\frac{\partial q(a_2)}{\partial a_2}}{q(a_2)}a_2) = \frac{\beta}{q(a_2)}\frac{\partial u(c_2)}{\partial c_2}$$
$$\frac{\partial u(c_1)}{\partial c_1}(1+\epsilon_q(a_2)) = \frac{\beta}{q(a_2)}\frac{\partial u(c_2)}{\partial c_2}$$

We consider CRRA utility $u\left(c\right) = \frac{c^{1-\sigma}-1}{1-\sigma}$ and replace consumption with the budget constraints. Income is deterministic and y_2 is independent of y_1. If $q = \frac{1}{1+r}$, then

$$a_2\left\{(\beta(1+r))^{\frac{-1}{\sigma}} + \frac{1}{1+r}\right\} = y_1 - (\beta(1+r))^{\frac{-1}{\sigma}}y_2$$

That is, a_2 is linear in initial cash on hand and, therefore, $MPA = \frac{\partial a_2}{\partial y_1}$ is constant. From the budget constraint it follows that the MPC is also constant.

For q non-constant, we focus our attention on $a_2 < 0$. First, we rewrite the Euler equation such that:

$$\xi = \beta\left(\frac{y_1 - q\left(a_2\right)a_2}{y_2+a_2}\right)^{\sigma} = q\left(a_2\right) + \frac{\partial q(a_2)}{\partial a_2}a_2 > 0$$

Differentiating by y_1, assuming that y_2 is independent of y_1:[30]

$$\left(\frac{y_1 - q\left(a_2\right)a_2}{y_2+a_2}\right)^{\sigma-1}\left[\frac{\left(y_2+a_2\right)\left(1-\frac{\partial q(a_2)}{\partial a_2}\frac{\partial a_2}{\partial y_1}a_2 - \frac{\partial a_2}{\partial y_1}q\left(a_2\right)\right) - \left(y_1 - q\left(a_2\right)a_2\right)\frac{\partial a_2}{\partial y_1}}{\left(y_2+a_2\right)^2}\right] =$$
$$\frac{1}{\beta}\left[2\frac{\partial q(a_2)}{\partial a_2}\frac{\partial a_2}{\partial y_1} + \frac{\partial^2 q(a_2)}{\partial a_2^2}\frac{\partial a_2}{\partial y_1}a_2\right]$$

$$\sigma\left(\frac{y_1 - q\left(a_2\right)a_2}{y_2+a_2}\right)^{\sigma}\left(\frac{y_1 - q\left(a_2\right)a_2}{y_2+a_2}\right)^{-1}\left[\frac{\left(y_2+a_2\right)\left(1-\frac{\partial a_2}{\partial y_1}\xi\right) - \left(y_1 - q\left(a_2\right)a_2\right)\frac{\partial a_2}{\partial y_1}}{\left(y_2+a_2\right)^2}\right] = \frac{1}{\beta}\frac{\partial a_2}{\partial y_1}\Gamma$$

where $\Gamma = \left[2\frac{\partial q(a_2)}{\partial a_2} + \frac{\partial^2 q(a_2)}{\partial a_2^2}a_2\right]$.

Collect further using the Euler equation to get:

[30] Or, equally, differentiate by a transitory income shock in period 1.

$$\sigma\frac{\xi}{\beta}\left(\frac{\xi}{\beta}\right)^{-\frac{1}{\sigma}}\left[\frac{\left(1-\frac{\partial a_2}{\partial y_1}\xi\right)-\frac{(y_1-q(a_2)a_2)}{(y_2+a_2)}\frac{\partial a_2}{\partial y_1}}{(y_2+a_2)}\right]=\frac{1}{\beta}\frac{\partial a_2}{\partial y_1}\Gamma$$

And finally:

$$\underbrace{\sigma\left(\frac{\xi}{\beta}\right)^{1-\frac{1}{\sigma}}}_{>0}=\frac{\partial a_2}{\partial y_1}\left\{\frac{1}{\beta}\Gamma\underbrace{(y_2+a_2)}_{>0}+\underbrace{2\sigma\left(\frac{\xi}{\beta}\right)^{2-\frac{1}{\sigma}}}_{>0}\right\}$$

which shows that $\frac{\partial a_2}{\partial y_1}\geq 0$ as long as $\Gamma>0$.

We now consider a generic functional form $q=\frac{1}{1+r}-\phi_1\left(-a_2\right)^{\phi_2}$. Then, $\xi=q+\frac{q-\frac{1}{1+r}}{\phi_2}$. We then impose log-utility ($\sigma=1$), to get:

$$1=\frac{\partial a_2}{\partial y_1}\left\{\frac{1}{\beta}\Gamma\left(y_2+a_2\right)+2\left(\frac{\xi}{\beta}\right)\right\} \tag{A.6}$$

With our functional form, ξ is always increasing in y_1, as long as $\frac{\partial a_2}{\partial y_1}\geq 0$. Recall that this happens when $\Gamma>0$, which is now $\Gamma=\phi_2\phi_1\left(-a_2\right)^{\phi_2-1}\left(1+\phi_2\right)=\frac{\partial q}{\partial a_2}\left(1+\phi_2\right)>0$ since $\phi_2>-1$ and q increases with net assets. Moreover, Γ is (weakly) increasing in y_1 as long as $\frac{\partial q}{\partial a_2}$ is. Recalling that we are considering $a_2<0$, and differentiating Γ by a_2, this happens when $\phi_2\phi_1\left(1-\phi_2^2\right)\geq 0$. For $\phi_1>0$, this requires $0<\phi_2\leq 1$, meaning that q is increasing and weakly convex in net assets. Finally, y_2+a_2 is also increasing in y_1. Hence, all terms in the RHS brackets are increasing in y_1, implying that $\frac{\partial a_2}{\partial y_1}$ is decreasing in y_1.

What about the MPC? Recall from the budget constraint that $MPC=1-q(a_2)\frac{\partial a_2}{\partial y_1}-\frac{\partial q(a_2)}{\partial a_2}\frac{\partial a_2}{\partial y_1}a_2$. We can immediately see that, for our parameter choices, the MPC increases with y_1.

$\square$

B Data appendix

Table B.1: Sample Characteristics for the SCE June 2020 Special Module

	June 2020 SCE	June 2020 CPS	p-value
Male	0.49	0.50	0.33
White	0.88	0.78	0.00
Age	52.18	52.29	0.79
	(15.83)	(17.05)	
College	0.54	0.39	0.00
Married	0.62	0.51	0.00
Have child under age 6	0.13	0.11	0.02
Have child under age 18	0.30	0.27	0.01
Working FT	0.46	0.46	0.79
Working PT	0.11	0.12	0.57
HH income $< 50k$	0.35	0.40	0.00
HH income $< 100k$	0.75	0.59	0.00
HH income $\geq$ \$100k	0.24	0.28	0.00
N	1,423	39,075	

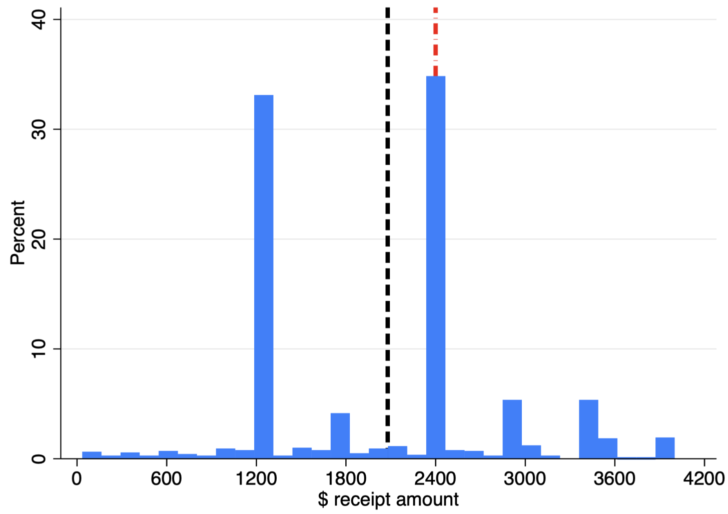
Notes. The first column shows statistics from the June 2020 special SCE module using the respondents who rotated out of the SCE panel, the second column shows the statistics from the June 2020 CPS, and the third column shows the p-value of the differences between the two columns.

Table B.2: Sample Characteristics for the SCE Household Spending Module

	SCE	CPS	p-value
Male	0.52	0.51	0.00
White	0.85	0.78	0.00
Age	51.08	51.39	0.02
	(15.24)	(17.10)	
College	0.56	0.35	0.00
Married	0.64	0.50	0.00
Have child under age 6	0.13	0.13	0.99
Have child under age 18	0.29	0.28	0.11
Working FT	0.56	0.49	0.00
Working PT	0.13	0.13	0.02
HH income $<$ \$50k	0.36	0.48	0.00
HH income $<$ \$100k	0.71	0.66	0.00
HH income $\geq$ \$100k	0.28	0.22	0.00
N	13212	3,622,389	

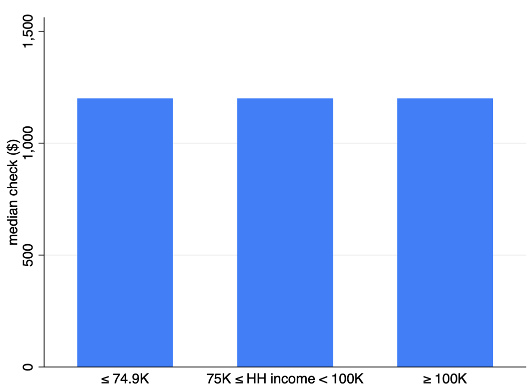
Notes. The first column shows statistics from the SCE Household Spending module for the dates between August 2015 and April 2019. This module is fielded every 4 months. The second column shows the statistics from the CPS, for the same dates as the SCE Household Spending module. The third column shows the p-value of the differences between the first two columns.

Figure B.1: Distribution of Reported Receipt Amount

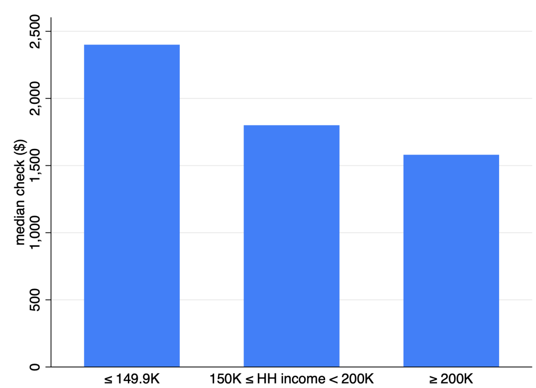


Notes. This figure shows the distribution of reported stimulus check amounts received among those who reported receiving the checks. The distribution is conditional on reporting a receipt amount below $4200. The black dashed line corresponds to the mean while the red dash-dotted line corresponds to the median.

Figure B.2: Reported Stimulus Amount Received by Households with no Children



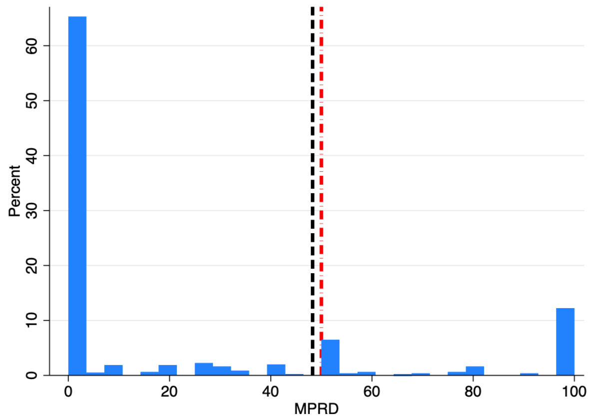
(a) Non-Married



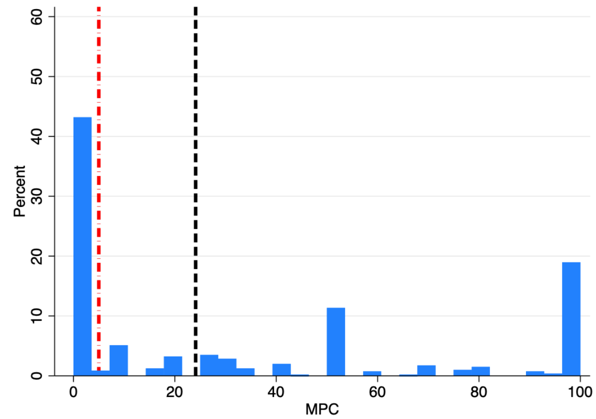
(b) Married

Notes. Panel (a) shows the histogram of the median reported stimulus amount among the three different income groups for non-married households with no children. Panel (b) shows the histogram the median reported stimulus amount among the three different income groups for married households with no children.

Figure B.3: Histograms of MPRD and MPC for those with negative net liquid wealth



(a) MPRD, negative net liquid wealth



(b) MPC, negative net liquid wealth

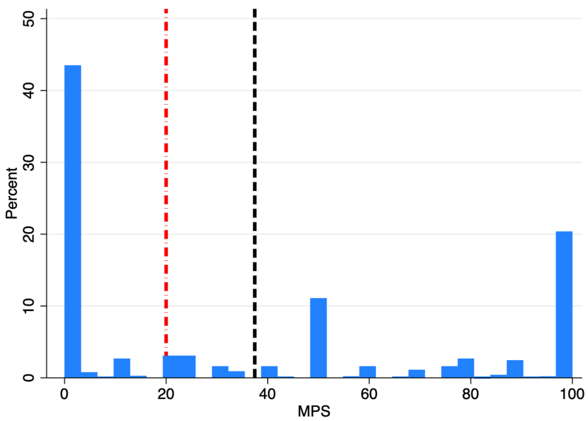
Notes. Panel (a) shows the histogram of self-reported MPRDs (the share of government payment used to pay down debts) for the sample with negative net liquid wealth. Panel (b) shows the histogram of self-reported MPCs (the share of government payment used to spend or donate) when we limit the sample to respondents with negative net liquid wealth. Figures B.4c-B.4d repeat the analysis for the MPS and MPA. In each figure, the red dashed line corresponds to the mean, while the red dash-dotted line corresponds to the median.

Table B.3: MPRD, MPC, MPS, MPA & Net Liquid Wealth to Income Ratio

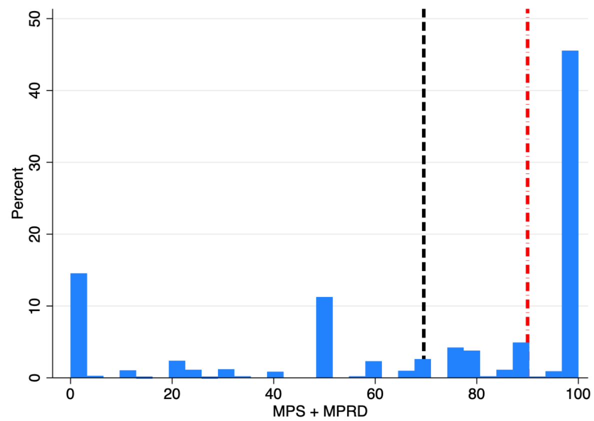
	(1) MPRD	(2) MPRD	(3) MPC	(4) MPC	(5) MPS	(6) MPS	(7) MPRD+MPS	(8) MPRD+MPS
Net liq w-to-inc	-4.71***	-4.19***	2.33***	2.10***	2.38***	2.09***	-2.33***	-2.10***
	(0.44)	(0.48)	(0.52)	(0.54)	(0.55)	(0.58)	(0.52)	(0.54)
Demographics		X		X		X		X
Region Dummies		X		X		X		X
Dep. Var. Mean	31.93	31.93	30.61	30.61	37.46	37.46	69.39	69.39
R^2	0.06	0.10	0.02	0.03	0.01	0.05	0.02	0.03
Net liq w-to-inc	-11.47***	-10.66***	4.41***	4.12***	7.06***	6.54***	-4.41***	-4.12***
cond. on net liq w-to-inc<0	(1.93)	(1.89)	(1.38)	(1.41)	(1.68)	(1.73)	(1.38)	(1.41)
Net liq w-to-inc	-3.56***	-3.05***	1.98***	1.74***	1.58**	1.31**	-1.98***	-1.74***
cond. on net liq w-to-inc≥0	(0.45)	(0.48)	(0.61)	(0.63)	(0.63)	(0.66)	(0.61)	(0.63)
Demographics		X		X		X		X
Region Dummies		X		X		X		X
Dep. Var. Mean	31.93	31.93	30.61	30.61	37.46	37.46	69.39	69.39
R^2	0.07	0.11	0.02	0.03	0.02	0.05	0.02	0.03
Observations	1361	1361	1361	1361	1361	1361	1361	1361

Notes. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Demographic controls include having a child under age 6, having a child under age 18, the marital status, gender, race, and age group of the household head, whether the household head lost their job between March 2020 and June 2020, and whether the household experienced a decline in income between March 2020 and June 2020.

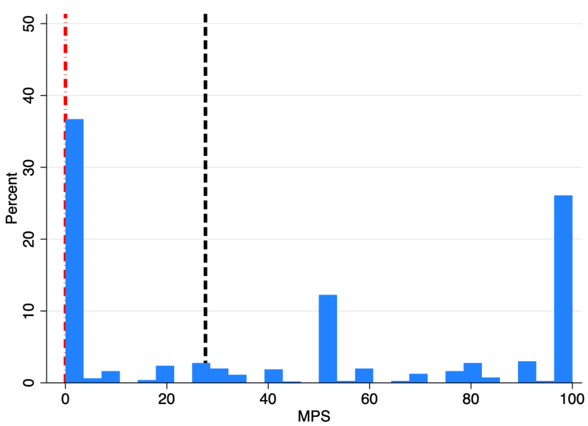
Figure B.4: Histograms of MPS and MPA



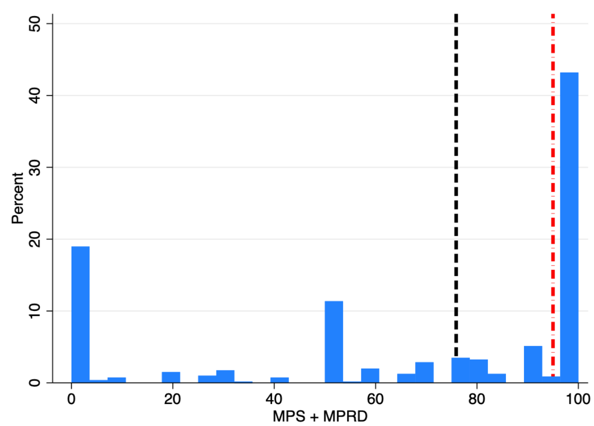
(a) MPS



(b) MPA



(c) MPS, negative net liquid wealth



(d) MPA, negative net liquid wealth

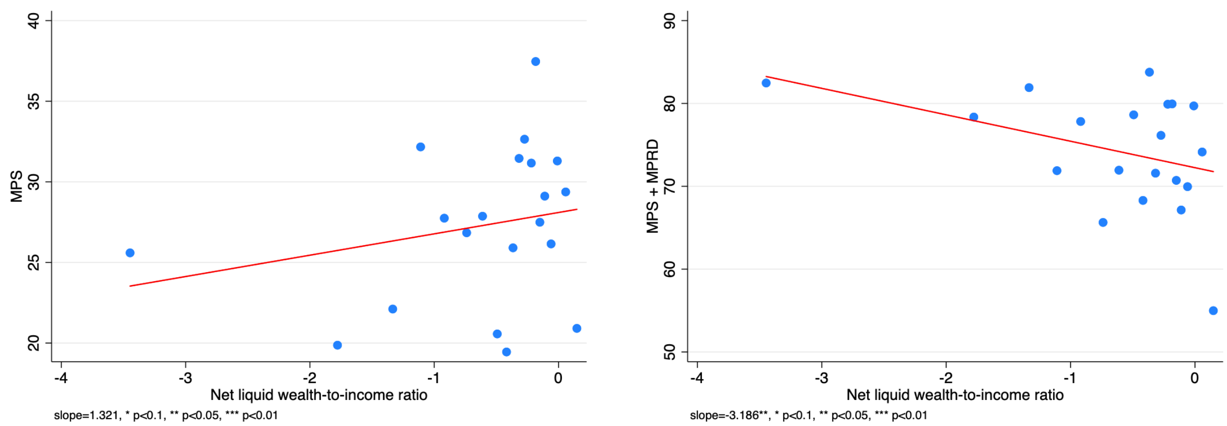
Notes. Panel (a) shows the histogram of self-reported MPSs (the share of government payment used to save) for the full sample of check recipients. Panel (b) shows the histogram of self-reported MPAs (the share of government payment used to save or pay down debt). Panels (c) and (d) show the same objects when we limit the sample to respondents with negative net liquid wealth. In each figure, the red dashed line corresponds to the mean, while the red dash-dotted line corresponds to the median.

Table B.4: MPRD, MPC, MPS, MPA & Net Wealth, Debt, and Income Measures

	(1) MPRD	(2) MPRD	(3) MPC	(4) MPC	(5) MPS	(6) MPS	(7) MPRD+MPS	(8) MPRD+MPS
Panel A: Net Liquid Wealth								
Net liq wealth	-0.08***	-0.07***	0.04***	0.04***	0.04***	0.03***	-0.04***	-0.04***
($1000s)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Demographics		X		X		X		X
Region Dummies		X		X		X		X
Dep. Var. Mean	31.89	31.89	30.64	30.64	37.47	37.47	69.36	69.36
R^2	0.07	0.11	0.02	0.03	0.02	0.05	0.02	0.03
Observations	1364	1364	1364	1364	1364	1364	1364	1364
Net liq wealth cond.	-0.17***	-0.19***	0.06*	0.05	0.11***	0.14***	-0.06*	-0.05
on net liq wealth<0	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Net liq wealth cond.	-0.07***	-0.05***	0.04***	0.03***	0.03***	0.02**	-0.04***	-0.03***
on net liq wealth≥0	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Demographics		X		X		X		X
Region Dummies		X		X		X		X
Dep. Var. Mean	31.89	31.89	30.64	30.64	37.47	37.47	69.36	69.36
R^2	0.07	0.12	0.02	0.03	0.02	0.06	0.02	0.03
Observations	1364	1364	1364	1364	1364	1364	1364	1364
Panel B: Gross Unsecured Debt								
Gross unsec.	0.17***	0.19***	-0.08***	-0.07***	-0.09***	-0.11***	0.08***	0.07***
debt ($1000s)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Demographics		X		X		X		X
Region Dummies		X		X		X		X
Dep. Var. Mean	31.86	31.86	30.59	30.59	37.55	37.55	69.41	69.41
R^2	0.03	0.09	0.01	0.02	0.01	0.05	0.01	0.02
Observations	1380	1380	1380	1380	1380	1380	1380	1380
Gross unsec.	11.33***	10.30***	-5.46***	-4.97***	-5.87***	-5.33***	5.46***	4.97***
debt-to-inc	(1.67)	(1.65)	(1.16)	(1.18)	(1.49)	(1.53)	(1.16)	(1.18)
Demographics		X		X		X		X
Region Dummies		X		X		X		X
Dep. Var. Mean	31.90	31.90	30.56	30.56	37.54	37.54	69.44	69.44
R^2	0.04	0.10	0.01	0.03	0.01	0.05	0.01	0.03
Observations	1377	1377	1377	1377	1377	1377	1377	1377
Panel B: Annual Household Income								
Annual hh income	-0.11***	-0.06**	0.02	0.00	0.09***	0.06**	-0.02	-0.00
($1000s)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
Demographics		X		X		X		X
Region Dummies		X		X		X		X
Dep. Var. Mean	31.90	31.93	30.56	30.61	37.54	37.46	69.44	69.39
R^2	0.02	0.11	0.00	0.03	0.01	0.05	0.00	0.03
Observations	1377	1361	1377	1361	1377	1361	1377	1361
Annual hh income	-0.10***	-0.08**	-0.00	0.01	0.11***	0.07*	0.00	-0.01
cond. on net liq wealth<0	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)
Annual hh income	-0.07***	-0.04	0.02	-0.01	0.06*	0.05	-0.02	0.01
cond. on net liq wealth≥0	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Demographics		X		X		X		X
Region Dummies		X		X		X		X
Dep. Var. Mean	31.90	31.93	30.56	30.61	37.54	37.46	69.44	69.39
R^2	0.11	0.16	0.02	0.04	0.05	0.07	0.02	0.04
Observations	1377	1361	1377	1361	1377	1361	1377	1361

Notes. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Demographic controls include having a child under age 6, having a child under age 18, the marital status, gender, race, and age group of the household head, whether the household head lost their job between March 2020 and June 2020, and whether the household experienced a decline in income between March 2020 and June 2020. The bottom two panels with annual household income also include net liquid wealth in the list of demographic controls. In the last panel, we also allow for the constant to differ by net liquid wealth being negative or greater than or equal to zero.

Figure B.5: MPSs, MPAs and net liquid wealth-to-income ratio for those with negative liquid wealth

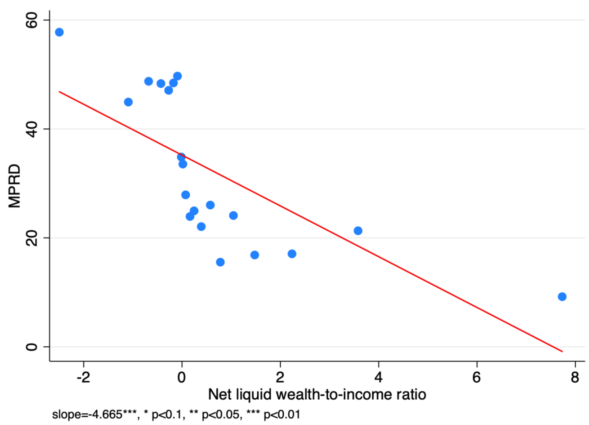


(a) MPS

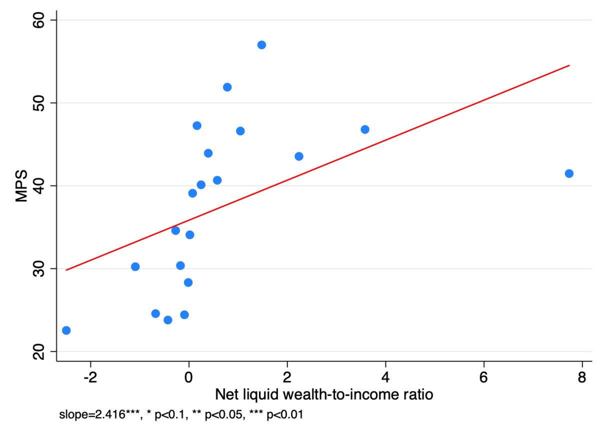
(b) MPA

Notes. Panel (a) shows a bin scatter of the self-reported, residualized MPS by residualized net-liquid wealth to income ratio. Panel (b) shows a bin scatter of the self-reported, residualized MPA by residualized net liquid wealth-to-income ratio. The controls include having a child under age 6, having a child under age 18, marital status, gender, race and age group of the household head, whether the household head lost their job between March 2020 and June 2020, and whether the household experienced a decline in income between March 2020 and June 2020.

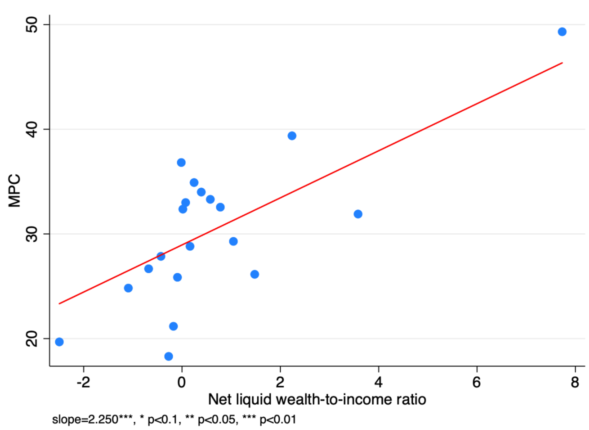
Figure B.6: MPRDs, MPCs, MPSs, MPAs and net liquid wealth-to-income ratio



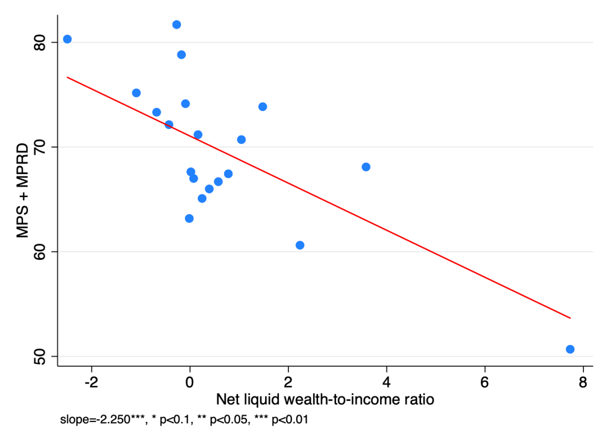
(a) MPRD



(b) MPS

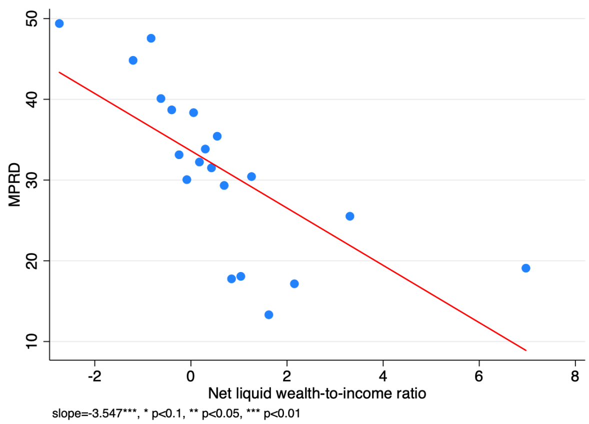


(c) MPC

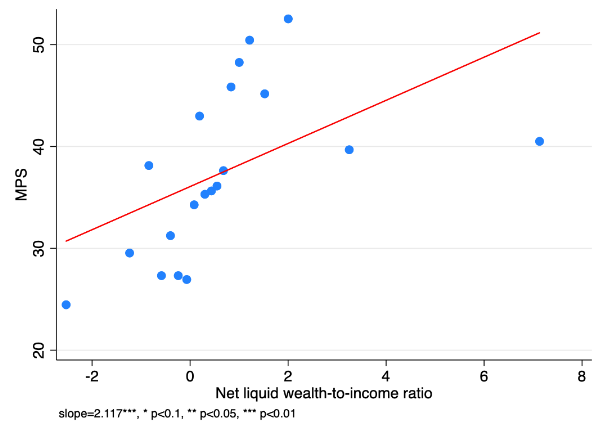


(d) MPA

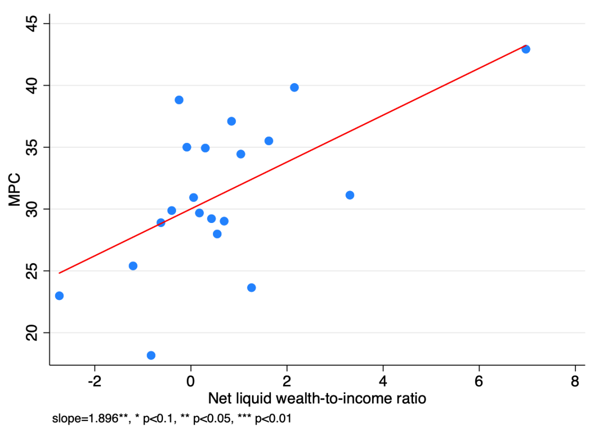
Figure B.7: MPRDs, MPCs, MPSs, MPAs and net liquid wealth-to-income ratio, residualized



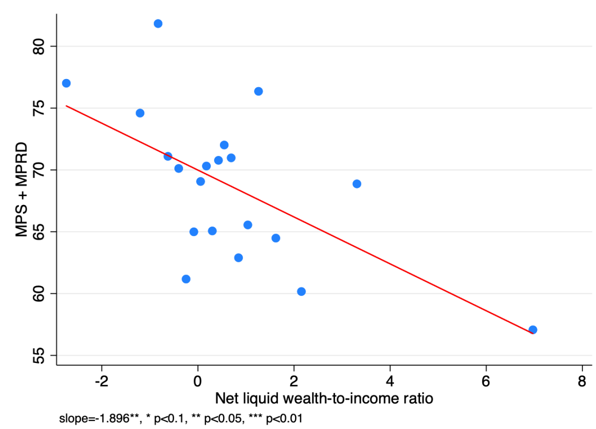
(a) MPRD



(b) MPS



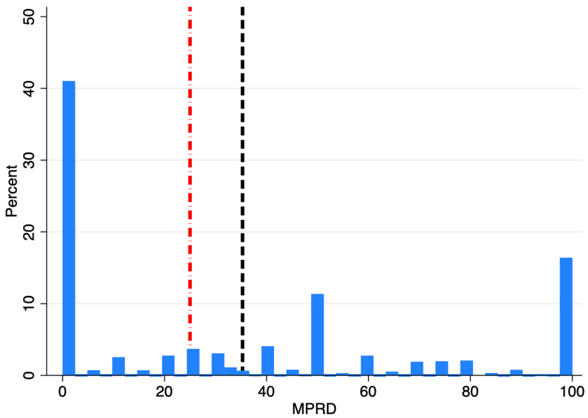
(c) MPC



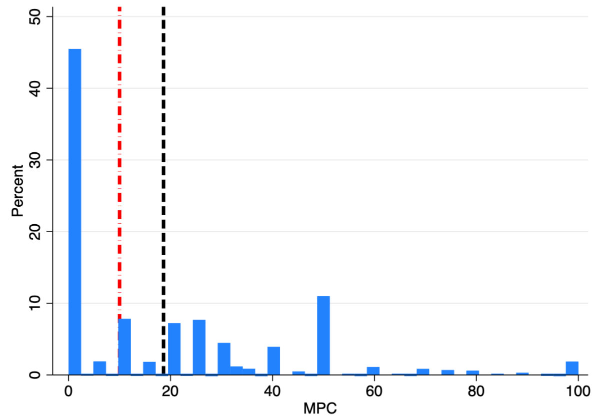
(d) MPA

Notes. The controls include having a child under age 6, having a child under age 18, marital status, gender, race and age group of the household head, whether the household head lost their job between March 2020 and June 2020, and whether the household experienced a decline in income between March 2020 and June 2020.

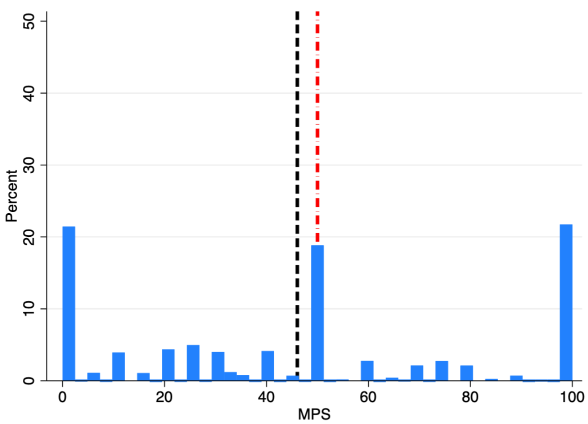
Figure B.8: Histograms of hypothetical MPRD, MPC, MPS, and MPA



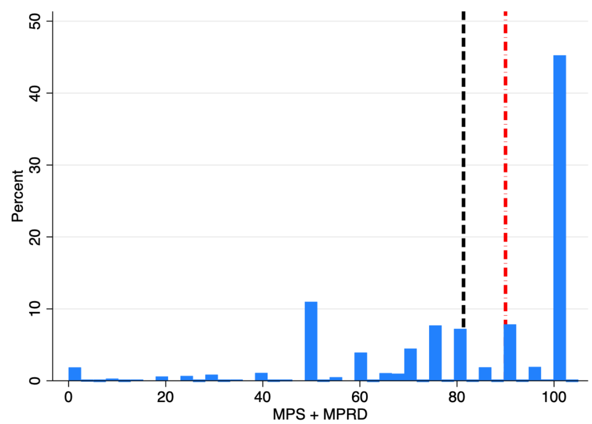
(a) MPRD



(b) MPC



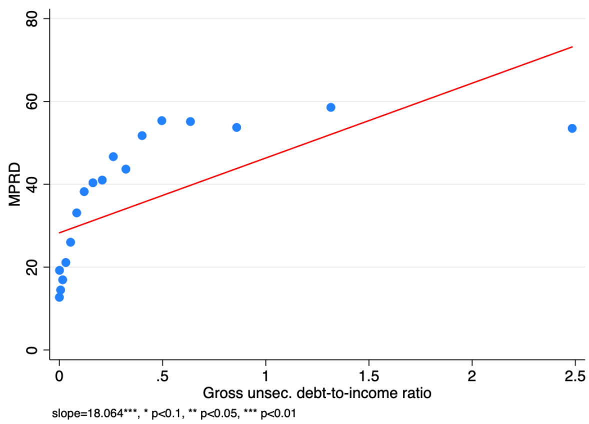
(c) MPS



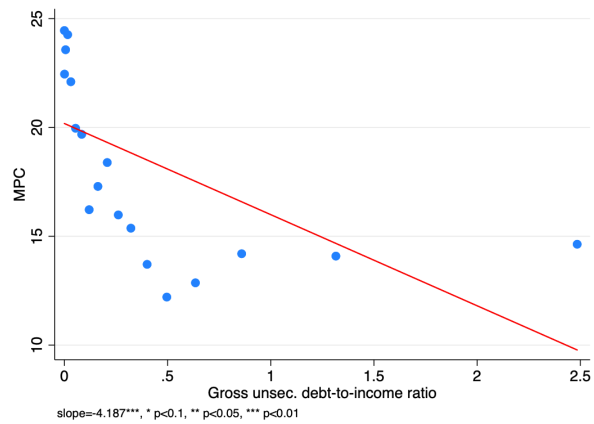
(d) MPA

Notes. Panel (a) shows the histogram of self-reported MPRDs (the share of government payment used to pay down debts) out of a hypothetical 10% additional household income. Panel (b) shows the histogram of self-reported MPCs (the share of government payment used to spend or donate), panel (c) shows the histogram of self-reported MPSs (the share of government payment saved), and panel (d) shows the histogram of MPAs (the share of government payments used to pay down debts or saved) for the same question. In each figure, the red dashed line corresponds to the mean, while the red dash-dotted line corresponds to the median.

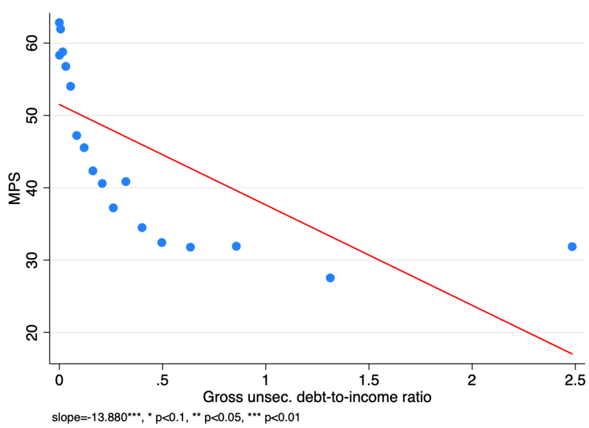
Figure B.9: Hypothetical MPRD, MPC, MPS, MPA and gross unsecured debt-to-income ratio



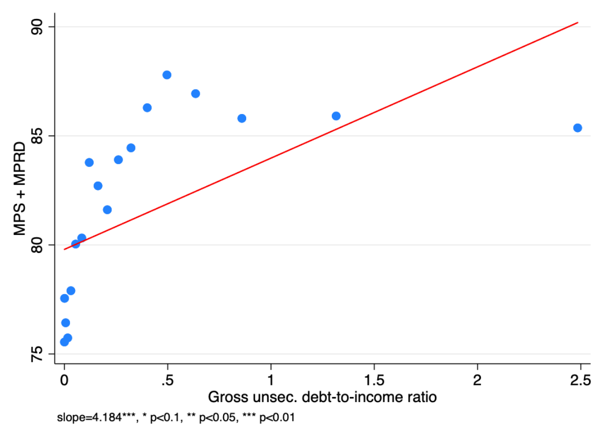
(a) MPRD



(b) MPC



(c) MPS

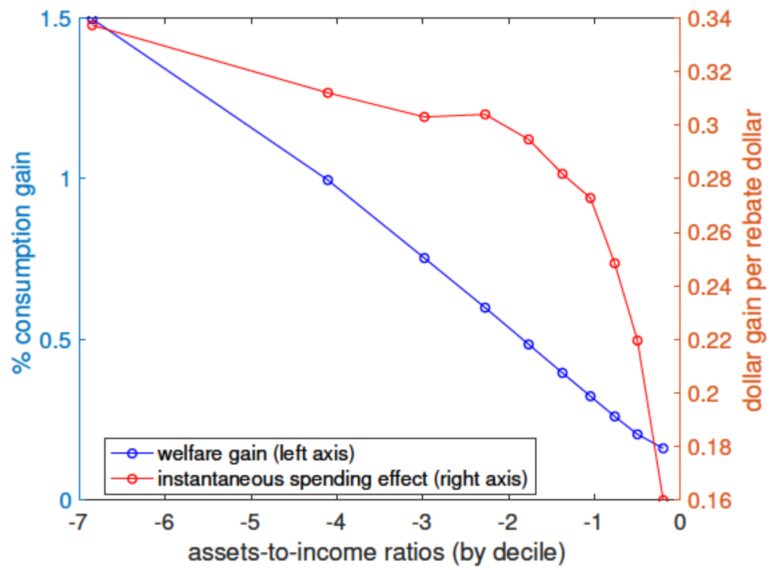


(d) MPA

C Supplemental quantitative results

Figure C.1 repeats the analysis of Section 4.2.1 in a model with constant q and where households face an exogenous borrowing limit equivalent to the one generated in our baseline model. We keep β equal to its calibrated value in the baseline model.

Figure C.1: Stimulus vs insurance across households - constant q

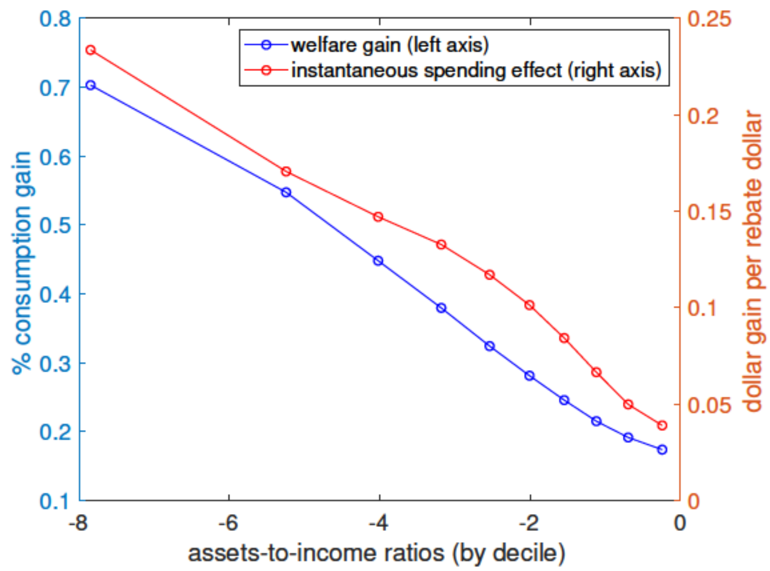


Notes. Model with constant Q and exogenous borrowing limit set to the minimum admissible level of net assets in the baseline model. We bin the stationary distribution of households' assets–to–income ratios, conditional on $a < 0$, by 10 deciles of equal mass. For each decile, we plot the average welfare gain due to the transfer, in blue, and the dollar-for-dollar spending effect of the transfer upon impact, in red.

In Figure C.2 we recalibrate the constant q model with $\beta = 0.9875$. Across 50 quantiles of negative asset–income–ratios, the correlation between welfare gains and short-run spending effects is 0.97.

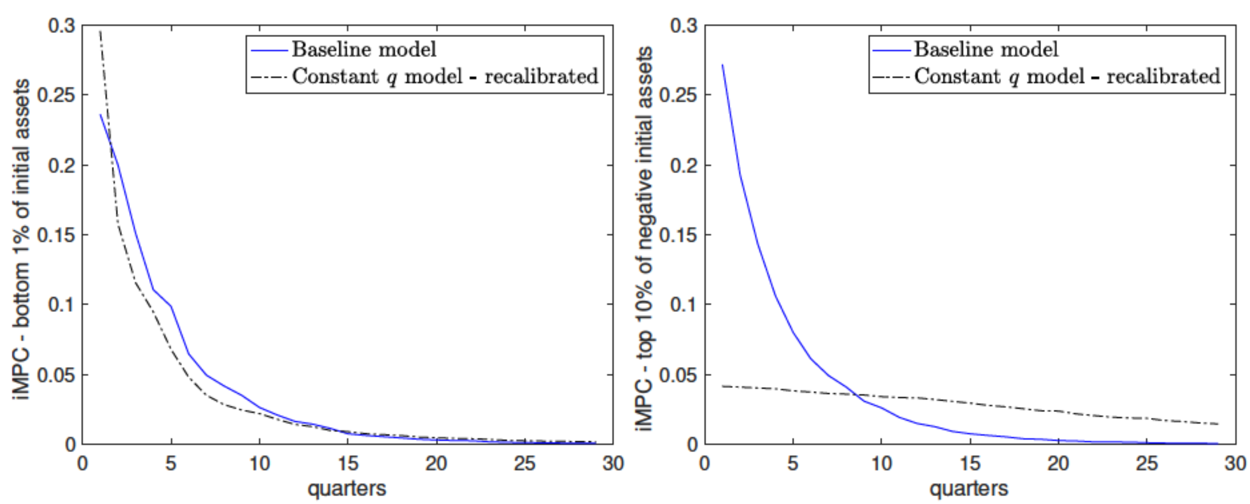
In Figure C.3 we repeat the analysis of Figure 7 in Section 4.2.2, but recalibrating β in the model with constant interest rates.

Figure C.2: Stimulus vs insurance across households - constant q recalibrated



Notes. Model with constant Q and exogenous borrowing limit set to the minimum admissible level of net assets in the baseline model. $\beta = 0.9875$. We bin the stationary distribution of households' assets–to–income ratios, conditional on $a < 0$, by 10 deciles of equal mass. For each decile, we plot the average welfare gain due to the transfer, in blue, and the dollar-for-dollar spending effect of the transfer upon impact, in red.

Figure C.3: Heterogeneous intertemporal MPCs: constant q recalibrated



Notes. In the constant q model, showed with dashed black lines, households exogenously face the same borrowing limit as in the baseline model, but interest rates do not vary. In this model, β has been recalibrated to 0.9875.