



Federal Reserve Bank of Chicago

## **Liquidity Constraints of the Middle Class**

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REVISED  
June 2016  
WP 2009-20

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## Abstract

Existing evidence from the U.S. middle class shows that the MPC out of tax rebates is either invariant to household liquid assets or a U-shaped function thereof. In contrast, precautionary savings models predict a monotone decreasing relationship. We bridge this gap with *term saving*: households' savings for large foreseen expenditures, which we find empirically widespread. Once incorporated into a calibrated precautionary savings model, term saving generates empirically realistic MPCs. This is because the approaching expenditure simultaneously motivates asset accumulation and raises MPCs by shortening the effective planning horizon. We conclude that liquidity constraints of the middle class are quantitatively important.

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\*We thank R. Andrew Butters, Ross Doppelt, and Ryan Peters for their excellent research assistance and Sumit Agarwal, Gadi Barlevy, Mariacristina DeNardi, Simon Gilchrist, and Monika Piazzesi for their thoughtful comments. The views expressed herein are those of the authors. They do not necessarily reflect the views of the Federal Reserve Bank of Chicago, the Federal Reserve System, or its Board of Governors.

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JEL Code: E21

Keywords: Fiscal Policy, Tax Rebates, Marginal Propensity to Consume, Term Saving, Precautionary Saving

# 1 Introduction

Liquidity constraints of middle-class households are of key importance for a host of macroeconomic questions, such as the size of the fiscal multiplier from tax cuts and the nature of monetary policy propagation. However, it may seem implausible that middle class households face liquidity constraints because they typically hold liquid assets. By definition, these can be converted immediately into consumption. Nevertheless, evidence from consumption responses to tax changes in the U.S. casts doubt on this view. For example, [Shapiro and Slemrod \(2003\)](#) found that households that own publicly-traded stocks spent no less and probably more out of one-time tax rebates arising from the Bush tax cuts than did poorer and more plausibly liquidity-constrained households. That is, there is evidence that middle-class households with liquid wealth can act like they face substantial liquidity constraints.

[Carroll and Kimball \(1996\)](#) proved that the consumption function from a precautionary savings model is concave in cash on hand (the sum of current earnings and past savings). Therefore, that model's consumption responses to tax rebates *decline* with household wealth. To bridge this gap between theory and data, we consider the possibility that a household's assets are accumulated to pay for a foreseen extraordinary expense. In that case, high assets signal a *shortage of liquidity* relative to the approaching expense rather than an abundance of liquidity arising from past good luck. For a household expecting such an expense, the time remaining until it arrives is a key state variable. Hence, we call the accumulated assets *term savings*. We provide household-level evidence from the Survey of Consumer Finances (SCF) that term savings motivations (particularly the purchase of a house or the payment of a child's college tuition) are at least as prevalent among the middle class as are standard precautionary savings motivations like earnings risks.

Term saving does not overturn the basic notion that high MPCs reflect liquidity constraints. However, it does bring into question the common view that only individuals with little liquid wealth can be liquidity constrained. With term saving, an expectation that liquid wealth will be low in the *future* can induce households with currently substantial liquid assets to behave as liquidity constrained and to have high MPCs today. Such expectations arise naturally when households foresee an approaching large expenditure.

For our empirical analysis, we assign households to the middle class if they are not in the top five percentiles of the wealth distribution, had after-tax labor income above the poverty line, and did not receive Temporary Assistance to Needy Families (food stamps) in the previous year. This definition allows for the possibility that middle-class households occasionally spend all available financial assets. Our matching theoretical definition of a middle-class

household combines impatience (relative to the market rate of interest), a borrowing constraint, and a recurring major expenditure. Impatience prevents middle class households from accumulating wealth and joining the rich, while the borrowing constraint keeps them from permanent immiseration in debt. With these two features alone, middle class households would become hand-to-mouth consumers like the “spenders” in [Mankiw \(2000\)](#). The foreseen expenditure provides a motivation to save.

Our term savings model embodies this theoretical definition within the standard infinitely-lived household. We begin by developing intuition in a deterministic environment. The household has utility from ordinary consumption and from a special good. Ordinary consumption always increases utility, but the household has a taste for the special good only at equally-spaced points in time. The taste for the special good induces term savings. For it to induce substantially different behavior than does earnings risk in a precautionary savings model, the hazard rate for its arrival should *increase* with the time since its last occurrence. The predetermined times for the special good’s consumption starkly capture this requirement.

In this deterministic model, the household eventually settles into a cycle. At its beginning, a long time remains until the special good’s consumption. Although impatience might initially dominate the household’s decisions and drive wealth to zero, consumption smoothing eventually motivates the household to save. When the taste for the special good arrives, the household spends all cash on hand and the borrowing constraint binds. This cycle exemplifies [Zeldes’s \(1984\)](#) distinction between a currently-binding liquidity constraint and one that could possibly bind in the future. As he noted, expectations of future liquidity constraints effectively shorten the horizon over which a currently unconstrained household optimizes and thereby generate a large marginal propensity to consume (MPC) out of transitory income. Here, assets accumulate as the foreseen expenditure approaches, and so the current model predicts that the observed MPC *rises* with wealth for households that are currently saving.

The quantitative assessment of term savings requires us to add earnings risk to the analysis, because precautionary saving works against term saving in shaping the empirical relationship between household wealth and the MPC. We calibrate income risk to match observations of earnings from the PSID in [Meghir and Pistaferri \(2004\)](#) and we choose the household’s discount factor and the special good’s expenditure share to match percentiles of wealth relative to labor income from middle-class households in recent waves of the SCF. With this calibration, the average MPC from a from a one-time transfer is a relatively flat function of wealth. For two households at either extreme of the wealth distribution, with no wealth and wealth exceeding current annual earnings, the MPCs equal 53 percent and 72 percent. If we remove the special good from the model and recalibrate the discount factor, the MPC

strongly decreases with wealth. That of households with no wealth is virtually unchanged while that for households with wealth exceeding current annual earnings falls to 15 percent.

The pervasiveness of liquidity constraints has received a great deal of attention in the consumption literature. Using the 1983 SCF, [Jappelli \(1990\)](#) found that about 20 percent of U.S. households were either rejected for credit or rationally anticipated being rejected if they applied. Other work has focused on documenting liquidity constraints as violations of [Hall's \(1978\)](#) random walk hypothesis for the marginal utility of consumption. Using food consumption data from the PSID, [Hall and Mishkin \(1982\)](#) found that about 20 percent of consumption is a simple function of current income, as if those households are consuming “hand-to-mouth.” Estimating a similar model with aggregate data, [Campbell and Mankiw \(1989\)](#) concluded that “Half of households follow the ‘rule-of-thumb’ of consuming their current income.” Also using the PSID, [Zeldes \(1989\)](#) observed that consumption growth of households with low wealth responds negatively to lagged disposable income. Because the analogous estimated responses for households with high wealth are weaker and sometimes statistically insignificant, [Zeldes](#) interpreted his results as evidence in favor of liquidity constraints. With this interpretation, different definitions of “low wealth” imply that between 30 to 66 percent of households are liquidity constrained. [Jappelli and Pistaferri \(2010\)](#) reviewed the considerable literature that has refined this approach and applied it to other countries and data sets. In this paper, however, we concentrate on evidence from the U.S. only.

[Hayashi \(1987\)](#) noted that these studies have only limited implications for the average MPC from temporary income in part because “the horizon of those who satisfy the Euler equation is unknown ...”.<sup>1</sup> The importance of term saving we document with the SCF leads us to conclude that [Hayashi's](#) “horizon” is typically much less than a decade, so that most of the middle class acts as if they are liquidity constrained. Our model's recurring large expenditure tractably embodies this conclusion and allows us to measure its influence on middle-class households' MPCs.

[Kaplan and Violante \(2014\)](#) provided an explanation for large MPCs of middle-class households that complements ours. In their model of “wealthy hand-to-mouth” consumers, households save for retirement in a high-return asset with large fixed transaction costs, which they interpreted as housing or retirement accounts, and a low-return liquid asset. They emphasized that if the difference between the two assets' returns is large enough, then those who have converted all of their liquid assets into illiquid assets will have high MPCs in spite of having substantial illiquid wealth. Our model of term saving shows that households currently

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<sup>1</sup>See that article's penultimate sentence for the full context of this quote.

saving for a foreseen expenditure will also have high MPCs even though they have substantial *liquid* wealth.

The remainder of this paper proceeds as follows. In the next section, we review existing evidence about the marginal propensity to consume out of tax rebates in the U.S. and document the prevalence of precautionary and term saving with the SCF. Section 3 develops the deterministic term savings model, and Section 4 adds earnings uncertainty and considers the quantitative implications of a calibrated version of the model for the evidence reviewed in Section 2. Section 5 offers concluding remarks.

## 2 Evidence

This section reviews the evidence on consumption and savings that motivates our exploration of middle-class liquidity constraints. We begin with a review of previous empirical analysis of households' MPCs from tax-induced changes to disposable income. We then document the pervasiveness of precautionary and term saving with data from recent waves of the SCF.

### 2.1 MPC Estimates

Changes in tax law provide rich opportunities for the empirical investigation of consumption choices in the context of economically significant, policy relevant, and plausibly exogenous changes to household income. The Reagan tax cuts, which were implemented in three stages, are particularly useful for this because the last two stages were known to the public well before their implementation. Whereas the permanent-income model predicts that the associated *anticipated* changes in take-home pay should have zero impact on consumption, Souleles (2002) estimated responses of nondurable consumption to the tax cuts of between 80 and 90 cents per dollar using Consumer Expenditure Survey data.<sup>2</sup> When he split the sample by liquid wealth relative to earnings, the consumption responses of households in the bottom quartile were within 15 cents of their counterparts in the top three quartiles. Furthermore, these differences were statistically insignificant.<sup>3</sup> It seems that the majority of households acted as if they were hand-to-mouth “spenders,” even those who had wealth when the tax cuts were implemented. Souleles labelled these consumption responses “the marginal propensity to consume (MPC) out of predictable income.”<sup>4</sup>

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<sup>2</sup>See the row labelled “ $d(\textit{withholding})_{t+1}$ ” in his Table 2.

<sup>3</sup>See the first two rows of his Table 4.

<sup>4</sup>See the third paragraph of his page 100.

Shapiro and Slemrod (2003, 2009), and Sahm, Shapiro, and Slemrod (2010) provided more recent evidence on households' MPCs from survey data. The Economic Growth and Tax Relief Act of 2001 lowered tax rates retrospectively to the start of 2001, and the Treasury mailed tax rebates to most taxpayers from July to October. Shapiro and Slemrod attached questions to the University of Michigan's monthly Survey of Consumer Attitudes and Behavior that solicited respondents' anticipated uses of these rebated funds as well as their expectations about future government spending and taxes. They found that 22 percent of respondents anticipated spending most of the rebate, while the rest planned either to reduce their debts or increase their savings. Using plausible distributions of the marginal propensities to consume across those who would "mostly spend" and "mostly save", Shapiro and Slemrod calculated an average marginal propensity to consume of about one third.

Famously, political disagreement made the persistence of the Bush tax cuts uncertain at the time of their passage. The original legislation sunset in 2011, but Congress could have either made them permanent or revoked them entirely before then. In theory, the persistence of a tax cut determines the resulting the consumption response, but Shapiro and Slemrod found no connection between a respondent's views on future taxes and her propensity to mostly spend the rebate.<sup>5</sup> One might also expect that tax cuts represent real wealth to a household only if accompanied by a reduction in government spending. Again, the data reveal no such Ricardian link between expectations of government spending and the propensity to spend.<sup>6</sup>

A theoretical justification for large MPCs out of tax rebates is that households cannot borrow against higher expected future income to smooth consumption. Such traditional liquidity constraints should be most prevalent among households with low income and low wealth. Shapiro and Slemrod found no difference in the propensity to mostly spend the tax rebates by income.<sup>7</sup> They also tabulated the propensities to mostly spend across different households based on their ownership of stocks, either in retirement accounts, mutual funds, or brokerage accounts. They did find statistically significant differences across households, but these are not consistent with the model of traditional liquidity constraints: the spending fraction *increases* with stock ownership, with exceptions for the highest bracket and that

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<sup>5</sup>See the lines below "Size of future tax cuts" in their Table 5.

<sup>6</sup>See the lines below "Impact of tax cut on government spending" in their Table 5.

<sup>7</sup>See the rows under "Income (\$)" in their Table 2.

with zero-assets.<sup>8,9</sup>

Shapiro and Slemrod (2009) used the same survey instrument and methodology to measure households' propensities to spend the obviously temporary Economic Stimulus Payments (ESP's) of 2008. Surprisingly, the fraction of respondents who mostly spend their ESP's is nearly identical to that from the 2001 rebate checks, 20 percent. Just as with the earlier tax rebates, Shapiro and Slemrod found "there is no discernible difference in spending propensity by income."<sup>10</sup> Finally, Sahm, Shapiro, and Slemrod (2010) found a dependence of the Mostly-Spend rate on the household's wealth in stocks similar to that from the 2001 tax rebates.<sup>11</sup> Table 1 presents the Mostly-Spend percentages by stock ownership level from both Shapiro and Slemrod (2003) and Sahm, Shapiro, and Slemrod (2010). It clearly shows that the survey evidence does not support the traditional liquidity constraint model for either the 2001 tax rebates or the 2008 ESP's.<sup>12</sup>

A pair of complementary articles, Johnson, Parker, and Souleles (2006) and Parker, Souleles, Johnson, and McClelland (2013), estimated the consumption responses from these two tax experiments using questions appended to the Consumer Expenditure Survey (CEX) that measured when the household received the disbursed funds. The Treasury randomized this

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<sup>8</sup>See the lines under "Stock" in their Table 2. Shapiro and Slemrod report in their article's original working paper that this pattern also arises in regressions with dummy variables for the different stock ownership brackets, while age and other control variables are included. However, the relationship is statistically indistinguishable from a flat line. See Tables 10 through 13 of NBER Working Paper 8672.

<sup>9</sup>One might be legitimately concerned that the failure to find that the propensity to mostly spend the tax rebate declines with stock wealth arises from the presence of illiquid retirement savings in that wealth. We address this possibility in Appendix A.

<sup>10</sup>See their Table 3. This quote is from the discussion below it.

<sup>11</sup>Sahm, Shapiro, and Slemrod also examined the dependence of the Mostly-Spend rate on income and wealth in a multivariate setting. They found "Given the substantial positive correlation of income and wealth, it is hard to statistically identify separate effects of these two factors." (Sahm, Shapiro, and Slemrod, 2010, page 86).

<sup>12</sup>Shapiro and Slemrod (2003, page 385) offered the following explanation for the positive effect of stock ownership on the Mostly-Spend rate: "Those stockholders with low wealth are trying to build wealth and therefore have a powerful saving motive; those with higher wealth may already have adequate assets and therefore are spenders on the margin." Sahm, Shapiro, and Slemrod (2010, page 84) apply the same explanation to their findings. However, the most natural extant model of such "target savings", the buffer stock model of Deaton (1991), does *not* deliver this result. That model does have a stationary long-run distribution of wealth, and households with initial wealth above its mean tend to dissave while those below it tend to save. Nevertheless, the MPC out of wealth *declines* with wealth. This is evident in Deaton's (1991) Figure 1, which shows consumption as a function of wealth to be *concave*. As noted in the introduction, Carroll and Kimball (1996) formally prove this concavity.

Stock Ownership Class	2001 Tax Rebates		2008 Economic Stimulus Payments	
	Percentage of Sample	Percentage Spending Most of Rebate	Percentage of Sample	Percentage Spending Most of Rebate
None	42.8	19.5	33	20
\$1 – \$15,000	9.1	13.1	13	19
\$15,001 – \$50,000	9.9	18.1	14	19
\$50,001 – \$100,000	6.8	26.7	10	14
\$100,001 – \$250,000	6.2	33.6	11	25
More than \$250,000	5.1	22.9	9	39
Refused/Don't Know	20.1	25.3	11	25

Table 1: Rebate Spending Percentages

Source: Table 2 of [Shapiro and Slemrod \(2003\)](#) and Table 8 of [Sahm et al. \(2010\)](#)

timing based on the second-to-last digit in the recipient’s Social Security number, so the effect of *receiving* the funds on current consumption can be estimated without substantial endogeneity concerns. [Johnson, Parker, and Souleles](#) estimated a one-quarter effect on non-durable consumption of 0.462 with a standard error of 0.173.<sup>13</sup> [Kaplan and Violante \(2014\)](#) labeled such estimates *rebate coefficients*. The MPC equals the rebate coefficient summed with any consumption response since the *announcement* of the tax cut.

[Johnson, Parker, and Souleles](#) sorted their sample into three groups by income. Households in their low-income group spent much more than those in the middle-income group, but those with the highest income also spent more than those in the middle. The same pattern arose when they split the sample by liquid assets.<sup>14</sup> These point estimates provide partial support for a “U” shape relationship between rebate coefficients and liquid assets, but the difference between the coefficients on the high liquid assets group and the middle group is statistically insignificant. In any event, these results provide no support for the standard view that the MPC should monotonically decline with liquid assets. For the 2008 ESPs, [Parker, Souleles, Johnson, and McClelland](#) measured rebate coefficients for nondurable goods and all consumption of 0.128 and 0.523. Only the latter is statistically significant.<sup>15</sup> When they sorted their sample by income and liquid assets, the resulting rebate coefficients were statis-

<sup>13</sup>See the first row and final column of their Table 3.

<sup>14</sup>See their Table 5.

<sup>15</sup>See the third row of their Table 2.

tically indistinguishable from each other.<sup>16</sup> We conclude that the CEX-based estimates are consistent with the irrelevance of a household’s assets for its rebate coefficients.

In a complementary analysis, Broda and Parker (2014) estimated rebate coefficients for the 2008 ESPs using weekly household expenditure data from the Nielsen Consumer Panel (formerly Homescan) augmented with survey data on the timing of the ESP’s receipt and available household liquidity. Specifically, the survey asked households

In case of an unexpected decline in income or increase in expenses, do you have at least two months of income available in cash, bank accounts, or easily accessible funds?

Since this question partitions households into only two groups, the resulting data cannot detect non-monotone effects of wealth on the rebate coefficient. Nevertheless, their point estimates indicate that the rebate coefficient for the data’s covered expenditures (barcoded items) over the three months following receipt was two to three times higher for households lacking two months’ of earnings to cover an unexpected expense than for those with such a financial cushion. Although this is an economically large difference, the associated 90 percent confidence interval for the difference between the two rebate coefficients includes zero.<sup>17</sup>

In summary, the existing evidence on the MPC from tax-induced income changes indicates that many households act as if they are liquidity constrained even though they have available liquid assets. Furthermore, estimated rebate coefficients do not contradict this conclusion.

One potential explanation for high MPCs among households with liquid wealth is that they base their consumption and saving decisions on “rules of thumb.” In support of this perspective, Hsieh (2003) used data from Alaskan households to estimate rebate coefficients for foreseen tax refunds and for much larger annual dividend payments from the Alaska Permanent Fund (received in the fourth quarter of the year). He found that the rebate coefficient from the tax refunds is positive and comparable to that estimated for the whole United States by Souleles (1999), but the “rebate coefficient” from the Permanent Fund payment was close to zero. He concluded that

This evidence suggests that households will take anticipated income changes into

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<sup>16</sup>See their Table 6. See also Misra and Surico (2014), who refined these estimates using quantile regressions.

<sup>17</sup>See their Table 8. Using only variation in timing within each method of receipt (paper check or electronic direct deposit), the two groups’ estimated rebate coefficients are 17.24 and 8.88, with standard errors of 6.72 and 4.84. Since the estimates come from independent samples, the  $t$ -statistic for their difference is  $(17.24 - 8.88)/\sqrt{6.72^2 + 4.84^2} = 1.01$ . The results from using all variation in timing (in Table 8’s Panel A) are similar.

account in their consumption decisions when the income changes are large, regular, and easy to predict, but will not do so when they are small and irregular. (Hsieh, 2003, page 397)

The small estimated rebate coefficient for Permanent Fund payments indeed suggests that large income fluctuations grab and hold households' attention. However, a zero rebate coefficient can coexist with a large MPC (consistent with Kaplan and Violante (2014)), so Hsieh's results imply nothing for the MPCs out of those Permanent Fund payments.

Shapiro and Slemrod's (2003) investigation of rules of thumb based on savings and consumption targets is of more direct relevance for MPCs. They sorted their respondents by whether or not they have a budget and if they do, whether it targets spending, saving, or debt repayment. (Multiple responses to this last question were allowed.) They reported

These findings are different than what one might have expected from an economic model of targeting, in which a household that spends a routine amount would save residual income and vice versa. The survey evidence is the opposite: target spenders tend to spend on the margin and target debt payers tend to save on the margin. There is no substantial difference in spending rates for target savers. (Shapiro and Slemrod, 2003, page 387)

Hsieh's (2003) evidence suggests that rules of thumb or other predictions of behavioral economics can illuminate households' responses to fiscal policy shocks. Nevertheless, Shapiro and Slemrod's (2003) results do not support the simplest such behavioral model. In any case, we believe that an explanation based on rational expectations and fully-optimizing behavior can be at least equally enlightening.

## 2.2 Term Saving and Precautionary Saving

We put forward an explanation for high MPCs among middle-class households that relies on saving to finance foreseen large expenditures. Before proceeding with its theoretical development, we present here evidence on the importance of such expenditures for the savings decisions of middle-class households. The principle expenses we have in mind are purchases of new homes and the college education of children.

### 2.2.1 The Sample

For our sample, we draw on five cross-sectional waves of the SCF; 1995, 1998, 2001, 2004, and 2007. Unfortunately, the more recent 2010 and 2013 SCF waves omit a key variable, the

household's Adjusted Gross Income, that we use to measure its federal income tax paid.

The SCF sample weights give the number of U.S. households that each household in the sample represents. The first row of Table 2 uses these weights to list the number of households represented in each of the five waves. This ranges from 99 million in 1995 to 116.1 million in 2007. We wish to focus the analysis on working-age middle class households. To be included in our sample, a household must have answered all of the questions regarding savings motives that we use below. Table 2's second line gives the number of represented households after dropping those that fail this screen. The total number of households lost varies between 2 and 3 million. Next, the household head must be between 25 and 64 years old at the survey date. This requirement removes approximately 25 percent of the households.

The next two criteria remove the poor from our sample. The first requires the household to have not received Temporary Assistance to Needy Families (formerly known as Food Stamps) in the previous year, and the second requires the household's after-tax labor income to exceed the official poverty line for a household of that demographic composition. Table 2's fourth and fifth rows list the number of households that these two poverty criteria retain. Together, they remove between 20 and 25 percent of the remaining represented households from our sample.

We compute after-tax labor income as pre-tax labor income less income and social insurance taxes as well as IRA contributions.<sup>18</sup> We elaborate on our treatment of IRA contributions below in Footnote 22.

To exclude the wealthy from our sample, we first measure each household's financial assets: stocks, bonds, and balances in checking, saving, money market, and mutual fund accounts. For consistency with our treatment of tax-advantaged retirement saving in the measurement of after-tax labor income, we exclude balances in IRA accounts from financial assets. We then define the wealthy to be those households in the top five percent of all households represented in that wave of the SCF. Our final sample-selection criterion removes households in which either the household head or spouse reports being self-employed. This ensures that savings for business purposes do not substantially influence our results, and it removes between 10 and 15 percent of the remaining households. Our final sample represents

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<sup>18</sup>More specifically, to compute the household's after-tax labor income we calculated an average tax rate using the household's Adjusted Gross Income, the household's federal tax filing status, and the federal income tax and social-insurance (FICA and Medicare) tax tables. The resulting tax is subtracted from pre-tax labor income of the household's head and his or her spouse. The SCF includes no information on state of residence, so we make no attempt to estimate state income taxes. However, we do assume that each worker with an IRA account that is eligible to contribute to it makes the maximum possible contribution.

43.1 million households in 1995 and 53.1 million households in 2007.

To present the financial wealth distribution in our sample, Table 3 reports summary statistics of financial wealth scaled by after-tax labor income for each SCF cross section. The second column gives the income-weighted average of this ratio, and the remaining columns give this income-weighted average for each decile of the ratio itself. We used all financial assets in the numerator. In 1995, the overall average equals 30.8 percent. This climbs quickly to 47.6 percent in 1998 and 50.4 percent in 2001. For 2004 and 2007, the overall averages are substantially lower, 43.7 percent and 46.1 percent.<sup>19</sup> Even though the sample focuses on middle-class households, the distribution of the ratio is quite skewed. The average ratio for households in the fifth decile is between 9.2 and 13.1 percent. The analogous averages for households in the tenth decile range from 171.6 percent to 263.8 percent.

### 2.2.2 Reasons for Saving

We begin exploring the quantitative importance of term saving by examining households' answers to the following question:

**Question 1** *Now I'd like to ask you a few questions about your family's savings. People have different reasons for saving, even though they may not be saving all the time. What are your family's most important reasons for saving?*

Each respondent could give up to six answers (five in 1995) from a detailed list, which we broke into three categories, Retirement and Estate, Precaution, and Anticipated Expenditure. Both Retirement and Estate had distinct entries on the list of answers, although the Estate answer included inter vivos transfers. Following Kennickell and Lusardi (2005), we assigned an answer to Precaution if it was

- Reserves in case of unemployment,
- In case of illness; medical/dental expenses,
- Emergencies; "rainy days"; other unexpected needs; For "security" and independence, or
- Liquidity; to have cash available/on hand.

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<sup>19</sup>Since the rise and fall of this ratio coincides with the growth and decline of the internet stock boom, we calculated the same ratios excluding directly-held stocks and stock-based mutual funds from financial wealth. The results (unreported here) confirm that excluding equities smooths this ratio's evolution.

	SCF Survey Year					
	1995	1998	2001	2004	2007	
Households Represented in Original Sample,	99.0	102.5	106.5	112.1	116.1	
& without imputed Age or Saving Survey responses,	97.0	100.3	103.5	109.9	114.5	
& with heads between 25 and 64 years old,	71.3	74.4	76.3	80.4	84.9	
& that received no TANF,	63.9	68.8	71.7	74.3	76.5	
& that had labor income above the poverty line,	54.2	59.2	61.5	62.5	64.3	
& are among least wealthy 95% of remaining households	49.9	54.3	57.0	57.9	60.2	
& are not self-employed.	43.1	46.9	48.8	49.1	53.1	

Table 2: Number of Households (in millions) Represented in the Surveys of Consumer Finances

Year	Full	Deciles									
	Sample	1	2	3	4	5	6	7	8	9	10
Including All Financial Assets											
1995	30.8	0.1	1.5	3.6	6.2	9.2	13.4	22.4	37.1	71.1	171.6
1998	47.6	0.3	2.1	4.6	8.0	13.1	20.4	32.3	54.7	100.5	247.7
2001	50.4	0.4	2.3	4.9	8.1	13.0	21.0	32.2	54.3	100.6	263.8
2004	43.7	0.1	1.5	3.6	6.2	10.3	16.0	25.4	42.4	85.5	214.9
2007	46.1	0.3	1.7	3.7	6.5	10.3	16.4	26.0	44.2	84.2	220.8

Table 3: Ratios of Financial Assets to Annual After-Tax Labor Income ( $\times 100$ )

Note: Each cell reports a weighted average of nonretirement financial assets to labor income net of federal income taxes, Social Security taxes, and contributions to tax-advantaged retirement accounts. The weights are proportional to this after-tax income measure. The second column uses the entire sample, while the remaining columns use observations grouped by deciles of this ratio. Financial wealth definitionally equals the sum of checking accounts, savings accounts, money-market deposit accounts, money-market mutual fund accounts, certificates of deposit, non-money-market mutual fund accounts, savings bonds, brokerage call accounts, directly-held bonds, and directly-held stocks.

The answers we used to infer an Anticipated Expenditure motive were:

- Children’s education; education of grandchildren,
- Own education; spouse’s education; education – NA for whom,
- Wedding, Bar Mitzvah, and other ceremonies,
- Buying own house,
- Purchase of cottage or second home for own use,
- Buy a car, boat or other vehicle,
- To travel; take vacations; take other time off, or

	1995	1998	2001	2004	2007
Retirement & Estate	44.6	60.1	55.4	57.9	64.2
Precaution	45.1	30.9	31.9	31.3	33.8
Anticipated Expenditure	43.6	43.7	41.9	42.6	39.2

Table 4: Percentage Frequencies of Stated Reasons for Saving from the SCF

- Burial/funeral expenses.

Table 4 reports the frequencies for each of these three classes. Because a given household can give multiple answers, these frequencies sum to more than 100 percent. In every year but 1995, Retirement and Estate is the most common of these three motivations with frequencies of about 60 percent. Again with the exception of 1995, between 30.9 and 33.8 percent of households reported Precautionary motives, while between 39.2 and 43.7 percent of them reported motivation from an Anticipated Expenditure. In 1995, the Precautionary motive is much more frequent and the Retirement and Estate motive is much less frequent. Overall, the data indicate that saving for an anticipated expenditure is widespread and at least as salient for middle-class households as precautionary saving.

### 2.2.3 A Closer Look at Term Saving

The SCF has an additional question on savings motives particularly relevant for term saving:

**Question 2** *In the next five to ten years, are there any foreseeable major expenses that you and your family expect to have to pay for yourselves, such as educational expenses, purchase of a new home, health care costs, support for other family members, or anything else?*

Note that this question explicitly references health care costs, which we counted above as a motive for precautionary savings. However, we can separate term saving for health care from other term saving using a follow-up question. If the respondent answered Question 2 affirmatively, then the interviewer asked

**Question 3** *What kinds of obligations are these?*

The interviewer then showed the respondent a list of possible expenditures. Another follow-up question asked whether or not the household was currently saving for the expense. A

	1995	1998	2001	2004	2007
Foresees Expense	63.1	58.8	60.5	59.0	57.5
Saving Now	38.1	37.1	36.8	35.8	33.9
Saving Complete	.	.	.	.	1.6

Table 5: Percentage Frequencies of Saving for Anticipated Expenditure

household that is not currently saving might either have not begun saving or have already completed saving. In 2007, the SCF questionnaire addressed this ambiguity by asking respondents if their saving was completed.

Table 5 reports the frequencies with which respondents reported a foreseen expense, saving now for that expense, and (for 2007) whether or not the saving was complete. In all of the waves, about 60 percent of households report an anticipated expense, and about 35 percent report that they are saving now for it. This is not far below the approximately 40 percent of households that claim an Anticipated Expenditure as one of possibly several savings motivations when answering Question 1.<sup>20</sup> Only a very small fraction of households report that their saving for anticipated expenditures is complete. We have also tabulated the answers to these two savings questions by the wealth deciles used in Table 3. The fraction of households reporting a foreseen expense is nearly constant across wealth deciles, while the fraction reporting that they are currently saving for the expense rises with wealth. Therefore, the data do not reject the possibility that term savings substantially influences the wealthiest middle-class households.

As might be expected, the major expenses listed in Question 2 – education, purchase of a new home, and health care costs – are concentrated at specific stages of the life cycle. Table 6 reports the frequencies with which households responded to Question 3 with that particular category, both overall and by age of the household’s head. (The denominators for these frequencies include *all* households, not just those that answered Question 2 affirmatively.) Between 13.3 and 17.7 percent of households anticipate a home purchase in the next five to ten years. As expected, these are concentrated among younger households. Anticipated educational expenses are somewhat more frequent, and these are concentrated among the

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<sup>20</sup>One might wonder why many more households report anticipated expenditures when responding to Question 2 than report such expenses as a motive for saving in their answers to Question 1. One reason might be that Question 1 explicitly includes foreseen health costs. Another reason might be that the specific reference to “the next five to ten years” induces respondents to consider savings goals over a longer horizon.

middle aged. The overall frequency of anticipated medical expenses never exceeds 10 percent. In the 2001, 2004, and 2007 surveys this frequency is highest among those late in their working life, but one can hardly say that a typical older household is saving for medical care. This result validates our original decision to label saving in anticipation of medical expenses as precautionary. Overall though, Table 6 indicates that households tie anticipated expenditures to their life cycles.

### 3 The Model

Inspired by the above evidence, our quantitative model of middle-class consumption and savings decisions adds precautionary and term saving motivations to the impatient, borrowing-constrained household in [Campbell and Hercowitz \(2009\)](#). The precautionary motive arises from earnings uncertainty, and the term-saving motive comes from a periodic expenditure with predetermined timing but endogenous size. The household represents an infinitely-lived dynasty that is impatient relative to the market rate of interest. In spite of impatience, the household saves in anticipation of the periodic expenditure.

#### 3.1 Primitives and Optimization

The model proceeds in discrete time, and we think of a point in time as a “year.” This label reflects our choice to focus on the entire MPC out of tax rebates rather than just the rebate coefficient identified with variation across households in the monthly timing of their receipt.

The household values two goods, standard consumption and the special good. We denote the quantities of these consumed in year  $t$  with  $C_t$  and  $M_t$ . The utility function is

$$\sum_{t=0}^{\infty} \beta^t \left( \frac{C_t^{1-\sigma}}{1-\sigma} + \left( (1 + \mu_t)^{1/\sigma} - 1 \right)^\sigma \frac{M_t^{1-\sigma}}{1-\sigma} \right), \quad (1)$$

with  $0 < \beta < 1$  and  $\sigma > 0$ . Here,  $\mu_t = \mu > 0$  every  $\tau$  years and  $\mu_t = 0$  at other times. This specification generates a periodic expenditure with exogenous timing and endogenous size.<sup>21</sup>

The household is endowed with one unit of labor which it supplies inelastically at the wage rate  $W_t$ . Denote lump-sum taxes with  $T_t$  and net financial assets at the end of the

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<sup>21</sup>In the present context, the main issue regarding  $M_t$  is the liquidity shortage generated at the time of the expenditure. We interpret the utility from consuming  $M_t$  as the discounted expected future benefits from this expenditure. In any event, given that in the model the next expenditure endogenously shortens the effective planning horizon, the utility flows in the future are of secondary importance here.

Table 6: Frequency of Saving for a Specific Major Foreseen Expenditure by Age Group

Age Category	Home Purchase				Education				Medical Care						
	1995	1998	2001	2004	2007	1995	1998	2001	2004	2007	1995	1998	2001	2004	2007
All	15.5	17.7	17.1	15.5	13.3	18.6	19.9	17.8	19.2	17.1	8.3	5.8	5.4	5.9	6.8
25-29	28.3	33.5	24.0	29.5	35.1	11.8	18.5	11.1	16.3	13.7	5.7	5.3	2.5	5.6	4.3
30-34	25.2	28.1	29.0	21.2	14.4	14.7	16.9	16.9	14.9	13.3	9.5	7.1	6.5	2.6	5.2
35-39	16.9	19.0	22.6	16.1	16.4	27.0	26.8	20.5	22.1	23.4	7.8	7.9	4.7	5.6	4.8
40-44	8.3	15.3	14.8	11.8	11.5	24.5	29.4	26.6	27.3	21.6	8.9	6.5	6.0	3.3	4.0
45-49	9.4	15.4	11.2	12.7	8.5	26.9	19.1	23.1	26.4	25.3	8.0	5.8	3.4	5.7	7.5
50-54	8.9	5.3	12.6	10.4	11.0	13.4	19.2	15.7	15.5	15.5	9.7	3.8	7.0	6.0	8.1
55-59	11.9	6.1	6.4	11.3	5.0	7.1	6.4	7.7	11.8	9.3	7.9	2.0	6.4	11.3	11.8
60-64	5.9	3.4	6.1	7.3	3.0	4.9	2.2	2.6	6.2	6.7	9.5	6.0	10.1	14.3	10.2

This table reports the frequency of the three major foreseen expenses listed among households with some foreseen major expense for the Surveys of Consumer Finance in 1995, 1998, 2001, 2004, and 2007. The first row reports the frequencies for all households, and the remaining rows report the frequencies for households in the indicated 5-year age bins.

previous year with  $A_t$ . The household's budget constraint is

$$C_t + M_t = W_t - T_t + RA_t - A_{t+1}, \quad (2)$$

where  $R$  is the gross interest rate, assumed to be constant.<sup>22</sup> We assume that  $\beta R < 1$ , so the household is impatient. In [Campbell and Hercowitz \(2009\)](#), we provide a general equilibrium environment in which such a low interest rate arises endogenously from trade with a more patient household. The household's choices of all goods must satisfy nonnegativity constraints. Furthermore, the household faces the standard borrowing constraint

$$A_{t+1} \geq 0. \quad (3)$$

Given  $A_0$ , the household chooses sequences of  $C_t$ ,  $M_t$  and  $A_{t+1}$  to maximize its utility subject to the sequences of budget and borrowing constraints.

Denote the Lagrange multipliers on the year  $t$  budget and borrowing constraints with  $\Psi_t$  and  $\Gamma_t$ . The first-order conditions for optimization are

$$\Psi_t = C_t^{-\sigma}, \quad (4)$$

$$\Gamma_t = \Psi_t - \beta R \Psi_{t+1}, \quad (5)$$

$$\Psi_t M_t^\sigma = \left( (1 + \mu_t)^{1/\sigma} - 1 \right)^\sigma. \quad (6)$$

Without borrowing constraints,  $\Psi_t$  equals the marginal utility of lifetime resources. Here, it represents the marginal value of current resources. The multiplier  $\Gamma_t$  equals the marginal value of relaxing the borrowing constraint, which is the deviation from the standard Euler equation;  $\Gamma_t$  is zero when the borrowing constraint is slack. Because  $\Psi_t$  is always positive, the periodic expenditure  $M_t$  is positive when  $\mu_t > 0$  and zero otherwise.<sup>23</sup>

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<sup>22</sup>Our model omits one of the most prevalently cited savings motivations, retirement and estate. In the U.S., saving limited amounts towards retirement has tax advantages if the saver is willing to suffer penalties for withdrawal before a statutory retirement age. It is relatively straightforward to build such tax-advantaged retirement savings into the model if we abstract from earnings risk and assume that all households hit the statutory upper-bounds on retirement savings. That version of the model suggests that we measure income *net* of retirement savings contributions, as we did above. Including such savings vehicles in our model with earnings risk is much more challenging and lies beyond the scope of this paper.

<sup>23</sup>We can manipulate (4), (6), and the constraint that  $C_t + M_t$  equals total consumption expenditures in year  $t$  to get  $\Psi_t = (1 + \mu_t) (C_t + M_t)^{-\sigma}$ . That is,  $\mu_t$  has the interpretation of an increment in marginal utility for any given total consumption expenditure.

### 3.2 The Ergodic Distribution of Wealth and the MPC

Because of the periodic changes in preferences, the appropriate analogue of a steady state in this model is a deterministic cycle:  $W_t$  and  $T_t$  are assumed to be constant, and all of the household's choices follow a pattern that repeats itself every  $\tau$  years. If we assume that households are uniformly distributed over the cycle at any point in time, then we can calculate the cross sectional distribution of financial wealth and the MPC. The remainder of this section characterizes this ergodic distribution of wealth and the MPC analytically. These results verify the intuition given above that term saving makes wealth an indicator of anticipated liquidity constraints, so MPCs increase with wealth amongst households with positive wealth. They also serve as a foundation for understanding the next section's quantitative model which incorporates both term saving and precautionary saving.

Denote ordinary consumption and assets  $\kappa$  years after the most recent purchase of the special good in a deterministic cycle with  $C^\kappa$  and  $A^\kappa$ .<sup>24</sup> From (4) and (5), the necessary conditions which a deterministic cycle must satisfy are

$$\frac{C^{\kappa+1}}{C^\kappa} \geq (\beta R)^{1/\sigma} \text{ for } \kappa = 1, 2, \dots, \tau - 1, \text{ and} \quad (7)$$

$$\frac{C^1}{C^\tau} \geq (\beta R)^{1/\sigma}. \quad (8)$$

The corresponding budget constraints are

$$\begin{aligned} C^\kappa + A^{\kappa+1} &= W - T + RA^\kappa \text{ for } \kappa = 1, 2, \dots, \tau - 1, \\ (1 + \mu)^{1/\sigma} C^\tau + A^1 &= W - T + RA^\tau. \end{aligned}$$

This final form of the budget constraint replaces the periodic expenditure with its optimal level derived from (4) and (6),  $((1 + \mu)^{1/\sigma} - 1)C^\tau$ . With these conditions defining a deterministic cycle, we can characterize them with the following

**Proposition 1** *There exists a unique deterministic cycle. In it*

1.  $C^1/C^\tau > (\beta R)^{1/\sigma}$ , and
2. if  $C^{\kappa+1}/C^\kappa > (\beta R)^{1/\sigma}$  and  $\kappa \geq 2$ , then  $C^\kappa/C^{\kappa-1} > (\beta R)^{1/\sigma}$ .

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<sup>24</sup>Our model has a deterministic asset cycle in common with the models of [Baumol \(1952\)](#) and [Tobin \(1956\)](#). Those models differ in key respects from ours. There, the length of the cycle is the key endogenous variable, while here it is exogenous. We focus on the link between the asset cycle and liquidity constraints, while those models focused on the link between assets and money demand.

Appendix B contains this proposition’s short proof. Its first enumerated result says that the borrowing constraint binds in the cycle’s final year, when the household consumes the special good. This fact is the analogue of the familiar result that an impatient household faces a binding borrowing constraint in a steady state. The second enumerated result says that if the borrowing constraint binds in some period before the special good is consumed, then it must bind in the previous period as well. Taken together, these results state that the periodic cycle always ends with the borrowing constraint binding while the household consumes the special good. Immediately afterwards, it might be binding for one or more years. If it ceases to bind, then the household accumulates wealth until the next opportunity to consume the special good.

Zeldes (1984) noted that a binding borrowing constraint in the future works like a terminal condition which shortens the effective planning horizon. The household’s response to an unanticipated one-time increase in  $W_t - T_t$  on the deterministic cycle illustrates this. If the borrowing constraint binds in the year of the increase, then the MPC equals one as expected. If instead the borrowing constraint is slack then, the household allocates the increase in current income across consumption between the present year in the cycle,  $\kappa < \tau$ , and the next time the borrowing constraint binds. The resulting marginal propensity to consume (which can be easily calculated from the corresponding finite-horizon utility-maximization problem) is

$$MPC^\kappa = \left( \frac{1 - (\beta R^{1-\sigma})^{\frac{\tau-\kappa}{\sigma}}}{1 - (\beta R^{1-\sigma})^{\frac{1}{\sigma}}} + (\beta R^{1-\sigma})^{\frac{\tau-\kappa}{\sigma}} (1 + \mu)^{\frac{1}{\sigma}} \right)^{-1}.$$

Whether or not this MPC is “large” relative to that we expect from the permanent income theory of consumption depends on the importance of the special good for consumption. Intuitively,  $MPC^\kappa$  can be quite small if  $\mu$  is so large that the household effectively only consumes the special good. To make this more precise, consider the marginal propensity to consume from the infinite-horizon utility-maximization problem with neither the special good nor borrowing constraints,  $1 - (\beta R^{1-\sigma})^{\frac{1}{\sigma}}$ . This will be less than  $MPC^\kappa$  if and only if

$$(1 + \mu)^{\frac{1}{\sigma}} < \frac{1}{1 - (\beta R^{1-\sigma})^{\frac{1}{\sigma}}}. \tag{9}$$

Reasonable calibrations of the model in which ordinary consumption accounts for the majority of expenditures satisfy (9) comfortably, so we hereafter assume that it holds good.

We began this paper highlighting the empirical failure of  $MPC$ s to substantially decline with observed household wealth. The next proposition shows that term saving can indeed

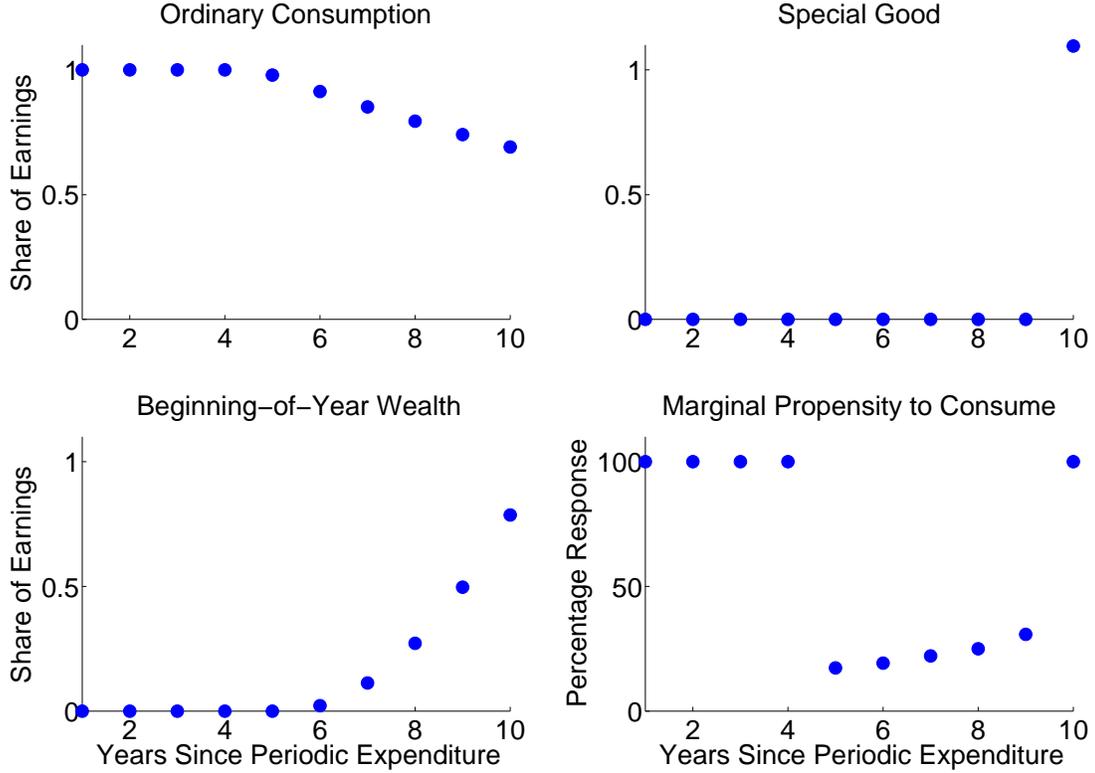


Figure 1: The Calibrated Model's Deterministic Cycle

account for this qualitatively. To see our model's implications for these observations, we differentiate  $MPC^\kappa$  above with respect to  $\kappa$ . The upper bound for  $\mu$  in (9) signs the derivative positively. Therefore, we conclude:

**Proposition 2** *Set  $\kappa \in 1, \dots, \tau - 2$ . If  $\mu$ ,  $\beta$ ,  $R$ , and  $\sigma$  satisfy (9) and*

$$C^{\kappa+1}/C^\kappa = C^{\kappa+2}/C^{\kappa+1} = (\beta R)^{\frac{1}{\sigma}},$$

*then  $A^\kappa < A^{\kappa+1}$  and  $MPC^\kappa < MPC^{\kappa+1}$ .*

Proposition 2 implies that if we sampled households from the deterministic cycle, we would find that  $MPC_t$  covaries positively with  $A_t$  among households with assets. Overall, the MPC is a U-shaped function of wealth, attaining its highest value of one when beginning-of-year wealth is either zero or its maximum observed value ( $RA^\tau$ ).

Figure 1 illustrates the qualitative implications of Proposition 2 with plots of the model’s deterministic cycle (that is,  $W_t$  is held constant) using the calibrated parameter values reported below in Section 4. In the year of the expenditure and for four years thereafter, the household chooses zero wealth, so its marginal propensity to consume in those years equals 100 percent. In the fifth year after the expenditure, saving begins and the marginal propensity to consume falls. The MPC increases as the expenditure approaches. Since wealth simultaneously increases, those saving households with the highest wealth also have the highest MPCs; just as predicted by the proposition.

In this section and throughout this paper, we have focused on the marginal propensity to consume out of temporary tax rebates. Before proceeding to our quantitative analysis, we wish to consider the deterministic model’s implications for another line of evidence that measures the *elasticity* of consumption with respect to a persistent wage increase. For example, Baker (2014) shows that the elasticity of consumption with respect to exogenous and persistent changes to earnings declines with wealth.<sup>25</sup> Our model reproduces this observation, even though the MPCs out of temporary tax rebates increase with wealth. To see this, note that the elasticity of current consumption with respect to a permanent increase in *total* resources available from the present until the next periodic expenditure equals one, because our household’s preferences are homothetic. The elasticity of interest is the product of this with the elasticity of total resources available from the present until the next periodic expenditure with respect to a permanent earnings increase. In year  $\kappa$  of the model’s deterministic cycle then this is

$$\frac{(W - T)(1 + R(1 - R^{-(\tau-\kappa)}))/(1 - R^{-1})}{RA^\kappa + (W - T)(1 + R(1 - R^{-(\tau-\kappa)}))/(1 - R^{-1})}.$$

This elasticity clearly declines with wealth,  $RA^\kappa$ ; just as documented by Baker.

## 4 Quantitative Analysis

In this section, we investigate the quantitative contribution of term savings to middle-class households’ MPCs by enriching the model with ongoing wage risk, calibrating its parameters, and calculating the MPCs to transitory income changes and balanced-budget tax experiments. Our addition of wage risk follows Meghir and Pistaferri (2004). Using annual PSID observations, they estimated a stochastic process of household heads’ log earnings that sums

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<sup>25</sup>See the fifth column of his Table 4.

a random walk with a first-order moving average. The resulting process for  $W_t$  is

$$\begin{aligned}\ln W_t &= \ln W_t^P + \ln W_t^T; \text{ with} \\ \Delta \ln W_t^P &\sim N(0, 0.177^2), \\ \ln W_t^T &= \varepsilon_t + 0.2566\varepsilon_{t-1}, \text{ and} \\ \varepsilon_t &\sim N(0, 0.173^2).\end{aligned}$$

Although they estimated several processes with heteroskedasticity, we focus on this homoskedastic process for the sake of simplicity. We assume that the household faces a four percent real rate of interest, so  $R = 1.04$ . Motivated by the phrasing of Question 2, we set  $\tau$  to 10. Our calibration uses logarithmic preferences ( $\sigma = 1$ ).<sup>26</sup> The remaining parameters to be determined are  $\beta$  and  $\mu$ , which jointly govern the household's desired intertemporal allocation of consumption. We set these so that the median and 75th percentile of the distribution of wealth to current labor income in the model's ergodic distribution equal 0.14 and 0.46. These are the averages (across years) of the analogous medians and 75th percentiles calculated from the 1995, 1998, 2001, 2004, and 2007 cross-sectional waves of the SCF. Given the model's other parameters, this procedure selects  $\beta = 0.8967$  and  $\mu = 1.5859$ .<sup>27</sup>

To solve the model, we first create its stationary representation by dividing  $C_t$ ,  $M_t$ , and  $A_t$  by  $W_t^P$ . Our solution of this stationary model uses standard discrete state space dynamic programming techniques. We constrain  $A_{t+1}$  to  $\{0, 0.0001, 0.0002, \dots, 1.3, 1.3001, 1.3002, \dots, 4\}$ . We approximate  $\ln W_t^T$  with a nine-point Markov chain constructed from a three-point Gauss-Hermite approximation to a standard normal random variable. We use the same three-point approximation to model  $\Delta \ln W_t^P$ .

Table 7 reports results obtained from this calibrated model. To calculate these, we begin with the model's ergodic distribution for wealth and earnings (both scaled by earnings' permanent component). For each point in its discrete state space, we compute the household's responses to four changes in lump-sum transfers. In the first, each household receives a one-time transfer. This is *not* a balanced-budget experiment, but the next experiment balances the budget with a lump-sum tax in all subsequent years equal to the interest cost of perpetually servicing the government debt used to fund the initial transfer. The next

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<sup>26</sup>We have also calibrated the model given  $\sigma = 1/2$ ,  $\sigma = 3/2$ , and  $\sigma = 2$ . The MPCs we report below are all within one percentage point of the analogous MPCs from these alternative calibrations. That is, the assumed value for  $\sigma$  has no impact on our results worth reporting.

<sup>27</sup>In the calibrated model, the special good accounts for about 61 percent of total consumption expenditures in one of every ten years.

Marginal Propensities to Consume out of a						
$12A_t/W_t$	Frequency	One Year Transfer	One Year Tax Cut	Three Year Tax Cut	Five Year Tax Cut	
0	30	53	51	82	93	
(0,1]	15	35	32	64	86	
(1,2]	8	26	24	59	81	
(2,3]	8	25	22	59	79	
(3,4]	6	24	22	59	78	
(4,5]	5	26	24	61	75	
(5,6]	4	31	29	64	75	
(6,7]	4	37	36	67	75	
(7,8]	3	46	44	71	77	
(8,9]	3	51	50	74	79	
(9,10]	3	58	57	78	81	
(10,11]	2	63	62	80	83	
(11,12]	2	66	65	82	84	
13 or more	6	72	71	88	91	
All Households	100	42	40	71	85	

Table 7: Average MPCs from the Calibrated Model with Term Saving

two experiments extend the initial tax cut to three and five years and increase the following permanent tax increase accordingly. Each row reports the MPCs in each experiment’s *first* year for the group of households with income to wealth ratios in 14 ranges. The first contains all households with exactly zero wealth (30 percent of the households), the second contains households with positive wealth that is less than one month of its current earnings, the third contains households with wealth greater than or equal to one month’s earnings but less than two month’s earnings, etc. The table’s column labeled “Frequency” shows that the distribution of the wealth to income ratio has a thick tail. The calibration ensures that its median value is 0.14, but its mean equals 0.28.

For the first experiment of a one-time transfer, the MPC of households with zero wealth equals 53 percent. Consistent with the intuition from a precautionary savings model, 43 percent of these households are actually accumulating wealth and so have MPCs below 100 percent. The MPC declines to 35 percent for households with between zero and one month

of income in wealth, and then to 26 percent for households with wealth between one and two months' income. Thereafter, the MPC flattens out until it begins to rise for households with wealth between 5 and 6 months' earnings. For the 6 percent of households with wealth exceeding a full year of earnings, the MPC equals 72 percent.

The deterministic version of the model suggested that the long-run tax increase to balance the current tax cut should have a small effect on the present consumption response – given the effective shortening of the planning horizon. The present, more quantitatively relevant, framework mimics this prediction: Permanently raising taxes to pay for the one-year tax cut reduces the MPCs very little. For those with no wealth, the MPC drops from 53 percent to 51 percent, and for those with wealth exceeding annual earnings it drops from 72 to 71 percent. Furthermore, the U-shaped relationship between the MPCs and household wealth remains unchanged. Extending the tax cuts to three and five years raises the MPCs and flattens them. For a five-year tax cut, the average MPC of households without wealth equals 93 percent. For those with wealth exceeding annual earnings, it equals 91 percent. Overall, these results suggest that the persistence of a tax-induced increase in current income matters much more than how it is financed.

In our model, households face both precautionary saving motives and term saving motives. To illustrate the quantitative contributions of term saving to its results, we have also calibrated our model without term saving. For this, we set  $\mu$  to zero and choose  $\beta$  so that the ergodic distribution's median ratio of financial wealth to current income equals 0.14. The resulting value for  $\beta$  is 0.9303. The model's other parameters remain unchanged. Table 8 reports the ergodic distribution and MPCs from this alternative calibration. Unsurprisingly, removing term saving motives makes the wealth distribution's right tail much thinner. Also as expected, the marginal propensities to consume *decline* with wealth. For the experiment with a one-year transfer the MPC of households with no wealth is 52 percent, while the analogous MPC for household's with wealth exceeding current annual earnings equals only 15 percent. The other experiments display a similarly dramatic decline of the MPC with wealth. Apparently, the model cannot come close to reproducing the empirical relationship between the MPC and household wealth without term saving.

## 5 Concluding Remarks

In standard precautionary saving models, liquidity constraints disproportionately influence the consumption and savings decisions of households with low wealth. However, evidence

Marginal Propensities to Consume out of a					
$12A_t/W_t$	Frequency	One Year Transfer	One Year Tax Cut	Three Year Tax Cut	Five Year Tax Cut
0	16	52	49	85	93
(0,1]	23	40	37	72	87
(1,2]	15	38	35	67	84
(2,3]	12	28	24	58	78
(3,4]	10	24	20	53	74
(4,5]	7	23	19	51	72
(5,6]	5	22	18	48	69
(6,7]	3	21	17	45	67
(7,8]	2	19	16	43	64
(8,9]	2	18	15	41	62
(9,10]	1	18	14	39	60
(10,11]	1	17	13	37	58
(11,12]	1	17	13	36	56
13 or more	1	15	12	33	52
All Households	100	34	31	63	80

Table 8: Average MPCs from the Calibrated Model without Term Saving

from the responses to tax rebates in the U.S. indicates that marginal propensities to consume are high (relative to the permanent-income-hypothesis benchmark) and fail to decline with wealth. To bridge this gap between theory and evidence, we have incorporated saving towards a large foreseen expense – term saving – into a standard precautionary savings model. In a deterministic version of the model with term saving only, high wealth reflects an anticipated demand for liquidity rather than a liquidity surplus arising from past luck (as with precautionary saving). In our quantitative model with earnings risk, the resulting high MPCs for high-wealth households flatten what would otherwise be a declining relationship between wealth and the MPC, thereby bringing the model into better alignment with the evidence.

The principal lesson we take away from these results regards the pervasiveness of liquidity-constrained behavior across the middle class. Identifying “liquidity constraints” with violations of the standard Euler equation leads one to conclude that only a minority of households

are liquidity constrained. The standard precautionary savings model reinforces this view, because it predicts that the MPC should sharply decline with wealth. However, the anticipation that liquidity constraints will bind in the future also compresses current consumption by propagating through term saving. The empirical pervasiveness of term saving motives, the failure of measured MPCs to decline with liquid assets, and the success of the term saving model at replicating the wealth-MPC relationship lead us to believe that liquidity constraints are salient for most middle class households' consumption and savings choices.



stock wealth. They also reinforce the impression that these data have power to detect an impact of stock ownership on the propensity to mostly spend the 2001 Bush tax rebate.

## B Proofs for Section 3.2

**Lemma 3** *The borrowing constraint must bind at least once in any deterministic cycle.*

**Proof.** Suppose otherwise. then from (7) and (8), we can conclude that

$$\frac{C^2}{C^1} \frac{C^3}{C^2} \cdots \frac{C^\tau}{C^{\tau-1}} \frac{C^1}{C^\tau} = (\beta R)^{\frac{\tau}{\sigma}}.$$

But this is impossible, because the left-hand side equals one while the right hand side is strictly less than one. ■

**Lemma 4** *Suppose that the borrowing constraint is slack in one year of a deterministic cycle. Then either the borrowing constraint is slack in the cycle's next year or the cycle's next year is  $\tau$ .*

**Proof.** Let  $\kappa$  denote a year in which the borrowing constraint is currently slack but which is followed by a year in which it binds. By construction,  $\kappa$  caps a spell of years over which the borrowing constraint has been slack. Denote the number of years in this spell with  $j$ . By definition, beginning-of-period wealth at the beginning of such a spell is zero. Therefore, consumption in that year cannot exceed  $W - T$ . Since the borrowing constraint is slack throughout the entire spell, this in turn bounds ordinary consumption in the year after  $\kappa$  from above with  $(W - T)(\beta R)^{\frac{j}{\sigma}} < (W - T)$ . However, *total* consumption expenditures in that year must weakly exceed  $W - T$ , because the borrowing constraint binds in that year (by assumption) and so consumption expenditures must equal total earnings summed with any accumulated wealth. If  $\kappa \neq \tau - 1$ , then this is impossible because total consumption expenditures equals ordinary consumption expenditures. Therefore,  $\kappa = \tau - 1$ . ■

**Proof of Proposition 1.** Lemmas 3 and 4 together imply that the borrowing constraint binds in the final year ( $\tau$ ) of a deterministic cycle. Therefore, a deterministic cycle corresponds to a solution of the finite-horizon utility maximization problem that starts in period 1 with zero assets and ends in period  $\tau$  with the household consuming all available resources. Since this problem maximizes a strictly concave objective over a convex constraint set, it has a unique solution. This guarantees existence and uniqueness of a deterministic cycle.

With this established, applying Lemmas 3 and 4 again yield the proposition's first numbered conclusion, and the second numbered conclusion is a consequence of Lemma 4 alone. ■

**Proof of Proposition 2.** Establishing that  $A^\kappa \leq A^{\kappa+1}$  proceeds inductively. First, suppose that  $A^\kappa = 0$ . That is,  $\kappa$  is the cycle's first year in which the borrowing constraint is slack. The borrowing constraint alone then gives us that  $A^{\kappa+1} \geq 0 = A^\kappa$ . Next, suppose that  $A^\kappa > 0$  and that  $A^\kappa \geq A^{\kappa-1}$ . Since the borrowing constraint is slack in year  $\kappa - 1$ , we know that  $C^\kappa = (\beta R)^{\frac{1}{\sigma}} C^{\kappa-1} < C^{\kappa-1}$ . Therefore, we have that

$$A^{\kappa+1} - A^\kappa = R(A^\kappa - A^{\kappa-1}) - (C^\kappa - C^{\kappa-1}) > 0.$$

To prove that  $MPC^\kappa < MPC^{\kappa+1}$ , differentiate the expression for  $MPC^\kappa$  in the text with respect to  $\kappa$ .

$$\frac{\partial MPC^\kappa}{\partial \kappa} = (MPC^\kappa)^2 \ln(\beta R^{1-\sigma}) \frac{1}{\sigma} \left( (1 + \mu)^{\frac{1}{\sigma}} - \frac{1}{1 - (\beta R^{1-\sigma})^{\frac{1}{\sigma}}} \right)$$

This is positive if and only if (9) holds good. In this case, integrating from  $\kappa$  to  $\kappa + 1$  gives us the result that  $MPC^\kappa < MPC^{\kappa+1}$ . ■

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