A Monthly Struggle for Self-Control? Hyperbolic Discounting, Mental Accounting, and the Fall in Consumption Between Paydays

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Abstract

An alternative conception of consumer choice has recently gained the attention of economists, which allows for two closely related departures from the standard model. First, consumers may have dynamically inconsistent preferences. Second, as a rational response to this dynamic inconsistency, the consumer may use external commitment devices or personal rules in an attempt to limit overspending. We use data from a large, representative sample of households in the UK to test the relevance of these twin predictions in the field. We find evidence that consumption spending declines between paydays, and jumps back to its initial level on the next payday. The decline is too steep to be explained by dynamically consistent (exponential) impatience, and does not appear to be driven by stockpiling or other rational motives. On the other hand a model with dynamically inconsistent (quasi-hyperbolic) time preference can explain the decline, for reasonable short-term and long-term discount rates. We also investigate whether households in our sample appear to make an effort at self-control, using a strategy emphasized in the literature: a mental accounting rule that limits borrowing during the pay period and thus puts a cap on overspending. We find that households who are able to borrow, in the sense that they own a credit card, nevertheless exhibit the spending profile characteristic of credit constraints. Investigating their behavior in more detail, we find that these households treat funds from the current and future income accounts very differently during the pay period. In combination, these facts suggest the use of a mental accounting rule limiting borrowing. Overall, our findings are difficult to explain in the standard economic framework, whereas the self-control problem framework offers a relatively parsimonious, unified explanation.

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> "Remember: If you don't see it, you won't spend it! … If your company offers a 401(k) retirement plan, make sure you sign up for the maximum possible contribution. It will be taken out of your *paycheck* automatically… The whole point is to get the money out of your checking account before you see it and spend it."
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> - T. Savage, *How small cuts become huge savings*, MSN Money website (undated)

1. Introduction

The standard economic model assumes that the consumer makes a plan for consumption over time, aiming to satisfy a single set of dynamically consistent preferences, and then sticks to this plan, unless new information arrives. This framework is tractable, and intuitive in the sense that it captures the deliberative side of human decision-making.

An alternative framework has recently gained the attention of economists, however, in which the consumer's ability to adhere to a plan for consumption depends on the outcome of an internal struggle. This struggle reflects two important departures from the standard model. First, consumers may have self-control problems, in the sense of dynamically inconsistent preferences: planning to be patient in the future, the consumer may nevertheless overspend when the future becomes the present, because of a recurring urge for immediate consumption. The second departure is a direct consequence of the first: assuming the consumer is "sophisticated," or aware of his own dynamic inconsistency, he has a motive to make efforts at self-control, either through external commitment devices or through internal commitments, i.e. rules. Importantly, the implications of the self-control problem framework depend on the interplay of these twin predictions. As argued by Benabou and Tirole (2004) and others, looking at only dynamic inconsistency without also considering the potential for individuals to exert efforts at self-control may lead to economic models that mischaracterize the economic and behavioral distortions arising from dynamic inconsistency.

This paper tests whether self-control problems are relevant in real market settings. This is important because much of the empirical support for the self-control problem framework comes from laboratory experiments (see Fredrickson, Loewenstein and O'Donghue, 2004; Thaler, 1999). Departures from the standard model could disappear in real market settings, due to higher incentives, greater opportunities for learning, or differences between the population of subjects typically used in experiments and the general population (see List, 2003, for a discussion of these points). We use data on the timing of consumption between monthly paydays, for a large, representative sample of working households in the UK, to test whether the pay period is an arena for a monthly struggle for self-control, as suggested by the quote at the beginning of this paper.

The first prediction is that households facing self-control problems will tend to exhibit a decline in consumption between paydays. Intuitively, this is because dynamic inconsistency causes household members to repeatedly succumb to an urge for immediate consumption, and thus run out of money by the end of the pay period (the decline is exacerbated by an unwillingness or inability to borrow, an issue to which we return below). We formalize this prediction using the quasi-hyperbolic discounting model (see Laibson, 1997), which incorporates dynamic inconsistency by allowing for different discount rates over short and long time horizons. We test for a decline using our data on the timing of consumption between paydays. Although a decline would be consistent with self-control problem, there are also fully rational explanations, which we evaluate in a series of robustness checks and calibration exercises.

The second prediction is that "sophisticated" households will make an effort to limit overspending by following a rule that limits borrowing during the pay period. This particular rule has been emphasized in the literature on self-control (Benabou and Tirole, 2004; Thaler and Shefrin, 1981; Thaler, 1999; Benhabib and Bisin, 2004; Loewenstein and O'Donoghue, 2005). In the language of Thaler and Shefrin, this rule is part of a system of "mental accounting," which makes the future income "account" less accessible than the current account. A recent field experiment by Wertenbroch, Soman, and Nunes (2002) provides direct evidence on the link between this type of deliberate "debt aversion" (Prelec and Loewenstein, 1998) and the need for self-control, showing that individuals who score high on a scale measuring impulsivity prefer to pay with cash as opposed to credit. Using our data, we identify households who own a credit card, and assess whether these households nevertheless exhibit the spending profile characteristic of credit constraints: a decline in spending over the pay period followed by a jump up on the next payday. We also investigate whether these households appear to treat current income and future income differently during the pay period, consistent with the use of a mental accounting rule.

In our data, we find support for both predictions. The typical household exhibits a statistically significant, 18 percent decline in consumption spending between the first week of the monthly pay period and the last. With the arrival of the next payday, consumption spending returns to its initial level. This pattern is robust to controls, and does not appear to be driven by motives such as stockpiling of durable goods on payday, or cycles in payments with non-discretionary timing, e.g. rent, mortgage, or other monthly bills. Other studies have also found evidence of declining consumption between paydays. Shapiro (2005) finds a decline in the caloric intake of food stamp recipients between food stamp payments, and Stephens (2003) finds a pattern of declining consumption spending among social security recipients. Stephens (2002), who developed simultaneously with this paper, finds a similar decline between paydays using the same data we use (Stephens does not focus on self-control problems in this paper, however, but on testing the permanent income hypothesis).

We find that dynamically consistent (exponential) impatience cannot explain the *magnitude* of the decline. The model needs either an implausibly large degree of annual impatience, or a very large intertemporal elasticity of substitution. Intuitively, the problem arises because the exponential discount rate is *constant* over time:[1] even a mild degree of short-run discounting, say a daily discount rate of 1 percent, implies a daily discount factor of 0.99 and thus an annual discount factor of $0.99^{365} = 0.03$. This is far below estimates of annual discounting in the literature, and implies that the consumer values consumption today 97 percent more than consumption in one year, which seems highly implausible. On the other hand, we find that the quasi-hyperbolic model can explain the magnitude of the decline for reasonable parameter values, precisely because the discount rate in the hyperbolic model is not constant.

Turning to the second prediction, we find that households with credit cards exhibit the same declining profile, with a jump on the next payday. Our data do not include information on credit limits or balances, raising the possibility that some of these households are actually unable to borrow, but we find a similar pattern when we restrict the sample to households with non-zero credit card spending. Investigating spending

[1] Constant discounting is a necessary condition for dynamic consistency (Strotz, 1956).

behavior in more detail, we find that households treat spending out of current and future income very differently. They exhibit the profile characteristic of being credit constrained with spending out of current income, while simultaneously choosing a “flat” profile for credit card spending over the pay period. This behavior suggests of the use of a mental account rule, and thus provides some indication that households in our sample are sophisticated, and able to use internal commitments to limit overspending.

In summary, the two main stylized facts generated by this paper are difficult to explain in the standard economic framework. The self-control problem framework, by contrast, offers a relatively parsimonious and unified explanation. In this sense, our findings provide support for the view that self-control problems are relevant outside of the laboratory. Our evidence is based on the everyday consumption choices of the typical household, and thus constitutes an important contribution to the body of evidence from previous studies, which have focused on various sub-populations and different choice domains. E.g., previous studies have used data on health club members (DellaVigna and Malmendier, 2003), smokers (Gruber and Koszegi, 2001; Gruber and Mullainathan, 2002), unemployed job searchers (DellaVigna, 2005), potential welfare participants (Fang and Silverman, 2004), food stamp recipients (Shapiro, 2005), and payday loan recipients (Skiba and Tobacman, 2005). Angeletos et al (2001) and Laibson, Rapetto and Tobacman (2003) also find evidence of dynamic inconsistency, based on life-cycle consumption and savings behavior.

Although our findings suggest the presence of self-control problems, they also contribute new field evidence suggesting that households are to some extent sophisticated and able to place limits on overspending. This evidence provides useful guidance in assessing the extent of households' self-control problems, illustrating the importance of considering both predictions of the self-control framework simultaneously. In particular, degree of dynamic inconsistency implied by our calibration of the quasi-hyperbolic model depends crucially on whether we assume sophistication or naiveté.

It is particularly relevant to study self-control with respect to credit card spending, given widespread concern about excessive credit card debt.[2] Our results support a more nuanced view of the role of credit cards in contributing to self-control problems: they do not rule out that the level of credit card spending that is "too high," as has been argued in the literature on self-control (Hoch and Loewenstein, 1991; Shefrin and Thaler, 1988; Prelec and Simester, 2001; Soman, 2001; Wertenbroch, 2002; Soman and Cheema, 2002), but they suggest that households do not borrow as much as they could.

Finally, the shape of the spending profile over the pay period, and the motivation behind it, are important subjects for study in their own right. Our results add to the debate on whether the industry in "payday loans" exploits self-control problems, by testing whether households in fact experience a struggle for self-control between paydays.[3] Also, government efforts to regulate household spending over the pay period, or encourage sufficient saving for retirement, are typically criticized from the perspective of rational choice (Moffitt, 1989), but such programs may be more easily defended if households have trouble limiting their own spending.

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[2] Our findings are also relevant for the literature on credit cards and consumption smoothing, which has mainly studied decisions over longer, quarterly or annual time horizons (Japelli, Pischke, and Souleles, 1998; Gross and Souleles, 2000; and Zinman, 2004).

[3] See Skiba and Tobacman (2005) for evidence that (naïve) hyperbolic discounting may also play a role in explaining willingness to take out a payday loan.

The remainder of the paper is organized as follows. Section 2 describes the data. Section 3 explains our empirical design, presents results on the decline in spending between paydays, and performs robustness checks. Section 4 presents calibration results for models with exponential and quasi-hyperbolic discounting. Section 5 investigates the use of mental accounting rules as a response to self-control problems.

2. Data Description

We use data from the Expenditure and Food Survey (EFS), which is administered every year in the UK. The annual sample includes between six and seven thousand households. For each household, an initial interview collects detailed demographic information. Immediately after the interview, each household member starts a expenditure diary, in which they record everything they buy during the next fourteen days. Diary expenditures are aggregated to "diary weeks" in the data, for reasons of confidentiality, resulting in two seven-day aggregates of expenditure for each individual. Importantly, the timing of the EFS interview, and the subsequent diary recordings, is random during the sample year. Figure 1 illustrates the resulting data structure: diary weeks need not correspond to the calendar week, but rather start on different days of the week, at different distances from payday, and overlap to varying degrees.

Crucially for this paper, individuals report the amount and date of their last paycheck. This allows us to investigate how diary week expenditure changes, as the start day of the diary week gets farther from payday. The EFS interview also asks about the frequency of pay, e.g. calendar month, which makes it possible to impute the timing of the next payday. There is potentially some measurement error involved in imputing the next payday, however, which may lead to a margin of error of one or two days when classifying a diary week as including the next payday or not.[4] Accordingly, we check the robustness of our results by estimating regressions with and without diary weeks that overlap the imputed next payday by only one or two days.

The EFS data also include information on method-of-payment. Purchases are identified as having been made with cash (this category also includes spending with a debit card), or having been made with a credit card. This makes it possible to distinguish the way that households spend out of current versus future income during the pay period.

We lay the groundwork for our analysis with some simple descriptive statistics. Table 1 verifies that household characteristics are orthogonal to distance from payday, showing that sample means of household characteristics change very little with distance from payday. Thus, although we include demographics in our regressions to check whether these variables affect expenditure in a reasonable way, this is not strictly necessary for obtaining an unbiased estimate of the impact of distance.

Figure 2 presents frequency distributions for key variables. The first graph shows that distance from payday is evenly distributed, i.e. the timing of EFS interviews and timing of paydays is orthogonal. The second graph shows that pay dates, by contrast, are unevenly distributed. There is a strong concentration of pay dates on the last few days of the calendar month, suggesting that it will be important to control for calendar month effects. The final graph in Figure 2 shows that diary start dates are fairly evenly

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[4] E.g. some employers might pay on the last day of each month, and others might pay on the same calendar date each month. Thus, after being paid on the 30th of April, the next (unobserved) payday could fall on May 31st or May 30th.

distributed throughout the calendar month, as expected given the randomness of the EFS interview during the year.

Figure 3 provides a first look at relationship between consumption spending and distance from payday, as it exists in the raw data. The figure plots average log expenditure versus distance from payday, with 95 percent confidence bands. Each point on the graph is calculated by averaging all week-long aggregates of expenditure that begin at that particular distance from payday.[5]

Figure 3 shows that average consumption expenditures are markedly higher right after payday.[6] Expenditure declines over the pay period, reaching a low around three weeks after payday, then starts to climb rapidly at the point when diary weeks begin to overlap with the next payday.

3. Empirical Design, Baseline Results, and Robustness

3.1. Empirical design

The EFS data suggest a straightforward empirical design: we investigate how diary week expenditure change as the start-date of the diary week gets farther away from the payday. The first regression we estimate is of the form:

$$C_{it} = \alpha + \beta \cdot distance + \gamma \cdot T_t + \eta \cdot Z_i + \varepsilon \qquad (1)$$

The dependent variable, C_{it}, is the log of consumption expenditure by household i, during the diary week beginning at time t. The *distance* variable measures distance from payday

[5] Averages in the graph do not reflect the 1.6 percent of observations involving zero expenditure, because the log of zero is undefined. Comparing graphs of the level of diary week spending with and without these observations, there is no perceptible impact of excluding the zero observations.

[6] Using median log expenditure yields a very similar figure.

in days. To avoid the confounding effect of diary weeks that overlap the next payday, we exclude these observations from the sample used for the estimation. This first specification is useful for summarizing the relationship between distance and expenditure over the pay period, but it is restrictive in that it imposes linearity.

Our next specification uses a less-parametric specification for the relationship between distance and consumption spending:

$$C_{it} = \alpha + \beta_1 \cdot d_{0\,to\,7} + \beta_2 \cdot d_{8\,to\,14} + \beta_3 \cdot d_{-4\,to\,-1} + \gamma \cdot T_t + \eta \cdot Z_i + \varepsilon \qquad (2)$$

The distance measure consists of three dummy variables:[7] The first indicates diary weeks starting on payday, and weeks starting 1 to 7 days after payday. The second indicates weeks starting 8 to 14 days after payday. Diary weeks beginning at distances 15 to 22 are omitted from the equation and serve as the reference category. The third dummy indicates weeks beginning 4 to 1 days before the next payday. These weeks overlap the (imputed) next payday by at least three days. We exclude from the analysis diary weeks that we are likely to misclassify, in terms of whether or not they include the next payday. Roughly speaking, these are diary weeks beginning after distance 23 but more than 4 days before the imputed payday although the cutoff varies with the length of the pay period. We check the robustness of our results to inclusion of these diary weeks by estimating additional regressions, described below.

The vector T_t controls for day of calendar month, month, and year in which a diary week begins, as well as the day of the week on which payday falls. There is also a dummy for the second diary week, to control for survey fatigue. Z_i includes household income, interest income, credit card ownership, age and occupation of the main earner,

[7] These correspond roughly to weeks of the pay period. Below, we verify that our basic results are also robust to a less parametric specification.

household size, number of income earners, marital status, geographic region of residence, and size of city of residence. The full specification is shown in Table B2 in Appendix B.

Each household member records spending for the same two diary weeks, so we must pool observations across households to study expenditures over an entire month. Given that distance from payday is orthogonal to household characteristics, this pooling should not bias our estimate of the relationship between distance and spending.[8]

We impose a number of sample restrictions. People paid weekly are excluded, because every diary week includes a payday for these individuals.[9] If there is more than one paycheck received by the household, on different paydays, this would tend to obscure the relationship of interest, so we drop households where there is any secondary earner whose paycheck is greater than 25 percent of total household wage earnings, *and* for whom the paycheck arrives 3 or more days away from the main earner's payday, or is not a monthly paycheck.[10] We drop households missing information on key variables, households who have zero wage income, and households with a head who is retired or unemployed. We also drop outlier households with more than US $5,000 of weekly consumption, or more than $600 of weekly expenditures on highly non-durable goods.[11] The omission of key survey questions leads us to exclude EFS data earlier than 1988, and later than 2000. Accordingly, our final sample includes interviews conducted between

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[8] We find that adding demographics does not have any appreciable impact on the distance coefficient, providing further confirmation of orthogonality.

[9] The original sample includes roughly equal numbers of people paid monthly and people paid weekly. Only a small percentage of individuals have other pay frequencies, in contrast to the US where it is common to be paid every two weeks.

[10] Our results are robust to other cutoffs, e.g. secondary earners contributing 33 percent or 10 percent of total household wages.

[11] About 250 observations, substantially less than 1 percent of the sample, are excluded because of outlier values for total or highly non-durable consumption.

1998 and 2000 and is composed of roughly 15,000 monthly-paid households. This translates into roughly 30,000 observations, because in most cases our final sub-sample includes two diary weeks for each household.

Expenditures in the data are reported in pounds sterling. We adjust expenditures and pay amounts for inflation using the Retail Price Index for Britain, with 2000 as the base year.

3.2. Baseline Results and Robustness Checks

Table 2 presents results for our baseline regressions, and a series of robustness checks. These and all subsequent regressions include our full array of demographic and time controls, but we only report the distance coefficients for the sake of brevity.[12] All regressions report robust standard errors, which are adjusted for possible correlation between the error terms of observations drawn from the same household.

The first column of Table 2 summarizes the relationship between distance and diary week spending. Diary week spending declines significantly over the pay period at a rate of 0.8 percent per day. Over the entire pay period this implies a substantial decline. E.g., in a 30-day pay period, the diary week ending on the last day of the pay period begins at distance 23, so spending in this week is 23*(0.8) = 18 percent lower than spending in the diary week beginning on payday.

The second column of Table 2 tells a similar story, based on our second specification using four distance categories. The coefficient for 0 to 7 days after payday is highly significant and indicates that consumption spending in these diary weeks is

[12] For a full set of coefficients, including demographic controls, see Table B2 of Appendix B.

roughly 12 percent higher than spending in weeks starting 15 to 22 days after payday (the omitted distance category). This high level of spending extends well into the pay period: in weeks beginning 8 to 14 days after payday, spending is still 5 percent higher than in the omitted category. The final distance category captures the significant increase in spending due to overlap with the next payday.[13]

To further verify that our baseline results are not driven by our parameterization of the distance measure, we regress log expenditure on separate dummy variables for each starting distance from payday. This less parametric specification corroborates our baseline results: the individual dummies for different starting distances are highly significant and positive, beginning on payday and continuing until a distance of 13 days, for spending on all goods and spending excluding bills. These results are reported in Table B1 of Appendix B.

Robustness checks:

Self-control problems could explain our baseline results on the decline in consumption between paydays. There are alternative explanations, however, which reflect fully rational choice. Columns (3) to (5) in Table 2 test several of these explanations.

[13] In unreported regressions, use the full sample including diary weeks for which measurement error is a problem. We include a separate dummy variable for these observations. As expected, the resulting coefficient is consistent with the category including a mixture of weeks with and without a payday: spending in these weeks is significantly higher than in the omitted distance category, but about half the level of spending in the two distance categories that unambiguously include a payday. Including these weeks does not have an impact on our estimates for other distance categories, and the resulting coefficient does not have a clear interpretation, so we focus on the analysis without them.

The timing of monthly bill payments could explain the pattern we observe, if the timing happens to coincide with payday for most households. To the extent that the timing of bill payments is non-discretionary, this explanation implies that the decline in spending cannot be used to infer household preferences for timing of consumption. Column (3) allows us to reject this explanation, however, showing that the decline is still strong and significant when the sample used for estimation excludes bill payments, mortgage contributions, and other payments with plausibly non-discretionary timing (one crucial monthly payment, rent, is already excluded from the all goods category in the survey, for reasons of confidentiality).

A surge in expenditure after payday could also reflect stockpiling of durable goods. Households might try to minimize transaction costs of shopping by buying all of their durable goods in one large shopping trip. Given the presence of binding credit constraints, and even a slight degree of impatience, households could choose to time this large shopping trip at the beginning of each pay period. In this case the decline we observe in *expenditure* need not indicate a decline in *consumption*, because households could choose smooth consumption of durable goods over the pay period after stockpiling at the beginning. Column (4) shows that stockpiling is not an adequate explanation for the decline, because there is a significant decline in spending on instant consumption goods.[14] The decline is somewhat more gradual than the decline in all consumption spending, however, which could indicate that stockpiling does play some role. We return to this issue in the calibration exercises in the next section.

[14] Instant consumption includes goods that cannot be stockpiled: take-away food, alcohol and food consumed in bars and restaurants, cinema tickets, and admissions to discos.

Shapiro (2005) suggests that strategic interaction between household members could also explain a decline in spending over the pay period. If household members are concerned about maximizing their own share of household resources, they have an incentive to spend as much as possible as fast as possible whenever a new paycheck arrives. Similar to Shapiro, we are able to reject this explanation. Column (5) shows that there is an even larger decline for the sub-sample of single-person households, the opposite of what would be predicted by the strategic interaction explanation.

Given the concentration of paydays on the final days of the calendar month, it is important to test whether some unobserved event correlated with calendar date drives the decline. The fact that the decline is robust to the inclusion of day-of-calendar-month dummies ameliorates this concern, however, and in unreported regressions we also find a strong decline for the sub-sample of households who are paid in the interior of the calendar month.

In summary, we find little evidence to support various alternative explanations for the decline, including non-discretionary timing of payments, strategic motives within the household, stockpiling, or calendar-month effects.

4. Dynamically Consistent Impatience vs. Self-control Problems

A decline in consumption spending over time could reflect a struggle for self-control, but could also be explained by a dynamically consistent (exponential) preference for declining consumption over the lifetime. Because these explanations lead to similar qualitative predictions, this section calibrates models with exponential and quasi-hyperbolic discounting and compares their quantitative predictions.

We calibrate both models assuming weekly time periods, because our data provide a direct measure of the change in weekly spending over time. As shown in the first Column of Table 2, diary week spending declines by 0.8 percent for each additional day of distance from payday. This implies that spending falls by (-0.008)*7 = -5.6 percent over a week. Although weekly time periods are relatively short, compared to the quarterly or annual time periods typically considered in empirical studies, laboratory experiments suggests that the relevant horizon for time discounting may be even shorter, perhaps even as short as one day (see, e.g. McClure et al., 2004). Therefore, we also calibrate the models using an estimate for the decline in daily consumption spending.

4.1 Estimating the Decline in Daily Consumption Spending

Before proceeding with the calibration exercises, we estimate the decline in daily spending. Because daily spending is unobserved, this requires making an identifying assumption. We assume that the unobserved daily expenditure profile is *linear*. We do not expect this assumption to be strictly true, but the implied profile for diary week spending turns out to be at least a reasonable approximation to the v-shaped profile observed in the data, shown in Figure 3. Also, our estimate turns out to be in the same range as the 4 percent decline in daily consumption found by Shapiro (2005) using daily data on food stamp recipients. The details of our estimation procedure are given in Section A2 of Appendix A.

4.2. Calibrating the Exponential Model

For our calibration of the standard model, we assume utility is separable into *T* periods between paydays. We also assume that the consumer faces binding credit constraints, allowing the model to predict a "jump" in spending on the next payday, consistent with the data. Intuitively, a consumer with exponential impatience prefers a higher level of consumption on the last week of the pay period than in the first week the next pay period, but without the ability to borrow she is constrained to spend the same amount each month. Her preferred choice in this case is a consumption profile that declines at the rate of impatience over each pay period, but jumps back to the original level with the arrival of the next payday. The calibration results below do not depend on this assumption, however, as they relate only to the percent decline within a pay period, which is unaffected by the presence of credit constraints in the case of exponential discounting.

Given initial income *Y* at the beginning of the pay period, the consumer solves the following problem:

$$\text{Max} \quad U = \sum_{t=0}^{T} \delta^t u(c_{it}) \quad \text{st.} \quad Y \geq \sum_{t=0}^{T} \frac{p_t c_t}{(1+r)^t} \tag{3}$$

Where c_{it} is consumption, δ is the exponential discount factor, and r is the interest rate. This leads to the standard Euler equation:

$$u'(c_{it}) = \delta \frac{p_t}{p_{t+1}} (1+r) u'(c_{t+1}) \tag{4}$$

Assuming isoelastic utility, for which $u'(c_{it}) = c_{it}^{-\rho}$, and taking logs, one arrives at:

$$\ln(c_{it+1}) - \ln(c_{it}) = \frac{r-\gamma}{\rho} - \frac{\ln(p_{t+1}) - \ln(p_t)}{\rho} \tag{5}$$

Where $\gamma = -ln(\delta)$ is the period discount rate and $r = ln(1+r)$ is the interest rate. Assuming constant prices, the second term in (5) drops out. The parameter ρ describes the curvature of the period utility function. The inverse of ρ is known as the intertemporal elasticity of substitution, because a 1 percent increase in relative prices in period *t+1* leads to a 1/ ρ increase in period-*t* consumption.

We can now use (5) to calibrate the model. We begin by substituting an appropriate estimate from the data for the percent change in consumption, $\ln(c_{it+1}) - \ln(c_{it})$. The decline in consumption *expenditure* probably overstates the true decline in consumption, due to stockpiling of durable goods. In fact, the decline for expenditure on instant consumption is about 30 percent more gradual than the decline for all goods.[15] In order to provide a lower bound for the decline in consumption, we also calibrate the model using a deliberately over-conservative estimate: we assume that the decline in consumption is only 50 percent as steep as the decline for all expenditure. To pin down *r*, we assume an annual interest rate of 3 percent, which translates into a weekly interest rate of roughly 0.1 percent.[16]

We then proceed with two different calibration exercises. For the first exercise, we assume a plausible value for the intertemporal elasticity of substitution, and calculate the implied exponential discount rate. We assume ρ = 1, which corresponds to log utility, and implies a reasonable elasticity: a 10 percent increase in prices in *t+1* leads to a 10 percent increase in consumption in *t*. As a second exercise, we assume a plausible annual discount factor, and calculate the implied intertemporal elasticity of substitution. We

[15] This estimate comes from a regression of log instant consumption on distance from payday and all controls (not shown), using the same specification as the first column of Table 2.

[16] Real interest rates in the UK over our sample period were on average 4 percent (Seppala, 2000). By assuming 3 percent, we make things more favorable for the exponential model; the consumer has less motivation to save, and thus the exponential model is able to explain a given decline with a smaller degree of impatience.

assume an annual discount factor of 0.90, which recent estimates suggest is lower bound for the general population.[17] This annual discount factor implies a weekly discount rate of 0.002 and a daily discount rate of 0.0003.

Table 3 summarizes the results of our calibration exercises with the exponential model. Assuming weekly time periods and $\rho = 1$, the (weekly) exponential discount rate must be equal to 0.057 in order to explain the decline we observe in the data, which implies an extremely small annual discount factor, δ, equal to 0.05.[18] In this case an individual cares 95 percent more about consumption today than about consumption in one year. Assuming a more reasonable annual discount factor of 0.90, the intertemporal elasticity of substitution must be a highly implausible 38.7. In this case the individual would respond to a 10 percent increase in prices next week with a 387 percent increase in consumption this week. These values are almost certainly too extreme, because the decline in weekly *expenditure* overstates the true decline in *consumption*. Therefore we also calibrate the model using our conservative estimate for the decline in consumption. In this case, the calibration still generates a very small annual discount factor of $\delta = 0.22$. This is still far below accepted estimates, and would mean that a consumer values consumption today 78 percent more than consumption in one year. Alternatively, the model predicts an intertemporal elasticity of 19.35, which still implies an enormous

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[17] For example, Laibson, Repetto, and Tobacman (2003) find an annual discount rate of 0.91 for high school dropouts, the least patient group in their sample. Gournichas and Parker (2002) find estimates above 0.93 for the general population. Samwick (1998) finds a median discount factor of 0.92 using the Survey of Consumer Finances, which over-samples wealthy households. At the end of the section we discuss how the results change if we assume an even more conservative value for the annual discount rate.

[18] A weekly discount rate of 0.057 implies a weekly discount factor of 0.943 and an annual discount factor of $0.943^{52} = 0.05$.

willingness to substitute consumption between weeks: a 10 percent increase in prices in week *t+1* leads to an approximately 190 percent increase in consumption in week *t*.

Calibrating the model with daily time periods, the same condition as in (5) applies, except that *t* indexes days. Using our estimate of the daily decline (Appendix A), we find $\delta = 0.08$, or $1/\rho = 33.91$. If we assume that stockpiling explains 50 percent, the model needs $\delta = 0.27$ or $1/\rho = 16.96$ to rationalize the decline, parameter values that are still outside of range of accepted estimates and seem implausible given their implications for consumer behavior.

In summary, it takes an extremely small annual discount factor, or an implausibly large value for the intertemporal elasticity of substitution for exponential discounting to explain the decline. Overall, these calibration results raise doubts about the ability of the exponential model to explain the short-term discounting we observe between paydays.[19]

4.3. Calibrating the Quasi-Hyperbolic Model

To assess whether dynamically inconsistent impatience is a better explanation for the decline in consumption over the pay period, we next calibrate a model with quasi-hyperbolic discounting. In the quasi-hyperbolic model, the individual is assumed to be relatively patient when planning the path of consumption over future periods, discounting

[19] This conclusion is robust even if we are more conservative. Assuming an even lower annual discount factor, e.g. 0.85, which is well below accepted estimates, the model still requires an elasticity of intertemporal substitution of 23 to explain the weekly decline. On the other hand if we assume a larger value for ρ, a less conservative interest rate, or a less conservative magnitude for the decline in consumption, it is even more difficult to explain the decline. Also, incorporating uncertainty about future consumption would increase the difficulty of explaining the decline with exponential discounting, in the standard isoelastic case. With isoelastic utility, uncertainty leads to a precautionary saving motive, so that a greater degree of impatience is needed to explain a given decline in consumption.

utility between any two future periods by the exponential discount rate δ. When it comes to choosing the level of consumption in the current period, however, the individual is more impatient. The quasi-hyperbolic model is a simple modification of the standard utility function, adding one additional parameter:

$$U_t = E_t[u(c_t) + \beta\sum_{t=0}^{T}\delta^t u(c_{t+1})] \tag{6}$$

Where t indexes days, δ is the standard exponential discount factor, and β is an additional discount factor which discounts future utility relative to current period utility. If β = 1 this collapses to the standard model, but if β < 1 the short-term discount factor $\beta \cdot \delta$ between the current period and all future periods is smaller than the discount factor δ between any two future periods. This non-constant discounting gives rise to a self-control problem in the sense of dynamically inconsistent preferences. The individual plans to be relatively patient in period *t+1*, discounting consumption in *t+2* by only δ, but once period *t+1* arrives the new current period self discounts *t+2* by $\beta \cdot \delta$ and overspends from the perspective of his period-*t* self.

There is relatively little evidence addressing the question of whether hyperbolic discounters are "sophisticated," i.e. aware of their self control problem, or whether they are "naïve" and fail to predict the deviation of future preferences from current preferences (O'Donoghue and Rabin, 2005). Most previous studies have assumed sophistication.[20] We calibrate the quasi-hyperbolic model for both cases: assuming that the individual is aware of the preferences of future period selves, and assuming that the

[20] Exceptions include theoretical papers by Strotz (1956), Akerlof (1991), O'Donogue and Rabin (1999a and 1999b), and Geraats (2005), and an empirical paper by Skiba and Tobacman (2005).

individual has incorrect beliefs, expecting future period selves to behave as exponential discounters.

Assuming isoelastic utility, sophistication, and constant prices, the quasi-hyperbolic model leads to the following generalized Euler equation:[21]

$$c_t^{-\rho} = (1+r)[c'(W_{t+1})\beta\delta + (1-c'(W_{t+1}))\delta]c_{t+1}^{-\rho} \tag{7}$$

The discount rate is a weighted average of the exponential and current discount rates.[22] In the case of isoelastic utility, consumption in a given period *t+1* is proportional to wealth. Substituting $c_{t+1} = \alpha_{t+1}W_{t+1}$ into (7) one arrives at:

$$c_t^{-\rho} = (1+r)[\alpha_{t+1}\beta\delta + (1-\alpha_{t+1})\delta](\alpha_{t+1}W_{t+1})^{-\rho} \tag{8}$$

Using the fact that $W_{t+1} = W_t - c_t$, and solving for c_t:

$$\begin{aligned} c_t &= \alpha_{t+1}W_t \\ \alpha_t &= \frac{\alpha_{t+1}}{\alpha_{t+1} + \left[((1+r)^{1-\rho}\delta(1-(1-\beta)\alpha_{t+1}))\right]^{\frac{1}{\rho}}} \end{aligned} \tag{9}$$

Assuming the consumer is unable or unwilling to borrow, the consumer spends all remaining resources in the final period of the month, i.e., $\alpha_T = 1$.[23] Using this initial condition it is then possible to solve recursively for the optimal consumption path over the pay period. In Section A1 of Appendix A we provide a derivation of the results for the naïve hyperbolic discounter (for a derivation in the infinite-horizon case, see Geraats, 2005).

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[21] For a derivation, see Laibson (1996).

[22] This reflects an additional saving motive of the sophisticate. Because the sophisticate is aware that the period *t+1* self will overspend, he wants to save some of current income so that more will be passed on to the period *t+2* self.

[23] At the end of the section we discuss the effect of relaxing the assumption of unwillingness or inability to borrow.

In the case of complete naiveté, the individual no longer has correct beliefs about the behaviour of future selves. In particular, the individual expects future selves to behave as exponential discounters, and fails to predict that they too will place a special premium on immediate consumption. Starting from the utility function given in (6), and assuming isoelastic utility, consumption is again proportional to wealth. In the final period the individual consumes all remaining resources, i.e., $\alpha_T = 1$. In previous periods consumption follows the rule:

$$\begin{aligned} c_t &= \alpha_t^N W_t \\ \alpha_t^N &= \frac{1}{(T-t)\beta^{\frac{1}{\rho}}(1+r)^{\frac{1}{\rho}-1}+1} \end{aligned} \tag{10}$$

In contrast to the case of sophistication, there is a closed form solution for α_t^N.[24] Note that the individual expects future selves to have $\beta = 1$, and thus to consume according to:

$$\alpha_t^E = \frac{1}{(T-t)(1+r)^{\frac{1}{\rho}-1}+1} < \alpha_t^N. \tag{11}$$

Thus the naïve discounter always overspends relative to the expectations of the previous period self.

Table 4 presents our calibration results for the quasi-hyperbolic model. Assuming weekly time periods and reasonable parameter values, the model can generate a decline that matches the data. We assume $\delta = 1$, which is reasonable over a week or a day, and an annual interest rate of $r = 0.03$. In the case of log utility, i.e., $\rho = 1$, the behaviour of naïve and sophisticated hyperbolic discounters is identical. Therefore, to illustrate the

[24] In the special case of log utility, when $\rho = 1$, the consumption rules for naïve and sophisticated hyperbolic discounters are the same, and thus so is behavior (Pollak, 1968).

importance of self-awareness beyond this special case, we assume ρ = 1.5, which still implies a reasonable intertemporal elasticity of substitution.[25]

Assuming sophistication, the quasi-hyperbolic model can explain the decline in weekly expenditure with a β = 0.87. Assuming naiveté and holding the other parameters constant, the model can generate the same decline with $\beta = 0.91$. Intuitively, it takes a larger self-control problem for a sophisticate to choose the same decline as someone who is naïve in this case, because the sophisticate takes into account the high spending of future selves and saves more in the current period. If we assume away 50 percent of the decline, to account for stockpiling, the model can explain the resulting estimate with $\beta = 0.93$ in the case of sophistication and $\beta = 0.96$ in the case of naiveté. We can also solve for the optimal consumption path in the case of daily time periods, with $T = 30$. Assuming sophistication, the quasi-hyperbolic model can explain our estimate of the daily decline with $\beta = 0.93$. Assuming naiveté, and holding other parameter values constant, the decline is consistent with $\beta = 0.95$. If stockpiling explains 50 percent, sophistication implies $\beta = 0.96$ and naiveté implies $\beta = 0.97$.

In summary, we find that the quasi-hyperbolic model can explain the decline for a β between 0.87 and 0.97 and reasonable values for the other parameters. The values of β that we find are in the same range as previous estimates (Fredrick, Loewenstein, and O'Donoghue, 2002; Laibson, Repetto, and Tobacman, 2003; Shapiro, 2005), although the upper bound of our interval is somewhat higher, implying a milder self-control problem. This could reflect a difference in preferences compared to populations used in previous studies, but differences in assumptions across studies could also play a role. Clearly, the

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[25] Maintaining other assumptions and using $\rho < 1$, e.g. $\rho = 0.5$, the model can still explain the decline, for values of β that are within the range of previous estimates.

assumption of sophistication versus naiveté matters for the estimate of β. In the next section, we find some evidence that households in our sample are sophisticated, in the sense that their behaviour is consistent with the use of a mental accounting rule limiting borrowing. This suggests that the true value of β for our sample is closer to the estimates assuming sophistication. Also, it provides some support for the assumption in the calibration exercises that households are effectively credit constrained.[26]

Compared to the exponential model, the hyperbolic model fares better as an explanation for the decline, in the sense that it can explain the magnitude of the fall in consumption for reasonable parameter values. On the one hand this is not surprising, given that the quasi-hyperbolic model has an additional parameter, and thus is more flexible. On the other hand, a non-constant discount rate has an intuitive, plausible interpretation in terms of self-control problems, and neatly solves the problem of rationalizing short-term discounting without implying unreasonable long-term preferences.

5. Mental Accounting and Self-Control

Individuals with dynamically inconsistent preferences have a motive to constrain the spending of future selves (Strotz, 1956). Thus, to the extent that they are sophisticated, or

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[26] Relaxing the assumption that households are unwilling or unable to borrow causes the quasi-hyperbolic model to predict a more gradual percent decline over the typical pay period, for a given β. Thus, a larger self-control problem, i.e. smaller values for β, would be needed to explain the decline observed in the data. Intuitively, a hyperbolic discounter chooses a consumption path that declines relatively gradually at first and then more steeply as the end of life approaches. Imposing credit constraints causes the same acceleration to occur at the end of each pay period, leading to a larger average percent decline over a given pay period.

aware of their own dynamic inconsistency, these individuals may be observed to take actions that serve the purpose of limiting overspending.[27]

The literature on self-control suggests that an important means of limiting overspending is the establishment of internal commitments, or rules. Thaler and Shefrin (1981) hypothesized that individuals with self-control problems are able to commit to such rules by exerting "willpower." Subsequent models have incorporated similar notions of willpower (Benhabib and Bisin, 2004; Loewenstein and O'Donoghue, 2005), appealing to evidence from neuroscience documenting the ability of cognitive systems in the brain to suppress emotional impulses or cravings (LeDoux, 1996; Cohen, 2005).[28] All of these models assume that willpower is in some way costly, however, so that perfect adherence to a rule is typically not possible.[29] In the context of monthly budgeting, this implies that households may make an effort to counteract self-control problems, but may not be entirely successful in preventing a decline in consumption between paydays.

One particular rule that has been emphasized in the literature is a rule that limits borrowing during the pay period, and thus puts a cap on total spending (Thaler and Shefrin, 1981; Thaler, 1999; Wertenbroch, Soman, and Nunes, 2002; Benhabib and Bisin, 2003). Wertenbroch, Soman and Nunes (2002), for example, provide direct

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[27] Ariely and Wertenbroch (2002) provide some evidence of sophistication in the field, showing that students adopt binding deadlines for class assignments in order to limit procrastination. DellaVigna and Malmendier (2003) argue that health-club members choose certain types of contracts in order to force themselves to exercise. Ashraf, Karlan, and Yin (2004), and Benartzi and Thaler (2004) also provide field evidence of demand for savings products that act as external commitment devices.

[28] Benabou and Tirole (2004) take a different approach, modeling willpower as a stock of self-reputation.

[29] This is consistent with evidence from choice experiments, showing that willpower can be exhausted by a series of temptations or choices (Baumeister and Vohs, 2003).

evidence on the link between the need for self-control and the use of such a rule.[30] In a series of laboratory experiments, they pose subjects with different purchase scenarios and different methods of payment. Subjects who score high on a psychological scale measuring impulsivity (Puri, 1996) are more likely to use cash rather than credit for a purchase. They find the same link between impulsivity and a preference for cash payment in a field study, in which 34 subjects kept a diary of actual consumption for a month. Thus, if households in our sample have self-control problems, and are to some extent sophisticated, we might expect to observe evidence of the same type of debt aversion.

To test this hypothesis, we first identify households in our data that have access to credit, and then look at whether these households nevertheless act as though they are credit constrained. We also investigate whether households appear to use current and future income differently during the pay period, consistent with a mental accounting rule. In the absence of such a rule, one would expect these types of income to be interchangeable and used similarly.

One possible proxy for access to credit is asset interest-income, which is a proxy often used in the consumption literature (e.g. Zeldes, 1989 and many others). This is a rather indirect measure of the ability to smooth short-term consumption, however, and has the problem that individuals with self-control problems are likely to accumulate fewer assets and thus have low asset income. Thus a weaker decline among high asset-

[30] Other previous evidence on debt aversion includes a survey discussed in Cagan (1965), in which a majority of US households indicate that they use some form of rule-of-thumb to guide borrowing. Warshawski (1987) provides another example, showing that households rarely borrow against life insurance accounts. There is also a related body of evidence on budgeting, showing that consumers establish rules limiting spending across products types and over time, in an effort to prevent overspending (see, e.g., Thaler, 1985; Zelizer, 1997; Thaler, 1999; Heath and Soll, 1996).

income households could mainly reflect selection rather than access to credit. Our preferred proxy is a more-direct measure of a household's ability to smooth short-term consumption, which is less likely to be correlated with self-control problems: access to a credit card. This measure comes from a question in the EFS survey that asks, for each household member, whether that individual has access to a credit card. In the case of cardholders, we can also clearly distinguish between spending out of current versus future income, because the FES indicates whether each purchase was made with cash or a credit card.

Table 5 shows evidence of a strong decline for households below the top quartile of asset income, but little evidence of a decline for households in the top quartile. To the extent that high asset income captures access to credit, this finding is consistent with households borrowing in order to smooth consumption. As discussed above, we would expect a hyperbolic discounter to exhibit a less pronounced decline during a typical pay period, and little or no jump in spending on the next payday, given the ability to borrow freely. On the other hand, it is problematic to compare individuals with and without high asset income. The lack of a decline for the second group could reflect differences in characteristics besides access to credit, e.g. a negative correlation between income and self-control problems.

Table 6 presents results for households with and without credit cards.[31] Strikingly, both groups of households exhibit a strong decline followed by a jump on the next payday. The drop from the first to the omitted distance category is somewhat less steep

[31]Roughly 78 percent of households in our sample own a credit card. The average ratio of credit card spending to total spending is 0.11. Excluding households who are observed spending zero with card during both diary weeks (46 percent of those with cards), the average ratio of credit to total spending is 0.24.

for households with credit cards, e.g. 11 percent rather than 17 percent (in the case of all goods) but the drop between the second and omitted distance categories is roughly the same. There is a substantial jump in spending on the next payday for cardholders, but the increase is only about half the size for non-cardholders. The more gradual decline and less pronounced jump for cardholders could indicate that cardholders use their credit cards to some extent, but the pattern suggests that they are nevertheless unable, or unwilling, to fully smooth consumption. Unfortunately, our data do not include information on credit limits and account balances, so it is difficult to identify households who have credit cards but are in fact unable to borrow, because they have reached their credit limit. One indication that a household has not reached their credit limit, however, is whether they used their card during one of the two diary weeks. Restricting the sample to only these households, we find very similar results. This provides some indication that the decline and jump for cardholders is not driven by binding credit constraints, but rather reflects something else, possibly an unwillingness to borrow.

Table 7 explores the behaviour of cardholders in more detail, investigating spending with cash and credit cards over the pay period. The first column shows that cash spending exhibits the pattern characteristic of credit constraints, declining significantly and then jumping up on the next payday. The second column shows a strikingly different pattern for credit card spending. There is no statistically significant relationship between credit card spending and distance from payday. One explanation could be that credit cards are easier to use for certain purchases, e.g. purchases made over the phone or the Internet, which also happen to have non-discretionary timing, e.g. bills. However, the cash category in our data includes spending with debit or ATM cards, which goes against this explanation because these offer the same advantages as credit cards in terms of payment method.[32] Furthermore, the third and fourth columns of Table 7 show the same method-of-payment difference for spending excluding bills.[33] In unreported regressions we also find similar results within an even narrower consumption category, instant consumption. We also check the robustness of these findings to exclusion of households who do not use their card during one of their two diary weeks. Table 8 shows that we find very similar results when we restrict the sample to households who use their cards.

In summary, households with credit cards act as though they are to some extent credit constrained, even when they apparently can use their credit cards. Furthermore, households treat spending out of current and future income very differently during the pay period, consistent with the use of a mental accounting rule limiting borrowing. They exhibit the profile characteristic of being credit constrained with spending out of current income, while they simultaneously choose a "flat" profile for credit card spending over the pay period. In combination, these findings provide some indication that households in our sample practice debt aversion as a strategy for self-control. Importantly, although this would imply that households do not borrow as much as they could, it leaves open the question of whether the level of credit card spending we observe is "too high," due to, e.g., limited willpower.

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[32] Debit cards were introduced relatively early in the UK, compared to the US, and offered an alternative to credit cards during most of our sample period (source: Bank for International Settlements, (BIS), "Payment Systems in the Group of Ten Countries," various years between 1990 and 2000.

[33] We also estimated the regressions in Columns (1) and (3) using the level of cash spending, to verify that the difference in cash and credit card spending is not driven by the different transformations of the dependent variable. We find similar results.

6. Conclusion

This paper provides two main stylized facts regarding the consumption choices of households in the general population Households exhibit a sizeable decline in consumption spending between paydays, and they treat current income (cash) and future income (credit cards) very differently during the pay period, consistent with the use of a rule of thumb limiting borrowing. Both findings are difficult to reconcile with the standard economic framework. On the other hand, they are consistent with a monthly struggle for self-control. The decline can be rationalized as the outcome of a self-control problem, in the sense of dynamically inconsistent impatience or hyperbolic discounting. A rule limiting borrowing could be part of a struggle against such self-control problems, as it puts a cap on total spending during the pay period. We do not rule out that other aspects of consumer psychology also play a role, but we argue that the self-control problem framework offers a simple, unified explanation for the behaviors we observe. In this sense our findings provide support for the view that self-control problems are relevant outside of the lab, and that models incorporating self-control problems may improve our ability to explain everyday consumer behavior.

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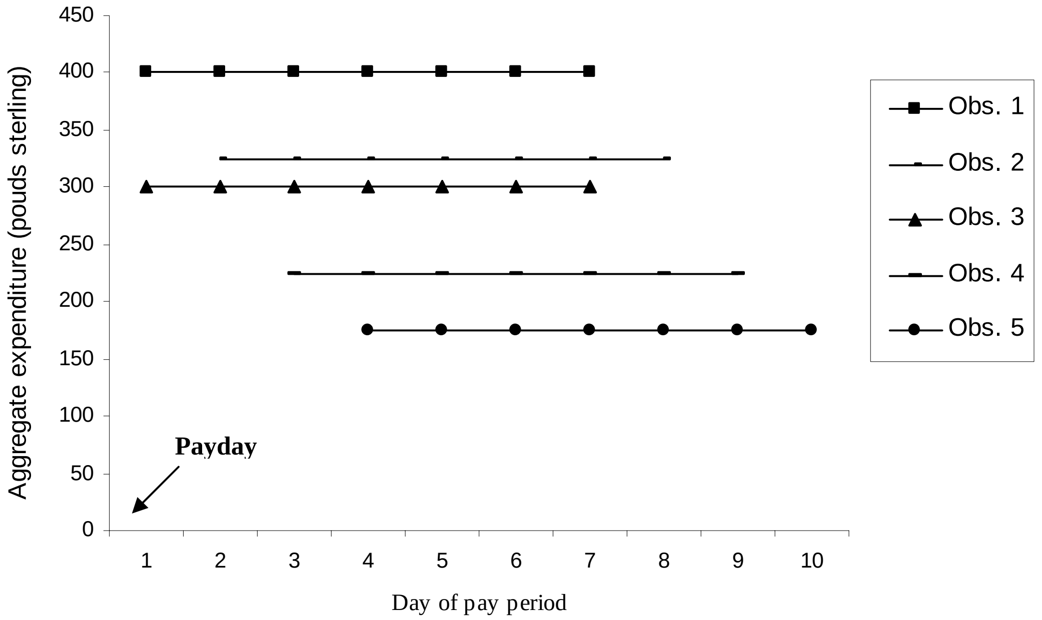
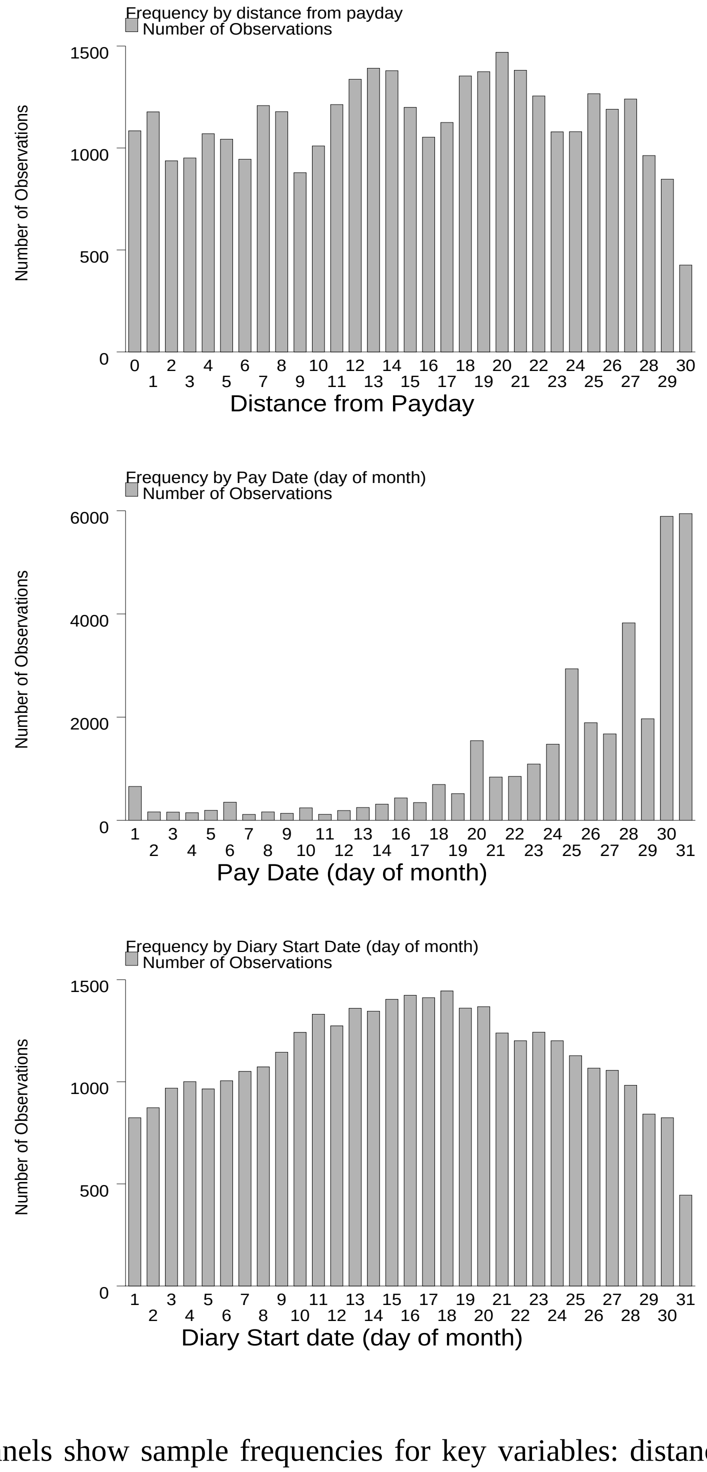
Figure 1: Data structure



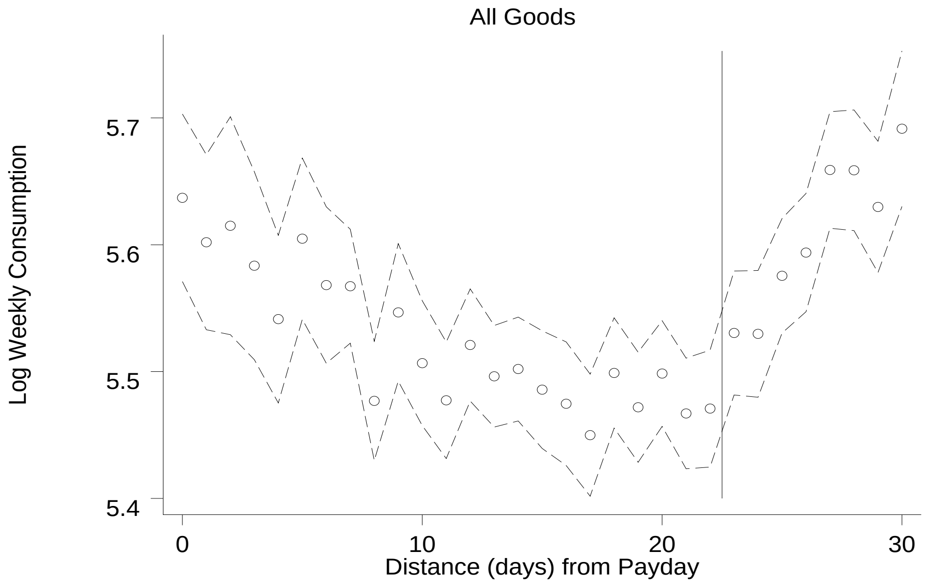
Notes: The data contain observations on many overlapping "diary weeks" (seven-day aggregates of consumption expenditure), which begin at all different distances from payday and need not correspond to the calendar week. E.g. average spending in diary weeks beginning on payday would be calculated by averaging observations 1 and 3 above.

Figure 2: Descriptive Statistics



Notes: These panels show sample frequencies for key variables: distance from payday, pay date, and start date of a week-long expenditure diary.

Figure 3: Diary Week Expenditure by Distance from Payday
(With 95% confidence bands)



Notes: Each point represents average consumption spending for diary weeks beginning at that distance from payday. Distance zero corresponds to weeks beginning on payday itself. The vertical line indicates the approximate distance at which diary weeks begin to overlap with the next payday (the exact distance depends on the length of the pay period).

Table 1: Household Demographics by Distance from Payday

	Distance of diary start date from payday			
	-4 to -1 days before	0 to 7 days after	8 to 14 days after	15 to 22 days after
Age	37.83	37.90	38.46	38.34
	(0.20)	(0.17)	(0.16)	(0.15)
Income	1,727	1,710	1,694	1,694
	(15.81)	(14.05)	(12.38)	(11.15)
Credit Card	0.78	0.77	0.78	0.79
	(0.01)	(0.00)	(0.00)	(0.00)
Married	0.61	0.62	0.63	0.62
	(0.01)	(0.01)	(0.01)	(0.01)
No. of Earners	1.51	1.49	1.49	1.50
	(0.01)	(0.01)	(0.01)	(0.01)
Members	2.26	2.26	2.29	2.29
	(0.01)	(0.01)	(0.01)	(0.01)
Observations	5,465	7,359	8,384	9,219

Notes: This table verifies that household characteristics are orthogonal to distance from payday. Income is the household's monthly pay amount, in pounds sterling (adjusted for inflation for with base year 2000). Standard errors are in parentheses.

Table 2: Percent Change in Weekly Consumption, as a Function of Distance from Payday

Spending in diary weeks beginning:	All goods (1)	All goods (2)	Excluding bills (3)	Instant consumption (4)	Single Person, Excluding bills (5)
Distance	-0.008***				
	(0.001)				
0 to 7 days after		0.121***	0.087***	0.061***	0.128***
		(0.014)	(0.013)	(0.726)[a]	(0.031)
8 to 14 days after		0.048***	0.041***	0.053***	0.075***
		(0.013)	(0.011)	(0.594)[b]	(0.027)
Omitted distance category					
4 to 1 days before next payday		0.148***	0.102***	0.068***	0.135***
		(0.015)	(0.013)	(0.739)[c]	(0.032)
Controls: All time, region, demographic controls, survey-fatigue dummy					
Observations	24,283	28,387	28,387	28,387	6,479
Estimation method	OLS	OLS	OLS	Tobit	OLS
R-squared	0.30	0.29	0.33	n.a.	0.13

Notes: Robust standard errors for all regressions are in parentheses, corrected for clustering on household. * significant at 10%; ** significant at 5%; *** significant at 1%.

The dependent variable for (1)-(3) and (5) is log diary-week spending. In (1), *Distance* measures days from payday, and the sample excludes diary weeks overlapping with the next payday (leading to a ßsmaller sample size). In (3), "bills" refer to payments with non-discretionary timing during the pay period, e.g. utility bill payments and mortgages. Model (5) is estimated for single-person households only.

The dependent variable in column (4) is the non-log level of instant consumption, due to substantial observations with zero expenditure, for which the log is undefined. The percentage change in spending on instant consumption is calculated by dividing the levels coefficients by average spending in the omitted distance category. Standard errors in (4) are for the levels coefficients; the coefficients themselves are as follows: [a] 2.076; [b] 1.778; [c] 2.322. The estimation method in (4) corrects for censoring of consumption spending at zero.

Table 3: Implied Preference Parameters, Assuming Exponential Discounting

	Estimated Decline in Expenditure	Assumed Decline in Consumption
Weekly Time Periods:	**-5.6%**	**-2.8%**
Implied annual discount factor: (assuming $1/\rho = 1$)	$\delta = 0.05$	$\delta = 0.22$
Implied intertemporal elasticity: (assuming $\delta = 0.90$)	$1/\rho = 38.70$	$1/\rho = 19.35$
Daily Time Periods:	**-0.7%**	**-0.35%**
Implied annual discount factor: (assuming $1/\rho = 1$)	$\delta = 0.08$	$\delta = 0.27$
Implied intertemporal elasticity: (assuming $\delta = 0.90$)	$1/\rho = 33.91$	$1/\rho = 16.96$

Maintained assumptions: Isoelastic utility, annual interest rate = 0.03.

Notes: This table reports results of calibration exercises, assuming exponential discounting. The data provide estimates of the percentage decline in weekly or daily spending over the pay period. The decline in consumption (second column) is a conservative estimate, based on the assumption that only 50 percent of the decline in expenditure is due to a decline in consumption, and that the remainder reflects stockpiling of durables at the beginning of the pay period. Calibration is based on substituting the estimated decline into $ln(c_{t+1}) - ln(c_t) = (- \gamma)/\rho$, which follows from the first order condition under isoelastic utility. The parameter γ is the weekly or daily discount rate; the implied annual discount factor δ is given by $(1- \gamma)^{52}$ *or* $(1- \gamma)^{365}$ respectively.

Table 4: Implied Preference Parameters, Assuming Quasi-Hyperbolic Discounting

	Estimated Decline in Expenditure	**Assumed Decline in Consumption**
Weekly Time Periods:	**-5.6%**	**-2.8%**
Consistent with short-term discount factor: (assuming sophistication)	β = 0.87	β = 0.93
Consistent with short-term discount factor: (assuming naiveté)	β = 0.91	β = 0.96
Daily Time Periods:	**-0.7%**	**-0.35%**
Consistent with short-term discount factor: (assuming sophistication)	β = 0.93	β = 0.96
Consistent with short-term discount factor: (assuming naiveté)	β = 0.95	β = 0.97

Maintained assumptions: Isoelastic utility; credit constraints; $\boldsymbol{\delta = 1; \rho = 1.5; r = 0.03}$.

Notes: This table reports results of calibration exercises, assuming quasi-hyperbolic discounting. The data provide estimates of the percentage decline in weekly or daily expenditure over the pay period. The decline in consumption (second column) is a conservative estimate, based on the assumption that only 50 percent of the decline in expenditure is due to a decline in consumption, and that the remainder reflects stockpiling of durables at the beginning of the pay period. Given the parameter values shown in the table, the quasi-hyperbolic model can predict an optimal consumption profile over the pay period such that the decline in weekly or daily consumption matches the corresponding estimates from the data.

Table 5: Percent Change in Weekly Consumption as a Function of Distance from Payday.

	Excluding Households in Top Quartile of Asset Income		Households in Top Quartile of Asset Income	
	All goods	Excluding bills	All goods	Excluding bills
Spending in diary weeks beginning:	(1)	(2)	(1)	(2)
0 to 7 days after	0.148***	0.102***	0.0042	0.018
	(0.015)	(0.014)	(0.033)	(0.038)
8 to 14 days after	0.062***	0.056***	-0.012	-0.019
	(0.013)	(0.012)	(0.029)	(0.027)
Omitted distance category				
4 to 1 days before next payday	0.172***	0.126***	0.048	0.006
	(0.016)	(0.015)	(0.036)	(0.034)
Controls: All time, region, demographic controls, survey-fatigue dummy				
Observations	22,635	22,635	5,752	5,752
Estimation method	OLS	OLS	OLS	OLS
R-squared	0.29	0.33	0.26	0.28

Notes: Robust standard errors are in parentheses, adjusted for clustering on household. *significant at 10%; ** significant at 5%; *** significant at 1%

This table reports regressions using high-asset income as a proxy for access to credit.

Table 6: Percent Change in Weekly Consumption as a Function of Distance from Payday.

	Households Without Credit Cards		Households With Credit Cards	
	All goods	Excluding bills	All goods	Excluding bills
Spending in diary weeks beginning:	(1)	(2)	(1)	(2)
0 to 7 days after	0.171***	0.139***	0.109***	0.074***
	(0.028)	(0.026)	(0.016)	(0.015)
8 to 14 days after	0.058***	0.049**	0.047***	0.041***
	(0.024)	(0.023)	(0.014)	(0.013)
Omitted distance category				
4 to 1 days before next payday	0.219***	0.175***	0.125***	0.080***
	(0.030)	(0.028)	(0.017)	(0.015)
Controls: All time, region, demographic controls, survey-fatigue dummy				
Observations	6,247	6,247	22,140	22,140
Estimation method	OLS	OLS	OLS	OLS
R-squared	0.31	0.34	0.26	0.29

Notes: Robust standard errors are in parentheses, adjusted for clustering on household. *significant at 10%; ** significant at 5%; *** significant at 1%

This table reports regressions using credit card ownership as a proxy for access to credit.

Table 7: Percent Change in Weekly Consumption as a Function of Distance from Payday.

	Households with Credit Cards			
	All goods		Excluding Bills	
Spending in diary weeks beginning:	Cash spending (1)	Credit card (2)	Cash spending (3)	Credit card (4)
0 to 7 days after	0.120*** (0.017)	0.095 (6.340)[a]	0.087*** (0.016)	0.048 (6.102)[d]
8 to 14 days after	0.042** (0.015)	0.0730 (5.267)[b]	0.037** (0.13)	0.068 (5.150)[e]
Omitted distance category				
4 to 1 days before next payday	0.134*** (0.018)	-0.001 (6.457)[c]	0.085*** (0.017)	-0.020 (6.323)[f]
Controls: All time, region, demographic controls, survey-fatigue dummy				
Observations	22,140	22,140	22,140	22,140
Estimation method	OLS	Tobit	OLS	Tobit
R-squared	0.22	n.a.	0.25	n.a.

Notes: Robust standard errors are in parentheses, adjusted for clustering on household. *significant at 10%; ** significant at 5%; *** significant at 1%

In (1) and (3) the dependent variable is log diary-week spending using cash. The dependent variable in columns (2) and (4) is the non-log *level* of diary week spending using a credit card, due to substantial observations with zero expenditure, for which the log is undefined. The percentage changes in (2) and (4) are calculated by dividing the levels coefficients by the average level of spending in the omitted distance category. The standard errors shown in (5) correspond to the levels coefficients; the (insignificant) coefficients are as follows: [a]5.782; [b]4.420; [c]-0.593; [d]2.815; [e]3.968; [f]-1.158. The estimation method in columns (2) and (4) corrects for censoring of the dependent variable at zero.

Table 8: Percent Change in Weekly Consumption as a Function of Distance from Payday.

	Households with Credit Cards, and Non-zero Credit-Card Spending			
	All goods		Excluding Bills	
Spending in diary weeks beginning:	Cash spending (1)	Credit card (2)	Cash spending (3)	Credit card (4)
0 to 7 days after	0.119***	0.085	0.090***	0.047
	(0.024)	(6.611)[a]	(0.022)	(6.308)[d]
8 to 14 days after	0.026	-0.050	0.032***	-0.054
	(0.021)	(5.718)[b]	(0.019)	(5.610)[e]
Omitted distance category				
4 to 1 days before next payday	0.130***	-0.042	0.075***	-0.049
	(0.026)	(6.947)[c]	(0.023)	(6.822)[f]
Controls: All time, region, demographic controls, survey-fatigue dummy				
Observations	12,812	12,812	12,812	12,812
Estimation method	OLS	Tobit	OLS	Tobit
R-squared	0.21	n.a.	0.23	n.a.

Notes: Robust standard errors are in parentheses, adjusted for clustering on household. *significant at 10%; ** significant at 5%; *** significant at 1%

The sample includes only those households who are clearly able to borrow using their credit cards, i.e. households who used their credit card during at least once diary week. In (1) and (3) the dependent variable is log diary-week spending with cash. The dependent variable in columns (2) and (4) is the non-log *level* of diary week spending with credit, due to substantial observations with zero expenditure, for which the log is undefined. The percentage changes in (2) and (4) are calculated by dividing the levels coefficients by the average level of spending in the omitted distance category. The standard errors shown in (5) correspond to the levels coefficients; the (insignificant) coefficients are as follows: [a]8.837; [b]-5.148; [c]-4.325; [d]4.787; [e]-5.500; [f]-4.907. The estimation method in columns (2) and (4) corrects for censoring of the dependent variable at zero.

Appendix A

A.1 Estimating the daily percent decline

We estimate the decline in daily spending by making an identifying assumption. We assume that the unobserved daily expenditure profile is *linear*. We do not expect this assumption to be strictly true, but the estimates we find are in line with Shapiro (2005), who uses daily data.

Assuming a linear profile, the level of daily spending on day t of the pay period can be written:

$$e_t = E - \theta \cdot t + u_t \tag{A1}$$

where t goes from zero until the day before the next payday, E is spending on payday, and θ is the slope of the linear daily spending profile. Ignoring the error term, we can express total spending in diary week t as:

$$a_t = \sum_{k=t}^{t+6} e_k = 7E - \theta t - \theta(t+1) - \theta(t+2) - .. - \theta(t+6) \tag{A2}$$

This implies a simple relationship between the absolute change in daily spending and the change in diary week spending over the initial portion of the pay period:

$$a_{t+1} - a_t = -7 \cdot \theta \quad \text{for } 0 \le t \le 24 \tag{A3}$$

Thus, we can recover θ by estimating $a_{t+1} - a_t$ and dividing by -7.[34] The initial interval is shorter for shorter pay periods, e.g., 23 or 21 for 30-day or 28-day pay periods,

[34] We could also use the change in dairy week spending over the final portion of the pay period, which is predicted to be increasing because of the overlap with the next payday. In this case θ can be recovered by dividing by 24. We are less confident about correctly assigning diary weeks to distance from payday in this portion of the pay period, however, due to measurement error in the timing of the next payday, discussed above. Thus we

respectively. Note that this condition implies a linear decline in diary week spending, up to a distance of roughly 24 days from payday, followed by a steeper increase leading up to the next payday. This is at least roughly consistent with the profile actually observed in Figure 3, although linearity is clearly only an approximation.

The first column of Table A1 presents results from a regression of the *level* of diary week spending on distance from payday and a constant, up to a maximum distance of 24 days. In this case the coefficient on distance is -2.72. Adding our full list of controls in the second column causes the coefficient on distance to decrease slightly, to -2.51. We calculate the implied decline in daily spending, £0.36, by dividing this second coefficient by -7. Based on our assumption that spending in diary weeks beginning on payday is given by $a_o = 7*E - \theta(1 + 2 + \ .. + 6)$, we can next use our estimate of θ to solve for the level of daily spending on payday: $E = (a_0 + 21*\theta)/7$. Then, by repeatedly subtracting θ from E, we can calculate the level of daily spending on each day of the pay period, as shown in the final columns of Table A1. Finally, we calculate a daily discount rate for the pay period, which is the average percent decline in daily spending. We find a daily decline of 0.7 percent. Assuming that 50 percent of this decline is due to stockpiling, we arrive at a conservative estimate of the decline in consumption, i.e., 0.35 percent. This estimate is somewhat lower, but in the same range as Shapiro's (2005) estimate of the decline in food consumption, 0.4 percent, based on daily data.

focus on the initial portion of the pay period for the purpose of approximating the decline in daily spending.

Table A1: Estimating the Daily Decline

	Diary week spending	
	All goods	All goods
	(1)	(2)
Distance	-2.719***	-2.512***
	(0.355)	(0.412)
Controls	**No**	**Yes**
Observations	24,286	24,286
Estimation method	OLS	OLS
R-squared	0.003	0.168
Implied absolute decline* In daily spending:	-£0.36	
Mean diary week spending on payday:	£391	
Implied daily spending** on Payday:	£56.79	

*By assumption, equal to (*distance*/-7).

**See discussion above for calculation method.

Implied daily spending		
Day	Daily spending	% decline
1	56.794	
2	56.434	-0.006
3	56.074	-0.006
4	55.714	-0.006
5	55.354	-0.006
6	54.994	-0.007
7	54.634	-0.007
8	54.274	-0.007
9	53.914	-0.007
10	53.554	-0.007
11	53.194	-0.007
12	52.834	-0.007
13	52.474	-0.007
14	52.114	-0.007
15	51.754	-0.007
16	51.394	-0.007
17	51.034	-0.007
18	50.674	-0.007
19	50.314	-0.007
20	49.954	-0.007
21	49.594	-0.007
22	49.234	-0.007
23	48.874	-0.007
24	48.514	-0.007
25	48.154	-0.007
26	47.794	-0.007
27	47.434	-0.008
28	47.074	-0.008
29	46.714	-0.008
30	46.354	-0.008
31	45.994	-0.008
	Average % decline:	-0.007

A2. Naïve hyperbolic discounting and consumption over the pay period

Consider an individual with quasi-hyperbolic time preferences given in (6), and assume that the individual is naïve, i.e., incorrectly believes that future selves have exponential time preference δ. For simplicity, assume $\delta = 1$. Assume further that the individual is unable to borrow, but is able to invest in one liquid asset with return r, during a pay period of length T. Initial income is denoted Y, and W_t denotes resources remaining in period t. Starting in the final period, the individual consumes all remaining resources:

$$c_T = W_T = Y(1+r)^{T-1} - \sum_{t=1}^{T-1} c_t (1+r)^{T-t} \tag{A4}$$

In the second to last period, the individual correctly anticipates that the period T self spends all remaining resources, and thus maximizes:

$$U_{T-1} = u(c_{T-1}) + \beta u(Y(1+r)^{T-1} - \sum_{t=1}^{T-1} c_t (1+r)^{T-t}) \tag{A5}$$

Leading to the following first order condition:

$$u'(c_3) - \beta(1+r)u'(Y(1+r)^3 - \sum_{t=1}^{3} c_t (1+r)^{4-t}) = 0 \tag{A6}$$

Assuming isoelastic utility it is possible to solve for c_{T-1} as a function of W_{T-1}:

$$c_{T-1}^{-\rho} = \beta(1+r)(Y(1+r)^{T-1} - \sum_{t=1}^{T-1} c_t (1+r)^{T-t})^{-\rho} \tag{A7}$$

$$c_{T-1} = \frac{(1+r)}{(T-1)[\beta(1+r)]^{\frac{1}{\rho}} + (1+r)} W_{T-1} \tag{A8}$$

In the second to last period, the individual *incorrectly* believes that the period T-1 self has no time preference ($\delta = 1$) and will thus split resources remaining in T-1 evenly over the two final periods. Setting up the maximization problem accordingly, and assuming isoelastic utility, we arrive at an expression for consumption in T-2:

$$U_{T-2} = u(c_{T-2}) + \beta\left[u(\frac{W_{T-1}}{2}) + u(\frac{W_{T-1}}{2})\right] \quad \text{(A9)}$$

$$u'(c_{T-2}) - \frac{\beta(1+r)}{2}u'(\frac{W_{T-1}}{2}) - \frac{\beta(1+r)}{2}u'(\frac{W_{T-1}}{2}) = 0 \quad \text{(A10)}$$

$$c_{T-2} = \frac{(1+r)}{(T-2)[\beta(1+r)]^{\frac{1}{\rho}} + (1+r)}W_{T-2} \quad \text{(A11)}$$

In each earlier period *t*, the individual makes the same mistake, expecting the *t+1* period self to split remaining resources evenly over the next *T-t* periods. The resulting expression for consumption in a given period *t* is thus:

$$c_t = \alpha_t W_t$$

$$\alpha_t = \frac{(1+r)}{(T-t)[\beta(1+r)]^{\frac{1}{\rho}} + (1+r)} \quad \text{(A12)}$$

Starting from period 1, in which consumption is a function of parameters and initial income *Y*, it is possible to solve for the consumption path over the pay period.

Appendix B

Table B1: Log Weekly Consumption vs. Distance from Payday, Non-Parametric Distance Specification

Spending in diary weeks beginning:	All goods (1)	Excluding bills (2)
On payday	0.203***	0.144***
	(0.029)	(0.026)
1 Day After	0.148***	0.089***
	(0.029)	(0.026)
2 Days After	0.127***	0.076***
	(0.031)	(0.028)
3 Days After	0.138***	0.106***
	(0.031)	(0.028)
4 Days After	0.128***	0.105***
	(0.030)	(0.028)
5 Days After	0.176***	0.133***
	(0.030)	(0.028)
6 Days After	0.144***	0.112***
	(0.031)	(0.028)
7 Days After	0.124***	0.096***
	(0.029)	(0.026)
8 Days After	0.059***	0.045*
	(0.029)	(0.027)
9 Days After	0.119***	0.104***
	(0.032)	(0.030)
10 Days After	0.093***	0.062***
	(0.030)	(0.028)
11 Days After	0.067***	0.061***
	(0.029)	(0.027)
12 Days After	0.102***	0.061***
	(0.028)	(0.026)
13 Days After	0.044***	0.066***
	(0.026)	(0.025)
14 Days After	0.041*	0.048***
	(0.027)	(0.024)
15 Days After	0.024	0.019
	(0.029)	(0.025)
16 Days After	0.041	0.009
	(0.029)	(0.027)
17 Days After	0.047	0.031
	(0.028)	(0.026)
18 Days After	0.040*	0.036
	(0.028)	(0.026)
19 Days After	0.011	0.041
	(0.027)	(0.026)
20 Days After†	0.175	0.019
	(0.028)	(0.025)
-4 Days Before	0.175***	0.122***
Payday	0.028	(0.025)
-3 Days Before	0.182***	0.123***

	0.027	(0.024)
-2 Days Before	0.188***	0.154***
	0.028	(0.026)
-1 Day Before	0.152***	0.085***
	0.032	(0.028)
Observations	28387	28387
Estimation method	OLS	OLS
R-squared	0.29	0.33

Notes: The omitted distance category aggregates distances 21 and 22, due to low observations at the latter distance. Using 22 alone does not have an effect on the qualitative results in the table. Robust standard errors are in parentheses, adjusted for clustering on household. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B2: Benchmark regression with all coefficients

Log Wkly Cons. (Dependt.Var)	Coef.	Std Err	t-stat	P>t	Sigf.[1]
1 to 7 Days After Payday	0.121	0.014	8.73	0.000	***
8 to 14 Days After Payday	0.048	0.013	4.01	0.000	***
4 to 1 Days Before Next Payday	0.148	0.015	10.09	0.000	***
Diary Exp. Week dummy (2^{nd} = 1)	-0.033	0.007	-4.41	0.000	***
Last pay usually received?	0.009	0.012	0.8	0.426	
Log Household (HH) Pay Income	0.213	0.010	20.95	0.000	***
Ratio Main Earner/Tot HH Income	-0.110	0.047	-2.33	0.020	***
Log HH Interest Income	0.036	0.003	11.03	0.000	***
Credit Card dummy	0.170	0.011	14.81	0.000	***
Log Age Main Earner	0.853	0.453	1.88	0.060	*
(Log Age Main Earner)^2	-0.103	0.062	-1.66	0.097	*
Married?	-0.053	0.015	-3.67	0.000	***
Children?	-0.044	0.014	-3.14	0.002	***
Log Number of Income Earners	-0.015	0.022	-0.71	0.479	
Log HH Size	0.632	0.021	30.42	0.000	***
Main earner's relation to Head	0.132	0.012	11.15	0.000	***
Occup. Main Earner [Professnl. Omitted]:					
Employers & Manager	-0.015	0.015	-0.96	0.336	
Intermediate non-manual	-0.088	0.017	-5.33	0.000	***
Junior non-manual	-0.116	0.019	-6.07	0.000	***
Skilled manual	-0.082	0.018	-4.56	0.000	***
Semi-skilled manual	-0.149	0.025	-5.94	0.000	***
Unskilled manual	-0.229	0.048	-4.79	0.000	***
Armed Forces	-0.146	0.041	-3.54	0.000	***
Diary Start Day, Month, & Year:					
1^{st} Day of the Calendar Month	0.049	0.033	1.48	0.140	
2^{nd}	0.054	0.033	1.63	0.103	*
4^{th} [3^{rd} of the Month omitted]	-0.012	0.032	-0.36	0.716	
5^{th}	0.019	0.033	0.58	0.560	
6^{th}	-0.012	0.032	-0.37	0.711	
7^{th}	0.030	0.032	0.95	0.341	
8^{th}	0.005	0.031	0.15	0.882	
9^{th}	0.010	0.031	0.32	0.752	
10^{th}	-0.004	0.029	-0.14	0.886	
11^{th}	-0.002	0.031	-0.07	0.947	
12^{th}	0.028	0.031	0.92	0.356	
13^{th}	0.007	0.030	0.24	0.811	
14^{th}	0.071	0.031	2.29	0.022	***
15^{th}	0.082	0.031	2.66	0.008	***
16^{th}	0.042	0.031	1.38	0.167	
17^{th}	0.067	0.031	2.14	0.032	***
18^{th}	0.067	0.032	2.12	0.034	***
19^{th}	0.062	0.033	1.88	0.060	*

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Table B2 (continued from previous page)

Log Wkly Cons. (Depndt.Var)	Coef.	Std Err	t-stat	P>t	Sigf.[1]
20th	0.083	0.033	2.48	0.013	***
21st	0.059	0.034	1.74	0.082	*
22nd	0.101	0.035	2.86	0.004	***
23rd	-0.004	0.036	-0.10	0.920	
24th	0.071	0.036	1.98	0.048	***
25th	0.079	0.036	2.17	0.030	***
26th	0.169	0.034	4.91	0.000	***
27th	0.108	0.032	3.40	0.001	***
28th	0.132	0.034	3.94	0.000	***
29th	0.093	0.034	2.71	0.007	***
30th	0.132	0.035	3.73	0.000	***
31st	0.115	0.042	2.75	0.006	***
February [January omitted]	0.023	0.023	1.02	0.307	
March	0.028	0.022	1.26	0.208	
April	0.034	0.024	1.42	0.155	
May	0.068	0.023	2.93	0.003	***
June	0.056	0.023	2.45	0.014	***
July	0.045	0.023	1.95	0.051	**
August	0.055	0.023	2.35	0.019	**
September	0.018	0.023	0.79	0.432	
October	0.051	0.024	2.15	0.031	**
November	0.098	0.022	4.43	0.000	***
December	0.241	0.024	10.27	0.000	***
1989 [1988 omitted]	0.036	0.021	1.71	0.088	*
1990	0.005	0.021	0.24	0.813	
1991	0.003	0.022	0.14	0.890	
1992	-0.002	0.021	-0.10	0.918	
1993	0.047	0.021	2.21	0.027	**
1994	0.063	0.038	1.67	0.095	*
1995	-0.031	0.023	-1.34	0.180	
1996	0.008	0.022	0.37	0.710	
1997	-0.003	0.022	-0.14	0.887	
1998	-0.061	0.022	-2.85	0.004	***
1999	-0.045	0.021	-2.16	0.031	**
2000	-0.068	0.034	-1.98	0.048	**
Day of the Week Last Pay Received:					
Monday	0.020	0.017	1.23	0.217	
Tuesday	-0.034	0.015	-2.23	0.026	**
Wednesday	0.000	0.015	0.01	0.991	
Thursday	-0.010	0.014	-0.73	0.468	
Saturday [Friday omitted]	-0.007	0.018	-0.40	0.691	
Sunday	-0.030	0.019	-1.63	0.103	*
Region of Residence [South omitted]:					
Greater London	0.044	0.021	2.08	0.037	**
North	-0.040	0.015	-2.71	0.007	***
Midlands	-0.015	0.013	-1.12	0.261	

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Table B2 (continued from previous page)

Log Wkly Cons. (Depndt.Var)	Coef.	Std Err	t-stat	P>t	Sigf.[1]
Wales	0.046	0.024	1.94	0.052	**
Scotland	0.013	0.017	0.77	0.442	
Northern Ireland	0.105	0.030	3.52	0.000	***
City Size [Very Large City omitted]:					
Large	-0.036	0.016	-2.22	0.027	**
Medium	-0.033	0.016	-2.03	0.042	**
Small	-0.050	0.016	-3.07	0.002	***
Wealthy Household?	0.235	0.018	12.81	0.000	***
Constant	1.529	0.811	1.89	0.059	*

[1] * significant at 10%; ** significant at 5%; *** significant at 1%