Present Bias, Mental Budget Constraint, and the Payday Overconsumption Puzzle

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JEL classification: D11, D12, E21

Keywords: Mental Accounting; Consumption; Self-Control; Present Bias

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1. Introduction

According to the standard economic model, consumption is expected to respond only to unpredictable changes in the timing of disposable income (Hall, 1978; Carroll, 1997). However, studies investigating the excessive sensitivity of consumption to income changes have produced mixed results, notably observed in the predictable increase and decrease in consumption during the payday cycle.[1] Researchers have proposed alternative modifications to the theory, such as the presence of impatient households with present bias and liquidity constraints, to address this payday consumption puzzle (Mastrobuoni and Weinberg, 2009; Kőszegi and Rabin, 2009; Kaplan and Violante, 2014). Despite these explanations, Olafsson and Pagel (2018) provide empirical evidence of significant spending responses during payday, even among unconstrained individuals in Iceland. They suggest that households' perception of having a "license to spend" upon receiving income may account for these intriguing findings. However, formal tests of this "license" concept are lacking in existing literature.

This paper seeks to address this gap by empirically examining the role of present bias (self-control) and mental budget constraints (the "license") in explaining the payday consumption cycle, particularly among unconstrained individuals. In understanding why consumption is highly sensitive to income, behavioral economists have proposed two theories: present bias and mental accounting. Present bias theory suggests that certain households exhibit higher impatience in the short term compared to the long term (Mastrobuoni and Weinberg, 2009;

[1] Huffman and Barenstein (2005) use household consumption data from UK, and find the evidence supporting that consumption spending declines between paydays, and jumps back to its initial level on the next payday. Mastrobuoni and Weinberg (2009) find that both consumption expenditures and consumption are higher in the week after Social Security checks are distributed than in the week before.

Kőszegi and Rabin, 2009; Kaplan and Violante, 2014). Mental accounting theory suggests that households allocate their income into separate accounts, leading them to assign more funds to specific categories when corresponding payments are received (Heath and Soll, 1996; Shafir and Thaler, 2006; Hastings and Shapiro, 2013; Abeler and Marklein, 2017). Drawing on a combination of these theories, Hsiaw (2018) explored the role of goal bracketing in mitigating present bias. Building on this framework, we propose that households with a higher degree of present bias tend to increase their spending around payday. However, due to the influence of monthly mental budget constraints, even without liquidity constraints, households that engage in excessive consumption immediately after payday subsequently reduce their spending as the monthly payday cycle progresses.

Our contribution lies in providing the first empirical evidence regarding the joint effect of present bias and mental budget constraints in explaining the payday overconsumption puzzle. This evidence also helps in better understanding the effect of anticipated income policies on household consumption. Using a proprietary dataset from a major Asian bank that includes 33,048 consumers and 23,992,848 consumer-day observations spanning from July 2013 to June 2015, we identify a similar pattern of payday overconsumption. We analyze consumption patterns within a seven-day period surrounding payday, following the methodology used by Olafsson and Pagel (2018). Our estimates provide compelling evidence of distinct overconsumption behavior. Specifically, on the first day after payday, consumers' daily normalized credit card spending significantly increases by 4.5 percentage points compared to non-payday days. However, spending levels return to normal patterns thereafter. Importantly, we demonstrate that this observed pattern is not primarily driven by cash constraints or durable goods consumption. We examine the effects of present bias and mental budget constraints on the payday overconsumption patterns, in the following two steps.

In the first step, we examine whether present bias is the underlying mechanism behind payday overconsumption. We develop two behavioral indicators of present bias based on measures of self-control ability derived from sleeping and exercising patterns (Altena et al., 2008; Digdon and Andrew, 2008; Dishman, 1994; Hagger et al., 2010). To categorize individuals, we employ a matching method to distinguish between early sleepers and late sleepers, as well as exercisers and non-exercisers. Our findings indicate that payday overconsumption is prevalent among individuals with self-control challenges, specifically late sleepers and non-exercisers. In contrast, individuals with greater self-control capabilities, such as early sleepers and exercisers, do not exhibit these patterns. These findings establish behavioral correlations that demonstrate the significant role of present bias in driving the payday consumption cycle.

However, solely relying on the presence of present bias and its association with excessive consumption does not sufficiently explain the observed pattern of an initial rise and subsequent decline in consumption following payday, because consumers with present bias but no cash constraints can, in theory, maintain a high level of consumption without subsequent decrease. However, we have documented the payday consumption cycle even in the absence of cash constraints, consistent with the existing literature (Olafsson and Pagel, 2018). Therefore, additional constraints beyond present bias are essential for comprehending this pattern.

Unfortunately, this aspect has been largely overlooked in the literature. For the first time, we provide empirical evidence on an explanation rooted in the concept of a monthly mental budget constraint.

In the second step of our analysis, we test the joint effect of present bias and mental budget constraints on the payday consumption cycle using an instrumental variable approach. Exploiting the intuition that consumers tend to spend more on weekends, we construct an instrumental variable that equals one if the payday, customarily a fixed date on the calendar month, coincides with a weekend (Friday, Saturday, or Sunday), and zero otherwise. Our analysis confirms that the relevance condition holds, as a higher level of consumption during and immediately after the payday (labeled the “pay day window”) is observed when payday falls on a weekend. We examine the instrumented effect of payday window consumption on consumption during four subsequent 7-day periods ("weeks") following the payday window. Each of these 7-day periods containing the same number of working days and weekend days, ensuring that the exclusion restriction plausibly holds---i.e., the instrument affects subsequent consumption not mechanically, but only through its effect on payday window consumption. This timing design allows us to evaluate the impact of monthly mental budget constraints on the payday consumption cycle through these instrumented effects. Applying this instrumental regression method, we discover that an exogenous surge in spending during the payday window significantly reduces consumption three to four weeks later, indicating the presence of mental budget constraints. These findings provide evidence for the existence of mental budget constraints and contribute to explaining the payday consumption cycle.

We contribute to the following literature. First, by empirically linking the present bias/self-control measures to payday overconsumption, we contribute to the overall literature studying the excessive sensitivity of consumption to expected income[2] (Parker, 1999; Souleles, 1999, 2002; Huffman and Barenstein, 2005; Shapiro, 2005; Mastrobuoni and Weinberg, 2009). The existing literature has primarily proposed liquidity constraints (Kaplan and Violante, 2014) and present bias/self-control (Laibson et al., 2022) as potential factors contributing to such overconsumption. However, only the former explanation has been widely tested in the literature, with mixed results[3] (Parker, 1999; Souleles, 2002; Johnson et al., 2006; Mastrobuoni and Weinberg,2009; Shapiro and Slemrod, 2009; Parker et al., 2013; Kaplan et al.,2014; Olafsson and Pagel, 2018). Drawing from the literature on measuring self-control (Shefrin and Thaler, 1988; Ameriks et al., 2007; Hsiaw, 2013; Cobb-Clark et al., 2016; Allcott et al., 2022),[4] we introduce two self-control measures based on sleep patterns and exercise behavior. Based on these two measures, we provide suggestive evidence of self-control in explaining the excessive sensitivity of consumption to expected income, bridging the gap in the literature.

It is recognized in the literature that self-control alone cannot fully explain this excess sensitivity, necessitating the presence of some form of constraint (Huffman and Barenstein,

[2] Empirical studies consistently show that household consumption exhibits higher sensitivity to anticipated payments, deviating from the predictions of the standard economic model (Parker, 1999; Souleles, 1999, 2002). Moreover, prominent studies by Huffman and Barenstein (2005), Shapiro (2005), and Mastrobuoni and Weinberg (2009) extensively document the existence of a payday consumption cycle characterized by recurrent instances of excess sensitivity to expected income.

[3] While survey data from Johnson et al. (2006), Mastrobuoni and Weinberg (2009), and Kaplan et al. (2014) exhibit a positive correlation between the two, studies by Parker (1999), Souleles (2002), Shapiro and Slemrod (2009), and Parker et al. (2013) find no such correlation. Additionally, detailed transaction-level data confirms the existence of a significant payday consumption cycle among individuals without apparent cash constraints (Olafsson and Pagel, 2018).

[4] Ameriks et al., (2007) show that higher self-control positively relates to greater wealth and a higher likelihood of holding financial assets. Cobb-Clark et al. (2016) find that locus of control (self-control) increases households' saving rates. Allcott et al. (2022) study how self-control affects payday loans using an experimental approach, and their results further show that most participants have self-control issues on payday borrowing, and three quartiles of participants are aware of their issues but can not repeatedly resist payday lending.

2005; Gelman, 2021). Our paper also contributes to establishing a connection between mental accounting and payday overconsumption. We employ a new instrumental variable method that leverages variations in payday timing to demonstrate the influence of a mental monthly budget constraint on consumption. This contribution extends beyond the scope of our study and has implications for the broader empirical research on testing mental accounting (Shafir and Thaler, 2006; Hastings and Shapiro, 2013; Abeler and Marklein, 2017; Gathergood et al., 2019; Gelman and Roussanov, 2021). [5]

The rest of the paper proceeds as follows. Section 2 introduces the data and presents summary statistics, and Section 3 reports the payday consumption cycle patterns in our data. Section 4, the main section of the paper, investigates the mechanisms of present bias and mental budget constraints in explaining the payday overconsumption puzzle. Section 5 concludes.

[5] Shafir and Thaler (2006) observe that individuals tend to categorize advanced purchases as "investments," considering goods purchased earlier and used as planned as "free." Hastings and Shapiro (2013) discover that households treat their "gas money" as nonfungible, distinct from other sources of income. Abeler and Marklein (2017) conduct a field experiment in which participants who receive an eight euro voucher spend significantly more in a beverage restaurant compared to those who receive an equivalent amount in cash. Gathergood et al. (2019) demonstrate that households prioritize debt repayment on each credit card proportionally to the share of balances on each card. Lastly, Gelman and Roussanov (2021) find that individuals tend to increase their spending merely upon receiving a new credit card, regardless of whether their credit limit remains unchanged.

2. Data Description and Summary Statistics

We utilize a proprietary dataset obtained from a prominent Asian bank (hereafter referred to as the "Bank"). This dataset encompasses comprehensive transaction records and monthly balances across various account types, encompassing checking, savings, credit cards, stocks, mutual funds, insurance, mortgages, and loans. Additionally, the dataset includes valuable demographic information relating to each consumer, such as gender, marital status, age, education, occupation, dependents, and zip code. The raw data encompasses a sample of 1.6 million consumers over two years spanning from July 2013 to June 2015.

To examine the fluctuations in credit card consumption surrounding payday, our analysis focuses on individuals aged between 15 and 65, representing the legally working age bracket. We specifically target those consumers who receive salary payments through direct deposit into their accounts at the Bank and exhibit consistent credit card usage throughout the sample period. To ensure the accuracy of our findings in capturing the consumers' primary spending patterns, we narrow our focus to a subset of individuals who utilize the Bank's credit cards every month. Furthermore, we restrict our analysis to those whose credit card transaction volume with the Bank surpasses that of all other financial institutions. This stringent criterion yields a sample size of 33,048 consumers, generating 23,992,848 consumer-day observations, constituting our primary credit card sample. As a robustness check, we also estimate the payday consumption cycle solely among individuals who exclusively possess credit cards issued by the Bank. This supplementary analysis encompasses 8,071 consumers, resulting in 5,859,546 consumer-day observations. (Please refer to Appendix Figure A1 for further details on this sole credit card sample).

Insert Table 1

Table Table 1 presents a comprehensive overview of the primary credit card sample. On average, consumers within this sample exhibit a monthly salary of $2,197 and a monthly consumption of $455.[6] The average financial wealth of these individuals amounts to $22,601. In terms of demographic characteristics, the average age of consumers stands at 39 years old, with females constituting 35.5 percent of the sample. Additionally, 15 percent of consumers have dependents, while 54.8 percent possess a bachelor's degree or higher. Moreover, over half of the population engages in white-collar occupations.

To accurately define the pay event, we exclude small-sized payments, which are defined as those falling below the 25th percentile of all direct deposit transactions. These smaller transactions are more likely to be reimbursements rather than salary payments. Accordingly, the sampling frequency of salary pay for consumers is calculated to be 1.09 times per month. This figure aligns with the standard monthly pay period observed in this particular economy. Thus, we define "payday" as the day on which such described income is received.[7]

[6] The average monthly income in official surveys conducted by the government of this economy is $1,693. Our sample average income is slightly higher than the official average. Therefore, our results only apply to a group of higher-earning workers who have access to financial services. Our sample credit card spending is approximately a third of the average monthly consumption in the survey ($1,265), This is consistent with credit cards being one of the two major methods of payment in this economy and with the fact that employees in the main credit-card sample also use other credit cards, while maintaining their highest balance with the Bank. The ratio of credit card consumption to income in our data is approximately 21% ($455/$2,197), slightly higher than Agarwal and Qian (2014) and Agarwal and Qian (2017), who report ratios of 12% and 11%, respectively.

[7] Figure B1 in the appendix plots the distribution of payday defined above on the day of the month. About one-fourth of the payday arrives on the 5th day of each month. It is reasonable because most government employees are paid on the 5th day of each month in this region, and many firms may follow the same practice.

3. Estimating the Payday Consumption Cycle

- **The main regression**

In the empirical analysis, following Olafsson and Pagel's (2018) specification, we estimate the payday consumption cycle by running the following fixed-effect model in equation (1).

$$x_{i,t} = \sum_{j=-7}^{7} \beta_j * I_i(paid_{t-j}) + control_{i,t} + year_t + mm_t + dom_t + dow_t + u_i + \varepsilon_{i,t} \quad (1)$$

The unit of the analysis is consumer i on day t. $x_{i,t}$ is the normalized daily consumption by the individual i: it is constructed as the ratio of total spending of individual i on day t to average daily spending of the individual i over the whole sample period. $I_i(paid_{t-j})$ is the key set of variables measuring the payday consumption cycle: it is an indicator that equals one if the consumer i received a payment on time $t-j$ and 0 otherwise, with j ranging from -7 to 7. For example, $I_i(paid_{t-7})$ equals one if consumer's consumption on day t is 7 days before a payday; $I_i(paid_{t+7})$ equals one if consumer's consumption on day t is 7 days after a payday. The set of variables denoted by $I_i(paid_{t-j})$ effectively select seven days before and after the payday to measure the consumption pattern, with days outside the payday period serving as the omitted group for comparison. The β_j coefficients thus measure the fraction deviations of normalized consumption surrounding the payday relative to the consumption level on days that are outside the payday period. This dynamic pattern is the payday consumption cycle we want to estimate.

Our control variables include financial wealth and other demographics, including marital status, age, education, occupation, and the number of dependents. We also include a set of fixed effects: day-of-week fixed effect (dow_t), day-of-month fixed effect(dom_t), month-of-the-year fixed effect (mm_t), year fixed effect($year_t$), and consumer fixed effect (u_i). Standard errors are clustered at the consumer level.

For simplicity, we use Figure 1 to illustrate the payday consumption cycle based on the estimates of equation (1) and report the complete estimation results in Column (1) of Table 2. In Figure 1, the x-axis is the day relative to the payday, and the y-axis is the estimated β_j coefficients, i.e., the change of normalized daily credit card spending j days away from the payday relative to the level on days that are outside of the payday period. The black dot in each figure represents that the coefficient is significant at the 5% level; otherwise, the dot is hollow.

Figure 1 (A) presents the estimates derived from Column (1) of Table 2, representing the overarching pattern observed within the entire sample. Notably, a conspicuous consumption cycle centered around payday becomes evident. Specifically, consumers' daily normalized credit card spending exhibits a significant increase (at the 1% level) of 4.5 percentage points on the day immediately following payday when compared to non-payday periods. Subsequently, consumption levels return to their normal range. This pattern contradicts the predictions of consumption smoothing posited by the neoclassical model concerning expected income but aligns with existing literature on payday overconsumption. For instance, Huffman and Barenstein (2005) observed a 12% increase in spending during the first week after payday compared to weeks occurring 15 to 22 days after payday. Similarly, Olafsson and Pagel (2018) found that households tend to overconsume by approximately 50% on payday compared to their average daily consumption. Our estimates are comparatively smaller, but yet still statistically significant, suggesting the existence of payday overconsumption across cultures and datasets.[8]

The findings in Figure 1(A) alone do not necessarily lead us to a behavioral explanation. One plausible neoclassical explanation is the existence of liquidity constraints, wherein the arrival of income alleviates these constraints, enabling a surge in consumption (Kaplan and Violante, 2014). Nonetheless, our sample reveals that consumers, on average, utilize only up to 10% of their credit limit, indicating a significant distance from any constraints. Additionally, we find no substantial changes in the proportion of credit utilization around payday (see Appendix Table A1).

To delve deeper into the matter, we conduct further analysis on a subset of individuals who are unlikely to face constraints (referred to as the unconstrained sample, as shown in Column (2) of Table 2 and Figure 1(B)). [9] However, we observe a strikingly similar pattern to that of the overall sample. This observation suggests that the payday overconsumption is unlikely to be explicable solely by liquidity constraints.

Insert Figure 1

An additional neoclassical perspective worth considering is the role of durable goods purchases. To investigate this, we explore whether our findings hold true when focusing solely

[8] The noteworthy surge in consumption observed on the day following payday may be attributed to individuals receiving their salary later in the afternoon on the payday or allocating time in advance for their intended consumption.

[9] We calculate the liquidity constraint measure based on whether the consumer has enough cash holdings to cover their monthly expenses. Specifically, we define a consumer-month observation as not having liquidity constraint if the consumer had sufficient money in the current saving account at the beginning of this month to cover the spending of the same month. We find that about 65% of the observations are unconstrained according to our measure. We also use alternative definitions of liquidity constraints based on whether balances in the saving account and security account at the beginning of the month can cover their spending in the same month, or whether the credit utilization is above the sample average. The results are also robust (Appendix Table A2 and Figure A2).

on non-durable goods, thereby excluding durable categories such as furniture and computer purchases. Specifically, we analyze spending categories encompassing clothing, supermarket purchases (representing food at home), and entertainment (including cinema and karaoke). Through estimation, we examine the presence of payday overconsumption within these three categories. Our analysis reveals a significant payday consumption cycle in all three categories, as detailed in Figure A3 and Table A3. This finding suggests that the consumption of durable goods alone does not provide a comprehensive explanation for the observed payday overconsumption.

The above findings of the existence of the payday consumption cycle and the exploration of the alternative channels generally replicate Olafsson and Pagel (2018), and we perform several robustness checks of the above payday consumption cycle estimation, including changes in definitions of the payday, regression specification and placebo tests.[10] In the following analysis, we always use the unconstrained sample to exclude this alternative.

4. Mechanism: Present Bias and Mental Accounting

In our sample, we have observed a substantial surge in consumption following the expected arrival of payday income, followed by a significant decrease thereafter, even in the absence of liquidity constraints. The underlying reasons for the existence of this payday consumption cycle remain puzzling. Existing literature has put forth present bias, accompanied by self-control issues and a propensity for compulsive consumption, as an intuitive explanation

[10] First, we adopt two alternative definitions of the payday: one is the 5th day of every month, and the other is the most frequent paydays within a firm. Second, we try an alternative regression specification by using the event study approach, in which we only include observations seven days before and after the payday and construct dummy variables indicating these days to estimate consumption change around the payday (Appendix Table A4 and Table A5; Figure A4 and Figure A5). Besides, we also perform placebo tests of the consumption categories in which the payday consumption cycle should not likely exist (Appendix Figure A6 and Table A6).

(Ameriks et al., 2007; Mastrobuoni and Weinberg, 2009; Gelman, 2021). However, to the best of our knowledge, direct evidence linking present bias to payday overconsumption is still lacking.

Another intriguing aspect is that while present bias and its associated inclination for excessive consumption intuitively lead to excess consumption around payday, in the absence of liquidity constraints, a present-biased agent would tend to overconsume consistently, making it unlikely to observe significant fluctuations after payday. Put simply, additional mental budget constraints are necessary, alongside present bias, to account for the cyclical nature of consumption around payday. Nonetheless, empirical evidence supporting such mental budget constraints has not yet been presented in the literature.

To tackle these two challenges, this section addresses whether present bias indeed influences the payday consumption cycle and explores the potential existence of monthly mental budget constraints that help explain the rise and subsequent drop in consumption surrounding payday.

4.1 Payday Overconsumption and Self-control

To explore whether present bias affects payday excess consumption, we develop several measures of present bias/self-control abilities and investigate whether such measures are correlated with payday overconsumption.

- **Sleeping hours and payday consumption cycle**

The first metric we employ to gauge self-control ability revolves around sleeping patterns. As per common knowledge, staying up late is detrimental to one's health, yet it proves challenging to regulate. Digdon and Andrew (2008) observe a significant association between staying up late and low self-control abilities through the analysis of survey data. Kroese et al. (2016) reveals a significant relationship between self-regulation and going to bed later than intended from a representative sample of Dutch adults. This evidence provides support for proxying present bias using sleeping time.

Leveraging the transaction timing information available in our dataset and the aforementioned research, we utilize the frequency of late-night transactions as an indicator of individuals' inclination to stay up late. Specifically, we classify consumers who did not engage in any transactions (either online or at ATM terminals) between 0:00 and 6:00 in the morning as early-sleepers, while those who conducted at least one transaction during this period are categorized as late-sleepers.[11] Our resulting measures yield a count of 1,415 early-sleepers and 31,633 late-sleepers. Given the substantial disparity in group sizes, we employ propensity score matching (PSM) to pair each early-sleeper with a late-sleeper possessing similar background characteristics in terms of average consumption, income, wealth, gender, marital status, education, and occupation. However, whether the matching is conducted or not, the estimation results consistently remain robust. The matching process and the estimation results without matching are reported in Appendix A7 and A8 for both the late sleep measure and the exercise measure.

The estimation of the payday overconsumption is conducted separately for the two distinct groups, and the findings are presented in Figure 2 and Table 2. Analysis of Figures 2(A) and

[11] Changing timing of transactions 0:00 to 7:00 am or restricting late sleepers as those engage ATM transactions does not change our results.

2(B) reveals that early-sleepers do not exhibit a significant payday consumption cycle. In contrast, late-sleepers demonstrate a noteworthy surge in consumption on the day immediately following payday, with a substantial increase of 9.7%. Additionally, late-sleepers tend to marginally overconsume on the actual payday, with a minor increase of 7.4%. In comparison, early sleepers consume 11.6% (Cross group comparison with a p-value of 0.012) less than late sleepers on the first day following payday. This observed consumption pattern aligns with the inherent predisposition of late-sleepers towards self-control deficiencies. As sleeping late serves as a prominent indicator of self-control challenges, our results establish a notable association between the payday consumption cycle and individual self-control capabilities.

- **Gym exercise and payday consumption cycle**

We introduce a second measure that utilizes gym exercise activities. Extensive research in the field of behavioral economics has demonstrated a strong correlation between self-control and maintaining an exercise regimen (DellaVigna and Malmendier, 2006; Charness and Gneezy, 2009; Acland and Levy, 2015). Additionally, literature on sports and kinematics has highlighted that discontinuing gym exercise signifies an individual's struggle with self-control (Dishman et al., 1980; Dishman, 1994; Muraven et al., 1999).

Drawing from these prior studies, we construct the following index as a measure of self-control ability based on individuals' adherence to exercising. Leveraging our granular transaction-level credit card data, we identify consumers who have engaged in at least one gym transaction. Within this group, we further differentiate between those who consistently persist in exercising and those who do not. To refine our analysis, we exclude consumers with gym transactions exceeding $165 (5,000 local currency), as such transactions are likely associated with the purchase of quarterly or annual passes. In these cases, subsequent gym visits cannot be observed in the credit card records, making it impossible to determine whether these individuals continued their exercise routine. Importantly, including these observations in the exercising group does not alter our findings.

To focus on consumers with gym transactions of relatively small amounts, we further impose a criterion that requires these individuals to have exercised at least twice at the gym to be classified as "exercisers".[12] This classification comprises 1,090 exercisers and 30,932 "non-exercisers" who are the remaining non-excluded consumers. Our estimation results remain robust even when we require exercisers to consistently exercise every month following the initial gym payment. However, such a condition leads to a further reduction in the sample size of exercisers. Similar to the analysis of sleeping patterns, we employ propensity score matching to pair each exerciser with a non-exerciser possessing similar background information. The estimation results are presented in Table 2, and the corresponding coefficients are depicted in Figures 2(C) and 2(D). Once again, we find no significant variation in consumption around payday among exercisers. Conversely, a notable payday overconsumption exists among non-exercisers: their normalized credit card spending exhibits a substantial increase of 14.7 percentage points on the first day following payday. In comparison, exercisers consume 14.5% (Cross group comparison with a p-value of 0.006) less than non-exercisers on the first day following payday. Given that exercise maintenance may be influenced by self-control abilities,

[12] Our findings still hold if we change the criteria of "exercisers" to be consumers that exercised in the gym at least one or three times.

these findings suggest a strong association between the absence of self-control and payday overconsumption.

Insert Figure 2

Our study offers empirical evidence indicating that consumers who possess strong self-control abilities (early-sleepers and exercisers), do not display tendencies of overconsumption around payday. Conversely, consumers experiencing self-control issues exhibit patterns of excessive consumption during this period.

4.2 Payday Consumption Cycle and Mental Accounting

The proposed explanation for the payday consumption cycle necessitates the presence of both present bias and a particular form of mental budget constraint. Prior theoretical studies, such as Koch and Nafziger (2016) and Hsiaw (2018), have put forth models suggesting that consumers establish mental accounts to address self-control issues. Under the assumption that these monthly mental budget constraints reset on payday, the combination of present bias and relaxation of the mental budget constraint leads to excessive consumption immediately after payday, followed by a subsequent reduction as the mental budget constraint tightens again. In essence, the mental budget constraint operates akin to a liquidity constraint, albeit being unobservable. This section addresses the challenge of identifying the presence of mental budget constraints in the absence of tangible cash constraints and explores the potential relationship between such mental budget constraints and the payday consumption cycle.

The empirical strategy centers around the key notion that if mental budget constraints do indeed exist and remain constant throughout the month, a larger consumption amount after payday would result in a greater reduction in subsequent consumption to maintain balance within the mental account. To examine the existence of such a relationship, we estimate the model specified in equation (2) using a sample unlikely to exhibit liquidity constraints.

$$\Delta cons\_week_{i,t+j} = \beta_j * \Delta payday\_cons_{i,t} + \delta_j * \Delta salary_{i,t} + control_{i,t} + u_i + \varepsilon_{i,t} \quad (2)$$

For ease of analysis, we divide the days after the payday in the payday cycle into several intervals: 0–2 days after the payday (interval 0), 3–9 days after the payday (interval 1), 10–16 days after the payday (interval 2), 17–23 days after the payday (interval 3), and 24–30 days after the payday (interval 4). The initial interval ($j = 0$), two days after the payday, is when we observe the increase in consumption, and the remaining intervals correspond to the subsequent four weeks (j=1,2,3,4) after payday.

We would like to understand how the average daily consumption in the first interval ($\Delta payday\_cons_{i,t}$, measured for $j = 0$) affects the average daily consumption in the subsequent intervals ($\Delta cons\_week_{i,t+j}$, j=1,2,3,4). To control for the unobservable consumption characteristic within an individual, in the estimation, we take the first difference by using the change relative to the corresponding variable in the last payday cycle to estimate the relationship. For example, the dependent variable $\Delta cons\_week_{i,t+j}$ is the difference in the average daily consumption between payday events t and t -1 in interval j.

The main independent variable $\Delta payday\_cons_{i,t}$ is the difference in the average daily consumption between the payday event t and t-1 in interval 0, which are the 0–2 days after the payday. The β_j coefficient thus measures how the consumption level in the 0–2 days after the payday affects the household's consumption level in the j_{th} week following the payday event t. If β_j is negative, then we find evidence that some fixed mental budget affects consumption behavior. $\Delta salary_{i,t}$ controls for the amount of "salary change" that the household i receives on payday events t relative to event t-1. The rest of the control variables are the same as the equation (1) and we also control for the consumer fixed effect (u_i). We run four separate regressions to examine the impact of payday overconsumption on consumption in the j_{th} week (j=1,2,3,4) following the payday event.

One concern with the aforementioned specification revolves around the endogeneity of the consumption increase immediately following payday (interval 0). To introduce exogenous variation into this consumption surge, we employ an instrumental variable approach that centers on whether or not interval 0 (0–2 days after payday) falls on a weekend. We construct a binary dummy variable that takes the value of one if interval 0 encompasses either Saturday or Sunday, and zero otherwise. The exclusion restriction plausibly holds. First, because paydays in this economy are customarily on the same calendar day of the month, whether the payday is on the weekend is exogenously determined.

Second, the instrumental variation does not affect the dependent variables mechanically. Indeed, the days after a weekend are working days so---for the same reasons why consumption goes up during the weekend---we might have a larger reduction in consumption during the working days. Specifically, Baugh and Wang (2018) use the variation that some calendar months contain five weekends, one more weekend than the modal month, to study the effect of liquidity constraints on consumption. However, our IV design does not capture that mechanical variation. It is important to note that our dependent variables are the consumption expenditures in intervals 1, 2, 3, and 4, respectively. These intervals contains seven consectively days each, spanning days 3-9, 10-16, 17-23, 24-30 of the pay day cycle. This design ensures that each interval for consumption outcome measurement always includes the same number of working days and weekend days. Put simply, our instrumental variation does not mechanically affect expenditures later in the payday period (in intervals 1, 2, 3, and 4) by making the later periods include more (or less) weekends. Instead, it does so purely by inducing payday window consumption. This ensures that the exclusion restriction plausibly holds.

We test the relevance condition in our data that if interval 0 falls on a weekend, that tends to make individuals spend more in interval 0. Intuitively, individuals generally have more discretionary time for consumption during weekends. In Appendix A10, we present the first-stage results of the instrumental variable estimation, which show a statistically significant increase in consumption during the subsequent day for consumers who receive their salary around weekends. Additionally, our data indeed confirm that individuals, even after controlling for individual characteristics, consume 29% and 16% more on Saturday and Sunday compared to Monday. Consequently, our instrumental variable satisfies the relevance criterion for IV estimation.

The above specification offers two distinct advantages. Firstly, by calculating the first difference in consumption within a given interval across months, we are able to control for unobservable consumption characteristics within individuals and mitigate the issue of spurious correlations. Secondly, our dependent variable encompasses consumption spending across four 7-day intervals following payday, with each interval consistently encompassing all seven days of the week, from Monday to Sunday. Importantly, our design explicitly addresses this challenge.

Table 3 presents the instrumental variable estimation results. In columns (1) to (4), we use $\Delta cons\_week_{i,t+j}$ (j=1,2,3,4) as the dependent variable for columns (1) - (4), respectively. Our analysis reveals a positive relationship between the change in consumption immediately after payday and consumption during week 1. Specifically, one additional dollar spent daily two days after the payday makes households consume about \$0.999 more in week 1, but \$0.011, \$0.141, and \$1.121 daily less in weeks 2, 3, and 4, respectively, and the first and the last two of the above four estimates are statistically significant. Consequently, these estimates indicate the presence of mental budget constraints: in the absence of liquidity constraints, a higher level of consumption immediately after payday tends to diminish consumption expenditure towards the end of the monthly payday cycle.[13]

Insert Table3

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5. Conclusions

This study utilizes comprehensive data on salary, credit card expenditures, debt, and

[13] The findings obtained through OLS estimation are presented in Appendix Table A9. Furthermore, we also adjust the definition of the initial interval (j=0) to encompass day 0 – day 1, and the results remain consistent.

financial accounts to empirically analyze the payday consumption cycle among unconstrained consumers. The study focuses on two potential explanations for this cycle: self-control abilities and the presence of a monthly mental budget constraint. The findings provide robust support for these theoretical propositions.

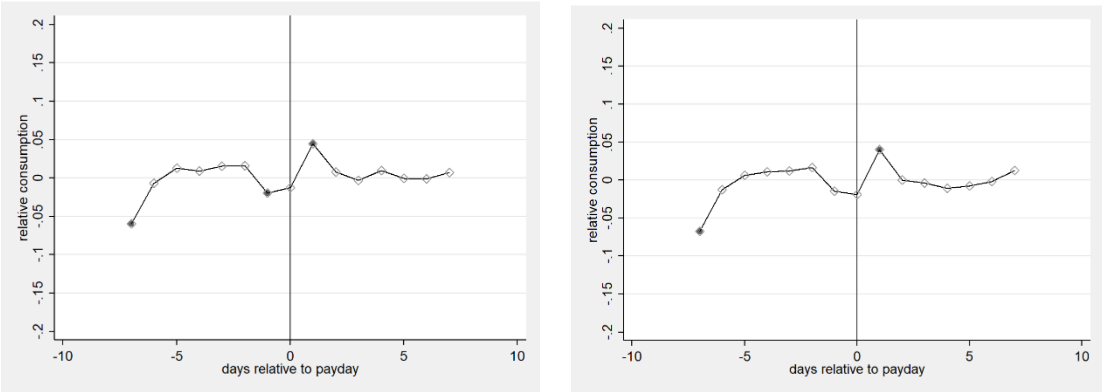
Specifically, we observe that individuals who are late-sleepers and non-exercisers exhibit payday overconsumption, while early-sleepers and regular exercisers do not display this pattern. This aligns with the concept that present bias drives the consumption cycle around payday. Furthermore, by employing an instrumental variable regression approach, we discover that increased consumption immediately after payday leads to subsequent reductions in consumption three to four weeks later. This indicates the existence of a fixed mental budget for expenditure within the payday period. In summary, our study offers compelling evidence that highlights the combined influence of present bias and mental budget constraints in shaping the observed payday consumption cycle.

Figures

Figure 1 Consumption around Payday

1(A) Full Sample

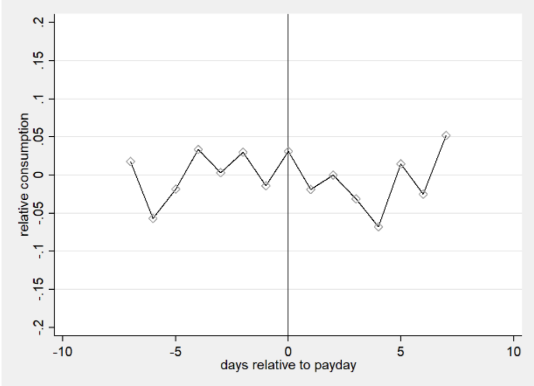
1(B) Unconstrained Sample



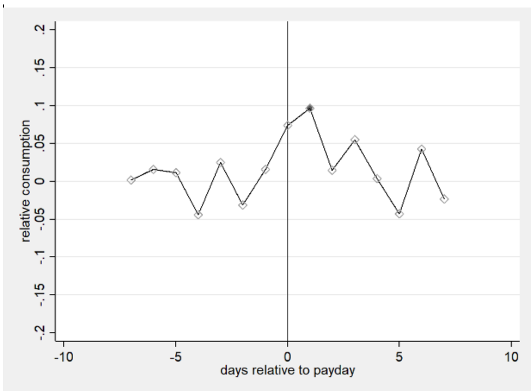
Note: Figure 1 plots the temporal consumption patterns around the payday estimated for the full sample and the unconstrained sample. Dots in black represents statistical significance at the 10% level, and hollow dots represent statistical insignificance at the same level.

Figure 2 Consumption around Payday for Consumers with Different Self-control Measures

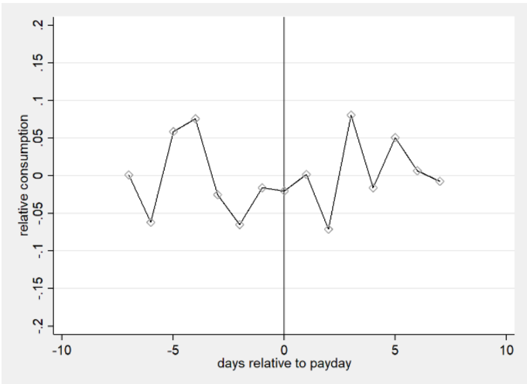
2(A) Early-Sleeper



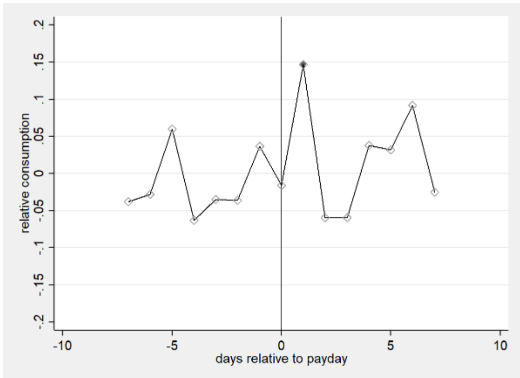
2(B) Late-Sleeper (Matched)



2(C) "Exercisers"



2(D) "Non-Exercisers" (Matched)



Note: Figure 2 plots the coefficients estimated from Table 2, column(3)-column(6), representing the normalized consumption around payday on consumers who sleep early or not, and who exercise or not. The figure reports the consumption responses to the arrival of income estimated by regression (1). The dependent variable is daily consumption relative to an individual's average daily consumption in the whole sample period, and the main independent variables are dummy variables indicating 7 days before and after the payday. Control variables include: Wealth, demographics (age, the square of age, marriage status, education and the number of dependents) and a bunch of fixed effects (year, month of the year, day of the month, day of the week, individuals). The horizontal axis represents the days relative to the payday (day 0), and the vertical axis represents the estimated change in the normalized consumption relative to periods other than the 15 days around the payday. The black dot in each figure represents that the corresponding change is significant, otherwise insignificant at the 90% level. Figure 2(A) shows the result of consumers who sleep early. Figure 2(B) shows the matching result of consumers who sleep late at night. Figure 2 (C) shows the result of consumers who exercise in the gym at least twice in the whole sample. Figure 2(D) shows the matching result of consumers who never consume in the gym. The results are estimated in the sample without liquidity constraint, which is defined as having sufficient money in the salary account at the beginning of this month to cover the spending of the same month.

Tables

Table 1(A) Summary Statistics of Consumption, Income and Age

	observations (individual-month)	mean	S.D	p25	p50	p75
Monthly Salary	793,152	2196.5	2002.2	1224.9	1702.5	2474.5
Monthly Consumption	793,152	455.3	588.5	120.4	256.6	558.8
Wealth	793,152	22601.0	32644.2	3234.4	4225.7	25092.5

Table 1(B) Summary Statistics on Demographic Information

	observations (individual)	mean	S.D	p25	p50	p75
Age	33,048	38.9	7.9	32	37	44

		mean
Education	**Master**	18.70%
	Bachelor	36.10%
	Vocational School	17.50%
	High School	13.90%
	Middle School	13.40%
Number of Dependents	**0 dependent**	84.00%
	1 dependent	6.80%
	Above 1 dependent	9.20%

	variables	mean
Occupation	**Government Official**	1.90%
	White Collar	51.30%
	Blue Collar	24.60%
	Farmer	0.20%
	Manager	16.90%
	Free Lancer	5.00%
Gender and Marriage	**Female**	35.50%
	Marriage	38.00%

Note: Table1(A) reports the summary statistic of the whole sample. Consumption, salary and wealth are reported on individual-monthly level. Table 1(B) reports the rest demographics, including age, gender, marriage status, education, occupation and number of dependents on individual-monthly level.

Table 2 Consumption Patterns Around Payday and Heterogeneity by Self-control Measures

	normalized consumption					
	(1)	(2)	(3)	(4)	(5)	(6)
			Unconstrained Sample			
			Self-control Measure I		Self-control Measure II	
	Full Sample	Unconstrained Sample	Early Sleepers	Late sleepers (matched)	Exercisers	Non-exercisers (matched)
day -7	-0.065***	-0.073***	0.018	0.002	0.001	-0.038
	(0.008)	(0.009)	(0.052)	(0.046)	(0.061)	(0.050)
day -6	-0.010	-0.013	-0.057	0.016	-0.062	-0.028
	(0.008)	(0.010)	(0.053)	(0.054)	(0.057)	(0.055)
day -5	0.011	0.010	-0.018	0.012	0.059	0.060
	(0.008)	(0.010)	(0.046)	(0.050)	(0.059)	(0.058)
day -4	0.011	0.011	0.034	-0.044	0.076	-0.063
	(0.008)	(0.010)	(0.051)	(0.046)	(0.063)	(0.046)
day -3	0.006	0.005	0.003	0.025	-0.025	-0.035
	(0.008)	(0.010)	(0.051)	(0.043)	(0.052)	(0.048)
day -2	0.006	0.004	0.030	-0.031	-0.065	-0.036
	(0.008)	(0.010)	(0.055)	(0.044)	(0.050)	(0.051)
day -1	-0.042***	-0.039***	-0.014	0.016	-0.016	0.037
	(0.008)	(0.009)	(0.041)	(0.050)	(0.060)	(0.058)
day 0 (Payday)	0.001	-0.003	0.031	0.074	-0.020	-0.016
	(0.009)	(0.010)	(0.056)	(0.059)	(0.059)	(0.061)
day 1	0.057***	0.047***	-0.019	0.097**	0.002	0.147**
	(0.008)	(0.010)	(0.059)	(0.042)	(0.054)	(0.060)
day 2	0.010	0.001	-0.000	0.015	-0.071	-0.059
	(0.008)	(0.010)	(0.059)	(0.054)	(0.053)	(0.050)
day 3	0.001	0.000	-0.031	0.055	0.081	-0.059
	(0.008)	(0.010)	(0.040)	(0.063)	(0.072)	(0.049)
day 4	-0.017**	-0.036***	-0.068	0.004	-0.016	0.038
	(0.008)	(0.010)	(0.045)	(0.047)	(0.064)	(0.056)
day 5	0.005	0.001	0.015	-0.043	0.051	0.032
	(0.008)	(0.010)	(0.055)	(0.047)	(0.062)	(0.055)
day 6	0.002	0.003	-0.025	0.043	0.007	0.092
	(0.008)	(0.009)	(0.047)	(0.057)	(0.064)	(0.059)
day 7	0.005	0.015	0.052	-0.023	-0.007	-0.025
	(0.008)	(0.010)	(0.077)	(0.057)	(0.059)	(0.052)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
ID fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
observations	23,856,905	15,577,169	585447	561041	367907	449763
R2	0.003	0.004	0.005	0.006	0.006	0.006

Note: Table 2 reports the consumption responses to the arrival of income estimated by regression (1) in different samples. Column (1) reports the results using the whole sample, and column (2) reports the result only using those without liquidity constraints, which is defined as having sufficient money in the saving account at the beginning of this month to cover the spending of the same month. Column (3) reports the result in people who never sleep late at night, while Column (4) reports the matched sample of people who sleep late at night. Column (5) reports the result in people who consume in the gym at least twice in our sample, while Column (6) reports the matched sample of people who never spend money in the gym. The results in Column (3) to Column (6) are estimated in the sample without liquidity constraint. * $p<0.10$, ** $p<0.05$ *** $p<0.01$.

Table3 Effect of Payday Overconsumption on Consumption in the Following Weeks (IV)

	(1)	(2)	(3)	(4)
	Consumption Change			
	first week	second week	third week	fourth week
Con_Payday	0.999***	-0.011	-0.140**	-1.121***
	(0.344)	(0.017)	(0.060)	(0.377)
Controls	Yes	Yes	Yes	Yes
Year and Month	Yes	Yes	Yes	Yes
ID F.E.	Yes	Yes	Yes	Yes
Obs	650,267	650,267	650,267	650,267

Note: Table3 reports the influence of overconsumption around payday on household's consumption in the following four weeks using instrumented variable regression. The dependent variable is the "consumption change" of each households on the j^{th} week following the salary event t; the main independent variable is the "increased consumption" of each households on a three-day window around salary event t. The instrumented variable for "increased consumption" around salary event is a dummy indicating whether the households receive their salary on Thursday, on Friday or on the weekend. Control variables include: Wealth, demographics (age, the square of age, marriage status, education and number of dependents) and a bunch of fixed effects (year, month of the year, individuals). Standard errors in parentheses are cluster at the individual level. Column (1) to (4) reports the influence of overconsumption around payday on household's consumption in the following one to four weeks. The results are estimated in sample without cash-constraint, which is defined as having sufficient money in the saving account at the beginning of this month to cover the spending of the same month. * p<0.10, ** p<0.05 *** p<0.01.

Reference

1. Abeler, Johannes, and Felix Marklein. Fungibility, labels, and consumption[J]. Journal of the European Economic Association 15.1 (2017): 99-127.
2. Allcott H, Kim J, Taubinsky D, et al. Are high-interest loans predatory? theory and evidence from payday lending[J]. The Review of Economic Studies, 2022, 89(3): 1041-1084.
3. Altena E, Van Der Werf Y D, Strijers R L M, et al. Sleep loss affects vigilance: effects of chronic insomnia and sleep therapy[J]. Journal of sleep research, 2008, 17(3): 335-343.
4. Ameriks J, Caplin A, Leahy J, et al. Measuring self-control problems [J]. American Economic Review, 2007, 97(3): 966-972.
5. Agarwal S, Qian W. Consumption and debt response to unanticipated income shocks: Evidence from a natural experiment in Singapore[J]. American Economic Review, 2014, 104(12): 4205-30.
6. Agarwal S, Qian W. Access to home equity and consumption: Evidence from a policy experiment[J]. Review of Economics and Statistics, 2017, 99(1): 40-52.
7. Baugh B, Wang J. When is it hard to make ends meet?[J]. RRC Paper No. NB117-05. Cambridge, MA: National Bureau of Economic Research, 2018.
8. Carroll C D. Buffer-stock saving and the life cycle/permanent income hypothesis[J]. The Quarterly journal of economics, 1997, 112(1): 1-55.
9. Cobb-Clark D A, Kassenboehmer S C, Sinning M G. Locus of control and savings[J]. Journal of Banking & Finance, 2016, 73: 113-130..
10. Digdon N L, Howell A J. College students who have an eveningness preference report lower self-control and greater procrastination[J]. Chronobiology international, 2008, 25(6): 1029-1046.
11. Dishman R K. Advances in exercise adherence [M]. human kinetics publishers, 1994.
12. Gathergood J, Mahoney N, Stewart N, et al. How do individuals repay their debt? The balance-matching heuristic[J]. American Economic Review, 2019, 109(3): 844-75.
13. Gelman M. The Self-Constrained Hand-to-Mouth[J]. The Review of Economics and Statistics, 2021: 1-45.
14. Gelman, Michael, and Nikolai Roussanov. Managing Mental Accounts: Payment Cards and Consumption Expenditures. working paper, 2021.
15. Hagger M S, Wood C W, Stiff C, et al. Self-regulation and self-control in exercise: The strength-energy model [J]. International Review of Sport and Exercise Psychology, 2010, 3(1): 62-86.
16. Hall R E. Stochastic implications of the life cycle-permanent income hypothesis: theory and evidence[J]. Journal of political economy, 1978, 86(6): 971-987.
17. Hastings, Justine S., and Jesse M. Shapiro. Fungibility and consumer choice: Evidence from commodity price shocks[J]. The quarterly journal of economics 128.4 (2013): 1449-1498.
18. Heath, Chip, Soll. Mental Budgeting and Consumer Decisions[J]. Journal of Consumer Research, 1996, 23(1):40-40.
19. Hsiaw A. Goal bracketing and self-control[J]. Games and Economic Behavior, 2018, 111: 100-121.

20. Hsiaw A. Goal-setting and self-control[J]. Journal of Economic Theory, 2013, 148(2): 601-626.
21. Huffman D, Barenstein M. A monthly struggle for self-control? Hyperbolic discounting, mental accounting, and the fall in consumption between paydays [J]. Institute for the Study of Labor (IZA) Discussion Paper, 2005, 1430.
22. Johnson D S, Parker J A, Souleles N S. Household expenditure and the income tax rebates of 2001 [J]. American Economic Review, 2006, 96(5): 1589-1610.
23. Kaplan G, Violante G L. A model of the consumption response to fiscal stimulus payments [J]. Econometrica, 2014a, 82(4): 1199-1239.
24. Kaplan G, Violante G L, Weidner J. The wealthy hand-to-mouth[R]. National Bureau of Economic Research, 2014.
25. Koch A K, Nafziger J. Goals and bracketing under mental accounting[J]. Journal of Economic Theory, 2016, 162: 305-351.
26. Kőszegi B, Rabin M. Reference-dependent consumption plans[J]. American Economic Review, 2009, 99(3): 909-36.
27. Kroese F M, Evers C, Adriaanse M A, et al. Bedtime procrastination: A self-regulation perspective on sleep insufficiency in the general population[J]. Journal of health psychology, 2016, 21(5): 853-862.
28. Laibson, D., Repetto, A., and Tobacman, J. Estimating Discount Functions with Consumption Choices over the Life-cycle. Working Paper, 2022.
29. Mastrobuoni G, Weinberg M. Heterogeneity in intra-monthly consumption patterns, self-control, and savings at retirement [J]. American Economic Journal: Economic Policy, 2009, 1(2): 163-89.
30. Olafsson A, Pagel M. The liquid hand-to-mouth: Evidence from personal finance management software [J]. The Review of Financial Studies, 2018, 31(11): 4398-4446.
31. Parker J A, Souleles N S, Johnson D S, et al. Consumer spending and the economic stimulus payments of 2008 [J]. American Economic Review, 2013, 103(6): 2530-53.
32. Parker J A. The reaction of household consumption to predictable changes in social security taxes[J]. American Economic Review, 1999, 89(4): 959-973.
33. Rubin K H, Hemphill S A, Chen X, et al. A cross-cultural study of behavioral inhibition in toddlers: East–West–North–South[J]. International Journal of Behavioral Development, 2006, 30(3): 219-226.
34. Shefrin H M, Thaler R H. The behavioral life-cycle hypothesis[J]. Economic inquiry, 1988, 26(4): 609-643.
35. Shafir E, Thaler R H. Invest now, drink later, spend never: On the mental accounting of delayed consumption[J]. Journal of economic psychology, 2006, 27(5): 694-712.
36. Shapiro J M. Is there a daily discount rate? Evidence from the food stamp nutrition cycle [J]. Journal of public Economics, 2005, 89(2-3): 303-325.
37. Shapiro M D, Slemrod J. Did the 2008 tax rebates stimulate spending? [J]. American Economic Review, 2009, 99(2): 374-79.
38. Della Vigna S, Malmendier U. Paying not to go to the gym[J]. american economic Review, 2006, 96(3): 694-719.
39. Charness G, Gneezy U. Incentives to exercise[J]. Econometrica, 2009, 77(3): 909-931.
40. Acland D, Levy M R. Naiveté, projection bias, and habit formation in gym attendance[J].

Management Science, 2015, 61(1): 146-160.

41. Dishman R K, Ickes W, Morgan W P. Self‐motivation and adherence to habitual physical activity 1[J]. Journal of Applied Social Psychology, 1980, 10(2): 115-132.
42. Muraven M, Baumeister R F, Tice D M. Longitudinal improvement of self-regulation through practice: Building self-control strength through repeated exercise[J]. The Journal of social psychology, 1999, 139(4): 446-457.
43. Souleles N S. The response of household consumption to income tax refunds[J]. American Economic Review, 1999, 89(4): 947-958.
44. Souleles, Nicholas S. Consumer response to the Reagan tax cuts[J]. Journal of Public Economics 85.1 (2002): 99-120.