

Consumer Responses to Income Versus Balance Information

ABSTRACT

Consumers do not spend indefinitely, but rather they calibrate their spending against their available funds. But what are these *available funds*? Two likely measures are a person's income or their current bank balance. While both are capable of describing a consumer's financial situation, income is a *flow* and balance is a *stock*. Yet, prior research on stock-flow reasoning suggests this distinction may lead to different judgments. Applying and extending this line of reasoning, we find consumers who attend relatively more to one metric tend to use the dollar amount of that metric as their measure of available funds. Because consumers are debt averse, they attempt to spend less than the amount of whatever metric they attend to (income or balance). This implies the way information is presented will lead to differences in consumer spending. Furthermore, because income information conveys only a rate of change while balance conveys information about past accumulation, we propose systematic differences in accumulation patterns for consumers who rely on one metric versus the other.

Keywords: stock-flow reasoning, debt-aversion, attention, income, consumer spending

Consumers seek to acquire products through spending but also seek to avoid debt (Prelec and Loewenstein 1998). Balancing these opposing motivations requires spending to be constrained at some limit of available funds. But what metrics do consumers use to assess their *available funds*? Two likely metrics are income and bank account balance. While both measures convey aspects of a person's financial situation, these metrics differ along an important dimension: Income is a *flow* and balance is a *stock*; therefore, income and balance can describe (equivalent) financial information through different formats. We explore whether (and why) these two presentation formats have implications for consumers' judgments and decisions.

Why might consumers be sensitive to encountering their finances in terms of either income or balance? Drawing from research describing the challenges of stock-flow reasoning (Cronin, Gonzalez, and Sterman 2009; Kainz and Ossimitz 2002; Korzilius et al. 2014; Newell et al. 2016; Reinholtz, Maglio, and Spiller 2021; Spiller, Reinholtz, and Maglio 2020; Sweeney and Sterman 2000), we propose consumers may be sensitive to the dollar *amount* of income or balance without making sufficient adjustments to account for the differences implied by the two metrics. If consumers are reliant on the amount of income or balance as-given, then their spending decisions should be sensitive to which metric they attend to. We consider these propositions in contexts in which only income or balance information is available, as well as contexts in which both are available. We propose that a consumers' attention can both reveal and induce how they perceive their available funds.

We begin by discussing how consumers' finances can be described by many different metrics. We make the case that income and bank account balances are influential metrics for consumers because they represent liquid funds in the present moment. Income and balance correspond to a flow and a stock, respectively. Therefore, we briefly summarize the literature on

stock-flow reasoning, identifying where the prior research applies to the consumer financial decision making context, and where it does not. Next, we discuss a connection with consumer spending and debt avoidance and suggest consumers will systematically underspend whatever metric (income or balance) they attend to. This has downstream consequences for accumulation trajectories over time, because income and balance differ in their ability to track or “remember” past financial events. We explore these ideas across a brief descriptive survey and three studies. The first study tests whether consumer decisions differ depending on whether a bank statement presents equivalent finances using either an income or balance frame. Studies 2 and 3 use an experimental game in which we measure (study 2) and manipulate (study 3) attention and observe the resulting spending decisions.

Theoretical Development

Consumers are constantly tempted by the pleasure of immediate consumption. Therefore, it is necessary to limit present consumption to allow for future consumption (Ando and Modigliani 1963; Browning and Crossley 2001; Prelec and Loewenstein 1998; Shefrin and Thaler 1988). Prior research explores how—and whether—consumers can constrain their consumption at a given limit, which often involves exploring discount rates or aspects of self-control (Ainslie 1975; Frederick, Loewenstein, and O’Donoghue 2002; O’Donoghue and Rabin 2000; Thaler 1980). For example, people might be nudged to save more if they can pre-commit to future saving, avoiding the steep differences in intertemporal discount rates attributable to present bias (Thaler and Benartzi 2004). Alternatively, consumers who visualize their future self as the recipient of saved funds may be willing to save more now (Hershfield et al. 2011). When considering goal maintenance and topics of self-control, receiving persistent reminders of

savings goals (Karlan et al. 2016; Soman and Cheema 2011) or holding fewer savings goals may help in constraining consumption (Soman and Zhao 2011). Such research, either explicitly or implicitly, suggests consumers have a certain limit of available funds that can be spent. Our research is broadly motivated by a more foundational question: how do consumers set such spending limits?

Spending limits. Consumers have multifaceted financial portfolios that may span debt, financial obligations, realized and expected earnings, liquid savings, and illiquid savings (e.g., home equity, retirement, brokerage accounts). While there may be sophisticated budgeting tools to integrate these various pieces of information to identify an optimal level of present constraint, we are primarily interested in how consumers perceive and understand their spending limit.

Based on prior research suggesting consumers are especially sensitive to current resources (as opposed to future resources; Hirst, Joyce, and Schadeewald 1994; Shefrin and Thaler 1988) and liquid resources (as opposed to illiquid resources; Olafsson and Pagel 2018), we expect current income and current bank account balances to be especially relevant for consumers' judgments regarding their current constraint. These expectations are corroborated in our descriptive survey. Therefore, the current research considers how financial information—conveyed in terms of either income or balance—shapes consumer judgments and decisions.

Of course, income and balance are merely different methods of representing the same financial situation. For example, imagine a consumer has \$2,625 in their bank account, which grows to \$3,625 after \$1,000 of income is deposited. This financial situation can be described in terms of either flows or stocks. Flows communicate changes over time: the \$1,000 increase of funds. Stocks communicate levels of a resource: a starting level of \$2,625 and ending level of \$3,625. We expect that this presentation form matters.

Stocks and flows. Prior research on stock-flow reasoning suggests people are sensitive to whether data are presented in terms of flows or stock. One explanation is that people do not spontaneously translate between the two formats (Spiller, Reinholtz, and Maglio 2020). Therefore, judgments and decisions may be influenced by how time series data are presented (Reinholtz, Maglio, and Spiller 2021; Weber et al. 2025). Second, even when people are prompted to translate between flows and stocks, performance is typically poor and translations are inaccurate (Newell et al. 2016; Ossimitz 2002; Sweeney and Serman 2000). Difficulty in stock-flow reasoning persists even for highly educated people, including those with economics and business training (Cronin, Gonzalez, and Serman 2009), and improvements may require specialized training programs (Kainz and Ossimitz 2002) or elaborate problem-solving processes, such as thinking aloud (Fischer, Degen, and Funke 2015; Korzilius et al. 2014). Taken together, the prior research suggests people are sensitive to how information is described and rely on the presentation as given.

Our core proposition is that consumers' judgments and decisions will also be sensitive to flow versus stock presentations of their own information. However, applying and extending the stock-flow reasoning literature to the consumer space requires several advancements.

First, we consider the role of consumers' endogenous attention (to either income or balance information), which is essential for financial contexts, where both types of information may be readily available. Second, we integrate stock-flow reasoning with consumer debt aversion to make predictions regarding consumer spending. Third, we consider the cumulative effect of attending to either income or balance over time, noting the two metrics differ in how they "remember" previously accumulated resources.

The role of attention. A key distinction between our research and the prior literature on stock-flow reasoning involves the role of endogenous attention. Whereas prior work presents information as either flows or stocks, we recognize that consumers can often choose their presentation format. For example, consumers may be able to monitor their finances by considering their paycheck or logging into their bank account. To accommodate consumers' preference for information type—as well as their potential exposure to both flow and stock information—we draw upon prior research on human attention. Specifically, attention research suggests that people put more decision weight on the information they spend more time looking at (Amasino et al. 2019; Fiedler and Glöckner 2012; Fisher 2017; Glickman et al. 2019; Rramani et al. 2020; Smith and Krajbich 2018; Yang and Krajbich 2021). Therefore, we expect consumers who attend relatively more to income as a metric should be more likely to use the amount of income as an input for their financial decisions; and consumers who attend relatively more to balance should be more likely to use the amount of their balance as an input for their decisions. Given income and balance serve as measures of present liquidity, these amounts should specifically inform consumers' perceptions of available funds.

H1: Attending relatively more to income or balance increases the likelihood of using that amount as a measure of available funds.

The role of debt aversion. Consumers are typically debt averse, meaning they experience disproportionately large psychological discomfort from spending more money than they have available, compared to spending that does not incur debt. Debt aversion is reference dependent, meaning consumers attempt to avoid overspending their financial reference point (Prelec and

Loewenstein 1998). For example, spending that does not exhaust a consumer's total resources but does exceed the funds in a given mental account will be psychologically painful (Soster, Gershoff, and Bearden 2014). To the extent that consumers use either income or balance as their measure of available funds, debt aversion implies spending may approach—but should not exceed—this amount.

Therefore, consumers who attend relatively more to income (and perceive income as their measure of funds) should be motivated to spend less than their income. And consumers who attend relatively more to balance (and perceive balance as their measure of funds) should be motivated to spend less than their balance.

H2: Because consumers are debt averse relative to their financial reference points, they will systematically underspend the amount they attend relatively more to.

Taken together, H1 and H2 suggest consumers interpret the amount of the metric they attend relatively more to as their measure of available funds (H1) and therefore avoid spending in excess of that amount (H2). It therefore follows that as consumers perceive a larger amount of available funds, they should spend more overall. Even though income and balance are different ways of reporting on the *same* financial situation at the same time, we expect relatively greater attention to the larger amount will increase consumer spending in the moment.

H3: Attending relatively more to the metric with the larger amount leads to greater spending.

The role of memory. Income and balance differ on another dimension, regardless of whether either metric is systematically larger than the other. This dimension reflects the very nature of how flows and stocks communicate financial information *over time*. Specifically, income-based and balance-based constraints may differ in their “memory” of past consumption. Income—a flow—is a rate of change, and balance—a stock—is a level accounting for prior accumulation. Therefore, income “forgets” past spending behavior and balance “remembers.” This asymmetric memory of income versus balance implies a greater memory burden on consumers using income as a metric of available funds. Of course, a consumer who overspends their income by \$100 during a past pay period may remember to reduce their current spending to get back on track; however, we suspect this might not always be the case. Therefore, we expect attending relatively more to income information decreases consumers’ awareness of their past accumulation.

H4: Attending relatively more to income versus balance information decreases the awareness of prior accumulation.

In summary, we first predict that relative attention to either income or balance increases the likelihood consumers use that metric as the measure of available funds (H1). This reflects peoples’ general tendency to accept flow and stock information as given, rather than translating between the two (Spiller, Reinholtz, and Maglio 2020). A consequence for consumers who are debt-averse is that attending to either income or balance should decrease the likelihood of spending more than that amount (H2). Whether this relates to an increase or decrease in consumer spending at any given moment depends on whether income or balance is larger in

magnitude (H3). The nature of flows and stocks also implies a difference from attending to income versus balance information over time. Namely, income “forgets” past spending, shifting the cognitive burden to consumers to track whether they have been systematically underspending, overspending, or hitting their financial targets. Balance—on the other hand—“remembers” past financial decisions. This memory asymmetry suggests consumers who attend to relatively more to income will be less accurate when recalling their prior accumulation (H4).

Overview of Studies

We begin with a descriptive survey examining consumers’ experience, preferences, and beliefs regarding income and balance information. We then present three studies exploring the role of attention to income or balance information on consumer spending outcomes. In studies 1 and 3, we exogenously manipulate attention through the availability of either income or balance information. In study 2, we measure endogenous attention (through mouse-tracking).

The first study considers the hypothetical choice of a cheaper or more expensive purchase for participants who interpret their finances through flows or stocks. This study provides a test of H1 and H2. The following studies use a multiperiod, incentive-compatible spending game to test H2, H3, and H4. The paradigm captures repeated measures of spending alongside attention and finances. In study 2, we measure attention and in study 3, we manipulate it. All three studies were preregistered, though we slightly deviate from certain preregistered analyses for ease of explication in studies 2 and 3. We report all preregistered models for study 2 (web appendix B) and study 3 (web appendix C), noting that our substantive and statistics claims do not meaningfully depend on model specifications or exclusions that may slightly deviate from our preregistrations. Additionally, all materials, data, and code are available at

Descriptive Survey

Method. We begin with a brief survey to explore consumers' experience, preference, and beliefs about using income and balance information in their own lives. Prolific participants (N = 100; M_{age} = 36; 48% female) described "the exact approach you use to determine how much money you can spend. There are no right or wrong answers, but please be as specific and precise as possible in describing your approach." This open-ended question captures participants' experiences, and these responses were later self-coded as pertaining to "mostly [their] paycheck," "mostly [their] bank account balance/s," "both," or "neither."

To assess preferences, we asked participants to imagine signing up for a new bank account, where the new bank sends automated text notifications whenever a direct deposit occurs. Respondents indicated whether they would prefer this information displayed as "the amount of the direct deposit (e.g., 'You have just received a payment of \$800')" or "the amount in your bank account after the deposit hits (e.g., 'You now have \$1,700 in your account/s')."

To assess beliefs about where income or balance is more important (in context of \$800 of weekly income and \$1,700 in the bank), we asked participants to indicate whether income or balance would be "a more important factor as you decide how to manage your spending."

Results. The descriptive survey summarizes the following responses regarding income versus balance information: which metric consumers typically (1) use (based on the self-coding); (2) prefer (based on text notification preference); (3) feel is more important (given the context).

Responses to the self-coded measure (reflecting the information type that is typically used) reveal 33% focus mostly on their paycheck, 27% focus mostly on their bank balance/s,

31% focus on both, and 9% focus on neither. When asked to identify which they prefer (if they were to sign up for a new bank with direct deposit text message notifications), 64% indicated a preference for income information and 36% indicated a preference for balance information.

When asked to reveal whether they believed income or balance information was more important (to manage spending) under the imagined scenario of \$800 in weekly income and \$1,700 in a bank account balance, participants were nearly evenly split at 51% and 49%, respectively.

Across three questions intended to capture what consumers do, prefer, and believe to be important, we find evidence that consumers rely on the metrics of income and balance to manage their finances (only 9% report using neither). This supports our decision to examine income and balance, as opposed to other financial metrics (e.g., retirement savings or net worth). While the vast majority of respondents report using income or balance in their own financial decisions, we observe substantial between-person heterogeneity in which metric people actually use, prefer to know, and believe is most important. Furthermore, we observe within-person heterogeneity when considering responses across the three measures. Only about half (52%) of respondents are perfectly consistent in terms of using, preferring, and rating as more important either income or balance (for all three measures).

This heterogeneity underscores our interest in this topic, as consumers may naturally encounter either (or both) types of information—perhaps as the result of arbitrary decisions by banks or financial service providers. We seek to understand whether this difference in presentation format matters for consumers.

Study 1: Bank Statements

Study 1 seeks to test whether attending to either income or balance information increases the likelihood of using that metric as a measure of available funds (H1), and therefore underspending that amount (H2). We assess H1 by asking participants to identify whether their own spending constraints are based more on income or balance. We assess H2 by examining rates of purchasing a cheaper or more expensive option, where the cheaper option does not exceed the dollar amount of income payments, but the more expensive option does.

Method

A total of 499 participants were recruited from Prolific Academic to take part in this study in exchange for a small payment.

Participants imagined owning a malfunctioning vehicle and receiving the following two options from their mechanic: They could repair the problem for \$300 or perform a comprehensive maintenance (that would also repair the problem) for \$1,200. To facilitate this decision, participants were asked to inspect their hypothetical bank statement from the prior month. The statement showed an initial bank balance of \$1,075, which grew to \$3,625 by the end of the month, after accounting for income and expenditures. Participants were randomly assigned to see this statement presented in terms of either income (income deposits and expense withdrawals) or balances, as depicted in figure 1. These two statements depict *equivalent* financial information (a starting balance of \$1,075 growing to \$3,625 due to four income deposits of \$1,000 each and two expenses totaling \$1,450).

Monthly Bank Statement (Jan. 15 - Feb. 14)**Beginning Balance: \$1,075**

| | Event Description | Withdrawals | Deposits |
|-------|-------------------|-------------|----------|
| 01/22 | Monthly Auto Loan | -\$350 | |
| 01/24 | Income | | +\$1,000 |
| 01/31 | Income | | +\$1,000 |
| 02/01 | Monthly Rent | -\$1,100 | |
| 02/07 | Income | | +\$1,000 |
| 02/14 | Income | | +\$1,000 |

Monthly Bank Statement (Jan. 15 - Feb. 14)

| | Event Description | Balance |
|-------|--------------------------------|---------|
| 01/15 | <i>Beginning balance</i> | \$1,075 |
| 01/22 | Monthly auto loan is withdrawn | \$725 |
| 01/24 | Income is deposited | \$1,725 |
| 01/31 | Income is deposited | \$2,725 |
| 02/01 | Monthly rent is withdrawn | \$1,625 |
| 02/07 | Income is deposited | \$2,625 |
| 02/14 | Income is deposited | \$3,625 |

Figure 1—Bank statements for the income condition (left) and balance condition (right) present equivalent information using different presentation formats. The statement period was Jan. 15 – Feb. 14 because data collection occurred on Feb. 15.

After considering the bank statement, participants decided whether they would choose the cheaper car repair (\$300) or the comprehensive and more expensive servicing (\$1,200). Note that while the \$300 repair is less than both income payments (\$1,000) and the ending balance (\$3,625), only the balance (and not income) is larger than the expensive \$1,200 repair.

Subsequently and on a new page, participants indicated the maximum amount of money they felt they could spend (right now), given the financial profile. The purpose of this exercise was to have participants think about their spending limit. At the end of the study (following comprehension checks), participants self-coded their response as pertaining to the starting balance (\$1,075), ending balance (\$3,625), income (\$1,000), other, or none of the above, by selecting all that applied.¹

Prior to self-coding their own response, participants encountered two comprehension questions (on separate pages). The first question asked participants to identify the starting balance on Jan. 15 out of a set of three options (\$575; \$1,075 = correct; \$1,575). The second

¹ The self-coding was positioned at the end of the survey to ensure that participants were not reminded of aspects of the financial statements (i.e., starting and ending balance, and income) prior to the comprehension questions, which asked about these very metrics.

question asked participants to identify the entire financial scenario out of a set of three options (the correct response had the starting balance, ending balance, total income, and total expenses; for exact wordings see web appendix A).

Results

Income and balance as measures of available funds (H1). All participants were included for analysis ($M_{\text{age}} = 39$; 63% female). We first examine whether participants were more likely to consider income or balance information when thinking about their spending limits (as indicated by the self-coded responses). Consistent with H1, participants in the income condition were more likely to say their spending limits would be based on the \$1,000 weekly income (60.4% vs. 45.4%; $t(498) = 3.36, p < .001$). Conversely, participants in the balance condition were more likely to indicate their spending limits would relate to their starting or ending balances (66.1% vs. 49.6%; $t(498) = 3.72, p < .001$).

Choice between cheap or expensive option (H2). In the income condition, only 20.16% of participants (50/248) chose the expensive \$1,200 option, compared to 38.25% (96/251) in the balance condition ($b_{\text{logistic}} = 0.897, se = .205, t(498) = 4.38, p < .001, \text{Cohen's } d = .40$). This is consistent with our prediction, as participants who perceive their available funds as \$1,000 (of income) should be averse to overspending this amount on the expensive \$1,200 car maintenance.

To ensure these results are not driven by participant misunderstanding, we reconsider the results based on participant comprehension. There was a meaningful rate of incorrect responses to the comprehension questions, which may not be surprising, given the task to recall specific numbers from the bank statement. There were no differences in the rates of incorrect responses

to comprehension questions across conditions ($ps > .46$; web appendix A). The main analysis on the choice of the cheaper or more expensive option remains significant when excluding then 94 participants who incorrectly recalled the starting balances ($b_{\text{logistic}} = .723$, $se = .228$, $t(404) = 3.18$, $p = .002$, Cohen's $d = .32$), the 115 participants who incorrectly recalled the entire financial sequence ($b_{\text{logistic}} = .682$, $se = .233$, $t(383) = 3.18$, $p = .003$, Cohen's $d = .30$), or the 181 who recalled either incorrectly ($b_{\text{logistic}} = .582$, $se = .260$, $t(317) = 2.24$, $p = .025$, Cohen's $d = .25$).

Discussion

Study 1 describes finances in a manner consumers might naturally encounter them: as a monthly bank statement. All participants saw the same starting balance, number of financial events, and event descriptions, and funds accumulated at the same rate and to the same level. Consistent with H1, attending relatively more to income information (based on condition assignment) increased the likelihood that participants self-reported considering income when thinking about the maximum amount of money they could spend. Consistent with H2, participants in the income condition—who should prefer to avoid spending more than \$1,000—were less likely to choose a \$1,200 purchase than those in the balance condition.

These results illustrate how the simple presentation format of personal finances affects judgments and decisions. Consumers attempt to underspend the amount they attend to, even if that number reflects an arbitrary presentation of their financial state. Nevertheless, study 1 is somewhat of a caged test of both attention *and* income versus balance. We manipulate attention, rather than observing endogenous attention. We summarize a time series of financial transactions in a single bank statement, rather than allowing participants to experience financial information

over time. Therefore, the subsequent study introduces a new paradigm that allows us to observe self-direction attention and repeated spending decisions over time.

Study 2: Incentivized Game with Endogenous Attention

We developed an incentivized game to observe how attention to either income or balance relates to spending decisions over time. The game is constructed around several desirable properties. First, we make both income and balance information available and measure attention to each (proxied by mouse-tracking). Second, the game is incentive-compatible, as all participants share the same financial goal and can earn individual bonus payments through strategic spending behavior. Third, there are many repeated observations, allowing participants to experience (and researchers to observe) financial information and spending decisions over time.

Method

Participants. A total of 400 participants were recruited from Amazon Mechanical Turk (MTurk). We preregistered a plan to exclude participants who never checked either their income or balance information during the incentivized four-week game, as these participants lack the necessary variation for analyses. The exclusion resulted in a remaining sample of 387 participants. We deviated from our preregistration by excluding an additional 36 participants who had extreme spending behavior extraordinarily inconsistent with the incentives of the game. This deviation does not meaningfully impact the interpretations of our results (web appendix B). One additional participant was excluded for having incomplete data, resulting in a final sample of 350 subjects ($M_{\text{age}} = 40.84$; 38% female).

Game structure. The spending game was structured as a series of simulated “days” organized into five-day “weeks” (Monday-Friday), though the entire experiment occurred within a single session. Every day began with an income payment, ostensibly representing daily wages from work. Subsequently, participants had the opportunity to earn points by purchasing consumer products with various costs. Participants maximized points to earn a larger bonus payment. There were five weeks; the first was described as “practice” and the final four constituted the incentivized game. As preregistered, we only consider the incentivized four weeks in our analysis.

Daily income. Dollars were earned each day in exchange for clicking a button ten times to simulate work. We used variable income—rather than fixed income—to make the game more engaging and reflect the experience of an increasing number of US households with non-salaried, part-time, or volatile income (West, Whillans, and DeVoe 2020). Daily income was repeatedly drawn in whole-dollar increments from the uniform distribution bound by [\$100, \$200]. Participants were informed of the lower and upper income bounds, as well as the expected value of draws from this distribution (\$150 each day; \$3,000 over the span of 20 days). After simulating work each day, participants progressed to the main spending screen.

Mouse-tracking. Daily income information was not immediately available on the spending screen. Instead, participants checked this information by hovering their mouse over a box labelled “Daily Income.” On the other side of the screen, hovering over another box labelled “Current Balance” revealed the bank balance (figure 2, panel A). Balance always integrated the current day’s income with any past accumulation. For example: a daily income of \$167 would be added to the previous day’s accumulated balance of \$63 to display a current balance of \$230. Either piece of financial information remained visible only while the participant’s mouse

remained within the perimeter of the information area. The sequence of dwell times was recorded for both the daily income and current balance regions of interest.

Daily purchase menu. Each day, participants repeatedly encountered a menu of 12 possible purchases with prices ranging from \$65 to \$590 (figure 2, panel B). These potential purchases were marked by images depicting ordinary consumer goods (e.g., household cleaning supplies, clothing, and home appliances). The images and product categories were intended to enhance participant engagement and game playability; these were not relevant to the game's incentive structure. In addition to price, each item had another attribute: points. Higher points were associated with higher prices. Participants maximized their real bonus by collecting as many points as possible through purchases. Points decayed exponentially through repeated consumption of the same item. Additional information about the precise point mechanics is available in web appendix B.

Financing purchases. During the incentivized four-week game, participants had access to zero-interest financing, allowing them to spend beyond their balance at any moment without penalty. However, there was a substantial penalty for ending the game in debt, with borrowed money being repaid directly from points at a rate of 3 points per dollar. Therefore, the optimal strategy involved spending all (or nearly all) income without incurring substantial debt by the end of the game. This incentive structure ensures debt-aversion exists in our game, without introducing any precautionary savings goals. This allows us to interpret deviations from this target (spending all income) as inadvertent (H4).

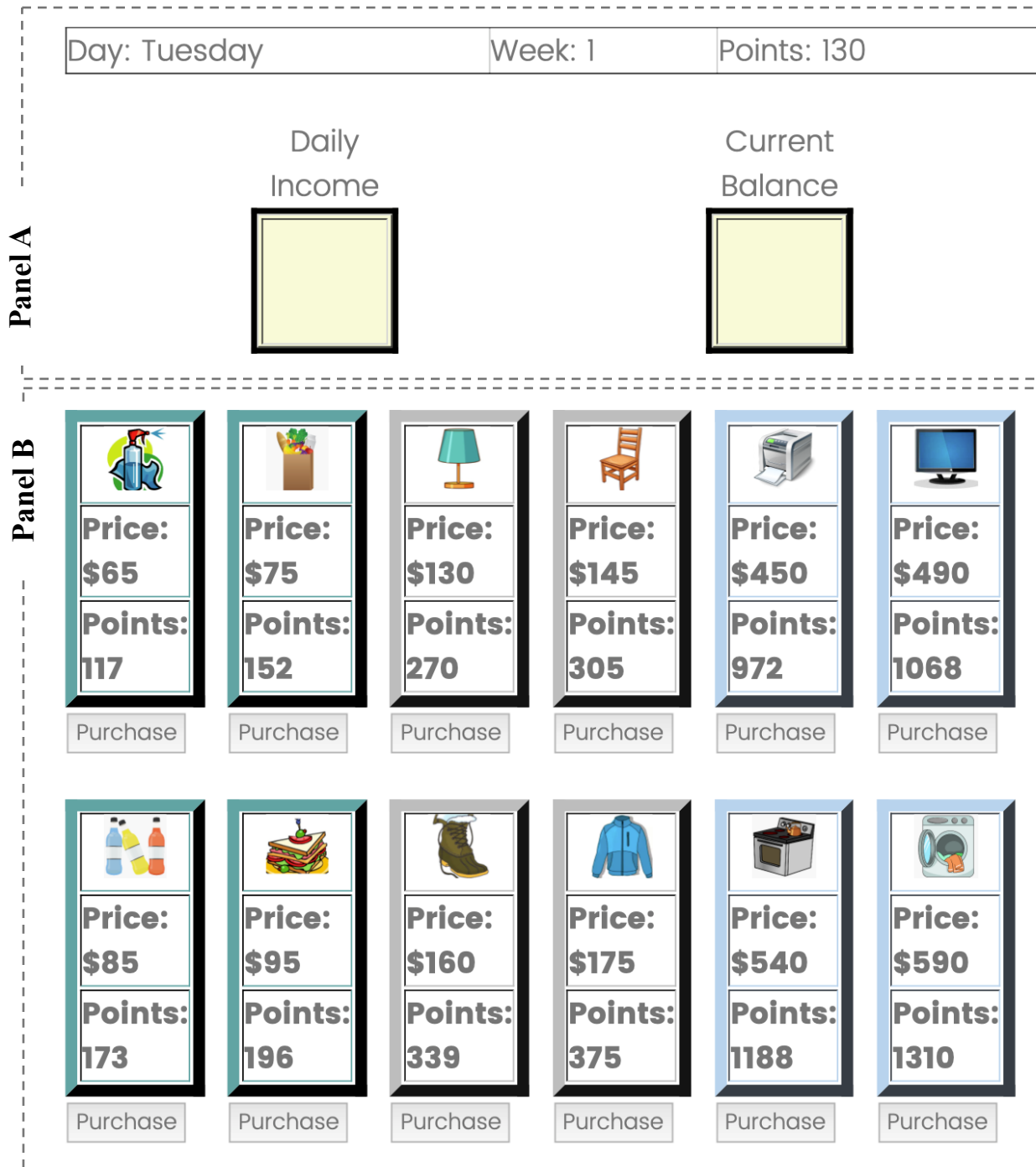


Figure 2—The daily game screen, as viewed by participants in study 2. Panel A permanently displayed game information (day of week, week, points). It also required a mouse hover to reveal income or balance information. Panel B is the grid of 12 possible purchases. Each purchase had a fixed price during the game, but the associated points diminished exponentially through repeat consumption.

Incentives. Participants knew they would have an opportunity to earn an additional bonus based on their income and spending decisions. Prior to starting the game, participants knew only that the maximum bonus was \$0.20 and that they could increase their likelihood of receiving a larger bonus by scoring as many points as possible. Bonuses were issued to participants who scored 5,550 points or more and the amount increased by \$0.01 for every 50 additional points until reaching the limit of \$0.20.

Learning and feedback. Game mechanics were learned through a series of instructions with five comprehension checks (web appendix B). After completing the instruction exercises but before playing the incentivized game, participants tested the game for one practice week. At the conclusion of the practice week, all participants received feedback about their daily incomes, end-of-week balance, total points, and total score, which was the number of points adjusted for any debt penalty. This feedback was not provided during the incentivized portion of the game.

Analysis Plan

Levels of analysis. The nature of the spending game allows us to consider the data at multiple levels. The trial-level data consist of repeated daily observations. These data can be analyzed to consider how daily attention relates to underspending daily income or balance (H2) as well as the amount of daily spending (H3). These repeated measures can also be aggregated into game-level measures. The aggregate-level analysis tests whether relative attention to income or balance throughout the game corresponds to different accumulation outcomes (H4).

Independent variables. Mouse-tracking data serves as our proxy for attention. We use mouse-tracking data to construct two attention variables, both at the daily level. First, we

construct the “proportional² attention to income” as the total dwell time, in milliseconds, in the income region / total dwell time in both regions. This will be used to examine how relative attention to income relates to spending less than income (H2) as well as overall accumulation and game performance (H4). Second, we will construct “proportional attention to the larger amount” as the proportion of dwell time in the region with the larger dollar amount. This will be used to examine how attention to the larger metric relates to daily spending amounts (H3).

Daily income surplus as the dependent variable for H2. Recall, H2 proposes relative attention to either income or balance increases the likelihood of underspending that amount. We use the terminology *income surplus* to signify underspending daily income ($\text{Spending}_t < \text{Income}_t$) and *balance surplus* to signify underspending relative to the current balance ($\text{Spending}_t < \text{Balance}_t$). H2 predicts proportional attention to income (balance) will be positively associated with the likelihood of an income (balance) surplus.

As preregistered, our focus is the income surplus (for testing H2), not the balance surplus. While both are of similar conceptual interest, there are mechanical limitations to hypothesis testing the balance surplus in our paradigm, because of the non-independence between an income surplus and a balance surplus. In our sample, balance exceeds income on 81% of days³. Therefore, an income surplus mathematically implies a balance surplus on these 81% of days. This implies a contradiction that attending proportionally *more* to income—and therefore proportionally *less* to balance—is associated with more income surpluses *and* more balance surpluses. Because we do not expect attending proportionally less to balance should correspond with more balance surpluses (and instead, explain how this is a mechanical artifact due to

² We construct a proportional measure (rather than using raw mouse-tracked timings), because proportion is a useful proxy for the allocation of attention that is not affected by individual differences in response time.

³ After day 1, where income and balance are mechanically guaranteed to be identical.

balance being systematically larger than income in our paradigm), we preregistered an interest in only income surpluses.

Our formal model regresses an indicator variable for whether a given participant experienced an income surplus on a given day (1 if $\text{spending}_t < \text{income}_t$; 0 otherwise) on the following predictors: daily mean-centered proportional attention to income, daily mean-centered income, their interaction, the subject's average daily proportional attention to income, the subject's total income, and a set of day fixed effects. Mean-centering occurred at the participant level. To address issues of non-independence between observations, we use participant-level cluster-robust standard errors. We consider this analysis using both a logistic regression (web appendix B) as well as a linear probability model.

Exploratory analysis of daily balance surplus for H2. As an alternative and exploratory method for analyzing balance surpluses (alongside income surpluses), we consider both model-free evidence and bunching analyses on the distributions of spending (Allen et al. 2017).

Daily spending as the dependent variable for H3. To address H3 (attending relatively more to the larger metric is associated with more spending), we consider the relationship between the proportional attention to the larger amount and daily-level spending. Our formal model regresses daily spending on the same set of predictors as specified for income surpluses, except the proportional attention to income is replaced with the proportional attention to the larger amount.⁴

Spending deviation as the dependent variable for H4. Given the incentive structure of the game, optimal accumulation is \$0 (or very near \$0) by the end of the game. Spending too little or

⁴ Conceptually and statistically, this resembles using the identical set of predictors as the surplus analysis and including an interaction term indicating whether income or balance is greater on a given day (web appendix B).

too much results in a lower bonus payment. Therefore, we construct a measure of inadvertent accumulation simply as the deviation in total spending from total income ($\text{abs}(\text{total spend} - \text{total income})$). We regress this on a participant's average proportional attention to income throughout the 20-day game.

Results

Attention. At the trial level, participants generally attended to financial information, with at least one piece of information considered on 86% of days. Across all participants and days, the mean proportion of time examining income information was .259 ($SD = .275$). Averaging the daily proportional attention to income measure at the participant level produced a nearly identical measure of subject-level attention to income ($M = .256$, $SD = .198$). A further analysis of the trial-level data suggests the proportional attention to income information decreased over the 20 days of the game ($b = -.009$, $se = .001$, $t(331) = -12.60$, $p < .001$). This is addressed by the day fixed effects in our trial-level analyses. The mean number of days checking income during the 20-day game was 10.55 ($SD = 6.99$), compared to a mean of 16.66 days checking balance ($SD = 4.83$). These relatively high frequencies imply participants often checked both income and balance on a given day; on average, both pieces of information were checked on 9.96 days during the game ($SD = 6.94$).

Earning and spending. Participants earned an average of \$3,002 during the 20-day game ($SD = \$130$), coinciding with the expected value of \$3,000 ($\sum_{i=1}^{20} X_i \sim U[100, 200]$). On average, participants spent a total of \$2,905 ($SD = \328), reflecting significant spending deviation of \$97, relative to their total income ($b = 97.28$, $se = 17.57$, $t(349) = 5.54$, $p < .001$). Some participants

who underspent their income by less than \$65 may have done so strategically (see web appendix B). However, 105 of all participants (30%) ended the game with a surplus of \$65 or more, which could have been used to earn points without penalty. Therefore, the observed underspending at the aggregate level is not easily rationalized or explained by strategic motivations. As previously discussed, balance exceeded income on 81% of days after the first day.

Daily attention to income relates to more daily income surpluses (H2). Income surpluses occurred on 71% of days. H2 predicts higher levels of proportional attention to income will be associated with greater instances of income surpluses. Our formal analysis regressed an indicator variable for income surpluses on the set of trial-level predictors, discussed previously. The linear probability model identified a significant coefficient on the proportional attention to income variable ($b = .206$, $se = .031$, $t(217) = 6.57$, $p < .001$), which was not qualified by a significant interaction with income ($p = .110$) (table 1).

| | <i>Dependent variable:</i> | |
|--|----------------------------|----------------------------|
| | Income Surplus (1) | Spending (2) |
| Prop. Attn. to Income (MC) | 0.206*** (0.031) | |
| Prop. Attn. to Larger (MC) | | 158.444*** (11.402) |
| Income (MC) | 0.001*** (0.0002) | 0.509*** (0.098) |
| Avg. Prop. Attn. to Income | 0.179*** (0.034) | |
| Avg. Prop. Attn. to Larger | | 46.083*** (7.804) |
| Total Income | -0.00001 (0.00004) | 0.065*** (0.010) |
| Prop. Attn. to Income (MC) x Income (MC) | 0.002 (0.001) | |
| Prop. Attn. to Larger (MC) x Income (MC) | | 0.685 ⁺ (0.371) |
| Constant | 0.847*** (0.119) | -116.721*** (32.302) |
| Observations | 6,040 | 6,040 |
| R ² | 0.071 | 0.087 |
| Adjusted R ² | 0.068 | 0.084 |
| Residual Std. Error (df = 6015) | 0.447 | 216.452 |

Note: + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 1—Daily-level regression results for the income surplus indicator variable (col 1) and daily spending (col 2). Standard errors are cluster-robust.

These results suggest greater attention to income is associated with an increased likelihood of spending less than income on a given day, after accounting for the daily draw of income, the subject-level average attention, total income, and the day of the game. The model

predicts about a 20-percentage point greater likelihood of an income surplus for someone who exclusively attends to income versus someone who exclusively attends to balance. As expected, there is also a similarly-sized positive association between a participant's average proportional attention to income (a model covariate) and the likelihood of income surplus ($b = 0.179$, $se = .034$, $t(82) = 5.25$, $p < .001$).

Visualizing income and balance surpluses (H2). The preceding analyses consider a binary measure of income surplus. Additional insights may be gained through exploring whether consumers underspend their available funds by a small or large margin. Therefore, we consider an additional exploratory method to visualize and analyze both income surpluses and balance surpluses independently.

We visualize daily surpluses for both income and balance by considering whether or not participants view each type of financial information on days with non-zero spending (figure 3). The visual discontinuities are apparent and consistent with our predictions.

There are discontinuities at zero in the income surplus distributions when participants viewed income but not when they did not view income. Beyond visual inspection, we can test this discontinuity using the bunching analysis procedure detailed in Allen et al. (2017). We use bins of \$5, a smoothing window of $[-100, 100]$, and a bunching window of $[0, 20]$, and we find consistent results. There was bunching as expected for income surpluses just above 0 when participants looked at income (total: excess mass = 28%, 95% bootstrapped CI = [11%, 47%]; income-only: 89%, [11%, 175%]), but not when participants did not look at income (total: 15%, [-1%, 34%]; balance-only: 15%, [-4%, 36%]).

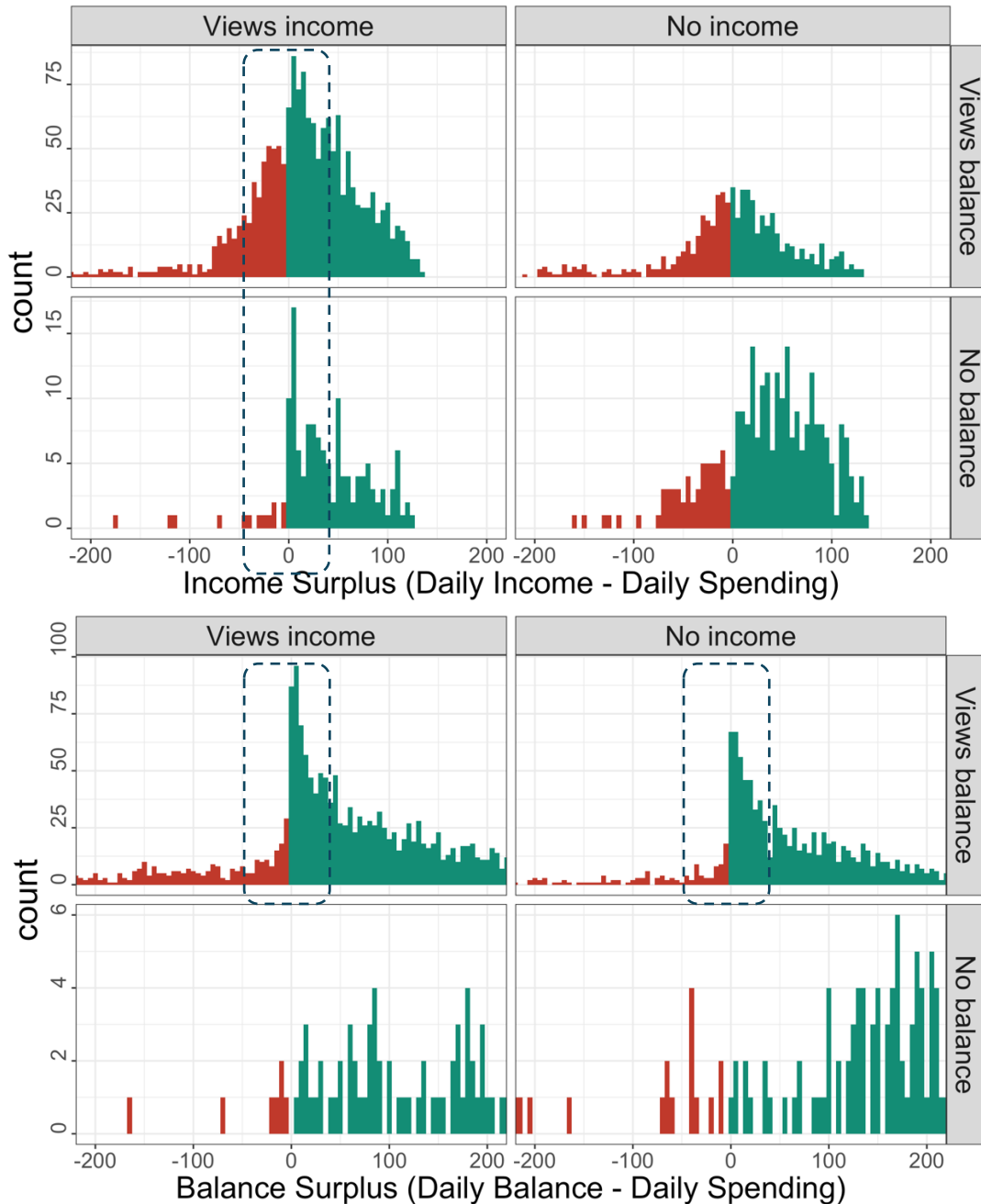


Figure 3—Visualizations of the income surplus (upper) and balance surplus (lower) for observations categorized by whether they viewed income (left column) or not (right column), and whether they view balance (top row) or not (bottom row). Non-negative surpluses are green and negative surpluses (deficits) are red. Plots include data from days with a non-zero amount of spending. We are especially interested in the discontinuities highlighted by the dashed outlines.

Similarly, there are discontinuities at zero in the balance surplus distributions when participants viewed balance but not when they did not view balance. Using the analogous

analysis, there was bunching as expected for balance surpluses just above 0 when participants looked at balance (total: 101%, [82%, 122%]; balance-only: 116%, [87%, 148%]), but no bunching or less bunching when participants did not look at balance, although these latter intervals are non-informative due to small samples (total: 47%, [-22%, 247%]; income-only: 55%, [-64%, 705%]).

Daily attention to the larger amount relates to more daily spending (H3). Though income and current balance are merely different metrics depicting the same financial situation, participants' spending appears sensitive to which metric is most attended to. Specifically, attending more to the larger amount was associated with greater daily levels of spending ($b = 158.44$, $se = 11.40$, $t(196) = 13.90$, $p < .001$). This represents a \$158 difference in expected spending between two people with an average draw of income, where one attends only to the larger metric and the other attends only to the smaller metric. This may be especially pronounced on days with larger income draws, as suggested by the marginally significant interaction between the daily mean-centered draw of income and the daily mean-centered proportional attention to the larger metric ($b = .69$, $se = .37$, $t(173) = 1.85$, $p = .067$) (table 1).

Attention to income is associated with greater spending deviations (H4). Does greater relative attention to income correspond with more deviant spending, relative to the incentivized goal of spending completely? As previously reported, the average participant spent about \$97 less than their total income. When considering spending deviations (the absolute deviation between income and spending), the average participant deviated by \$145.

As predicted by H4, the magnitude of the deviations was higher among those who attended relatively more to income, throughout the game. Specifically, higher average proportional attention to income was indeed associated with larger spending deviations

throughout the game ($b = 316.52$, $se = 72.95$, $t(348) = 4.34$, $p < .001$). Table 2 presents the full aggregate-level regression results, including analyses on total spending (rather than spending deviations relative to income) and game score.

| | Spending Deviation (1) | Total Spending (2) | Score (3) |
|-------------------------|---------------------------|-------------------------|----------------------------|
| Avg Prop Attn Income | 316.518*** (72.951) | -315.476*** (78.683) | -1,169.616*** (181.084) |
| Total Income | | 1.091*** (0.120) | 2.140*** (0.276) |
| Constant | 64.626** (23.552) | -289.590 (360.359) | -203.489 (829.339) |
| Observations | 350 | 350 | 350 |
| R ² | 0.051 | 0.219 | 0.224 |
| Adjusted R ² | 0.049 | 0.215 | 0.219 |

Note: + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 2— Aggregate-level regression results for spending deviations (col 1), total spending (col 2), and score (col 3).

Discussion

The experimental game in study 2 provides participants with funds, an assortment of options to buy, and a simple spending goal. Within this paradigm, we observe how participants navigate information and decisions over time. We neither force nor prescribe a specific type of information, and participants are free to attend to income and/or balance as they see fit.

We observe several patterns of behavior that are consistent with our hypotheses. Higher proportional attention to income is associated with more income surpluses (H2). Model-free evidence and bunching analyses suggest there may be spending discontinuities such that participants systematically spend right up to—but not over—the amount of the metric they attend to. These results further support H2. We also observe a relationship between proportional attention to the larger amount and higher levels of daily spending (H3). Finally, we observe that

greater proportional attention to income during the 20-day game is associated with larger spending deviations, relative to the incentivized goal (H4).

The study 2 paradigm allows us to observe spending decisions over time while participants actively allocate their attention between income and balance information. One trade-off of the paradigm is that while we benefit from the flexibility of endogenous attention, we are limited in our ability to make causal claims within this paradigm. Therefore, we conducted study 3 to explore causality (using a slightly modified version of the study 2 paradigm) as well as to achieve a balanced distribution of (manipulated) attention to income and balance.

Study 3: Incentivized Game with Exogenous Attention

Study 3 uses the same experimental game developed for study 2, except we independently manipulate attention to income and balance information. This allows for (1) separate measures of attention to income and attention to balance, (2) while clarifying the direction of causality between income and spending, and (3) ensuring roughly equal numbers of observations for attending to versus not attending to income and balance information.

Method

Participants. We recruited 479 participants from MTurk to take part in this experiment. A total of 53 participants were removed following our preregistered plan to exclude subjects who dramatically overspent or underspent.⁵ This is the same exclusion rule implemented (but not

⁵ We preregistered to excluded participants who spent less than \$1,500 or more than \$4,500 during the course of the 20-day game. All participants were informed that their expected earnings (therefore target spending) during the game was \$3,000.

preregistered) in study 2. The game failed to fully load for one additional participant, who was therefore removed from the data. This resulted in a final sample of 425 participants ($M_{\text{age}} = 38.15$; 47% female).

Manipulating availability of financial information. All aspects of the game were identical to study 2, except the manipulation of available financial information. Whereas study 2 measured attention to either income or balance information, study 3 manipulated the availability of such information and thus, we argue, attention to it. Participants were assigned across a 2 (Income Information: available, absent) x 2 (Balance Information: available, absent) factorial design. Condition assignment determined whether each piece of financial information was available when participants made their consumption decisions. We use the availability of information as a proxy for attention to information. While attention and availability should be closely aligned when only one piece of information is available, we recognize the cases when both or neither pieces of information are available are more opaque. Study 2 suggests people overwhelmingly look at balance over income; therefore, the same pattern may arise when both are available. When neither piece of information is available, participants are not attending to daily variation in income or balance; instead, they must use some alternative strategy (e.g., using expected daily income as a spending target).

When available (based on condition assignment), income and balance information were presented in the same regions as in study 2 (figure 2). As in the prior study, the instructions provided sufficient information about expected income for a reasonable strategy, regardless of condition (see web appendix B). Even in the no-information condition, participants knew they could expect to earn about \$3,000 over the course of the game.

This experimental design avoids concerns of endogeneity between attention and spending. Here, we exogenously manipulate whether participants *can* attend to either type of information; we expect people *will* attend to whatever is presented.

Analysis Plan

The same core set of models from study 2 are used in study 3. All predictors and model specifications remain the same, except (1) we no longer have a measure of participant-level average attention, and (2) we use a set of dummy-coded condition variables to capture attention to income vs. balance. Specifically, we construct a dummy variable for the condition with only income information available (*Income Only*), only balance information available (*Balance Only*), and no information available (*No Information*). This leaves the condition with both available income and balance information as the reference group. We use the case of full information as the reference group because it allows for easy comparison against the two conditions that are of greatest interest: Income Only (the comparison represents making balance information unavailable) and Balance Only (the comparison represents making income information unavailable). The model also compares the reference group against the case in which no information is available. Though the No Information condition may be informative, we note that participants assigned to this condition may adopt a qualitatively different game strategy than those in the other three cells, who have access to daily information.

Results

Earning and spending. Participants earned an average of \$3,004 during the 20-day game (SD = \$128) and spent a total of \$2,828 (SD = \$507), on average. As in the prior study, this reflects a significant degree of underspending relative to realized income ($b = -176$, $se = 25$, $t(424) = -7.16$, $p < .001$). 45% of participants ended the game with a balance surplus greater or equal to \$65 (the cost of the lowest-priced item), meaning this group of participants could have earned more points by making at least one additional purchase.

Daily attention to income increases income surpluses (H2). Participants ran income surpluses on 73% of days. According to H2, the frequency of these surpluses should be highest when participants attend relatively more to income. Within our experimental design, proportional attention to income should be highest in the Income Only condition. Therefore, we expect a positive effect of being in the Income Only condition on the likelihood of maintaining an income surplus. Similarly, we expect a negative effect of being in the Balance Only condition (because compared to having full information, this condition removes income information). This is the pattern we observe. Compared to having both income and balance information, having only income information increased the likelihood of maintaining an income surplus ($b = .047$, $se = .016$, $t(209) = 2.94$, $p = .004$) and having only balance information decreased the likelihood of maintaining an income surplus ($b = -.042$, $se = .013$, $t(223) = -3.12$, $p = .002$). There was no additional effect of being assigned to the No Information condition ($b = -.004$, $se = .015$, $t(205) = -.25$, $p = .799$), relative to the full information condition (table 3).

| | Income Surplus (1) | Spending (2) |
|---------------------------------|-------------------------------|-----------------------------|
| Income Only | 0.047** (0.016) | -5.763 ⁺ (3.075) |
| Balance Only | -0.042** (0.013) | 6.009** (2.150) |
| No Information | -0.004 (0.015) | -0.763 (4.015) |
| Income (MC) | 0.001*** (0.0003) | 0.283 ⁺ (0.148) |
| Total Income | 0.0001 ⁺ (0.00005) | 0.025* (0.010) |
| Income Only x Income (MC) | -0.001 (0.0005) | 0.464 ⁺ (0.247) |
| Balance Only x Income (MC) | 0.0001 (0.0005) | 0.375 (0.234) |
| No Information x Income (MC) | 0.002** (0.0005) | -0.502* (0.208) |
| Constant | 0.552*** (0.139) | 82.085* (33.974) |
| Observations | 8,500 | 8,500 |
| R ² | 0.037 | 0.027 |
| Adjusted R ² | 0.034 | 0.024 |
| Residual Std. Error (df = 8472) | 0.438 | 217.862 |

Note: + p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Table 3—Regression results for daily income surplus (col 1) and daily spending (col 2). Income surplus represents spending < income on a given day. Standard errors are cluster-robust.

Visualizing income and balance surpluses (H2). Following the same approach as in study 2, we again consider the surplus distributions by attention condition. Figure 4 plots the income surpluses and balance surpluses on days with non-zero spending. Again, we observe visual discontinuities around the zero surplus, reflecting a pattern of behavior where participants systematically spend near—but not beyond—the amount conveyed by the metric they attend to.

There are discontinuities at zero in the income surplus distributions when participants viewed income (total: excess mass = 57%, 95% bootstrapped CI = [37%, 80%]; income-only: 83%, [51%, 117%]), but not when they did not view income (total: -9%, [-23%, 5%]; balance-only: 5%, [-15%, 27%]). Similarly, there are discontinuities at zero in the balance surplus distributions when participants viewed balance (total: 89%, [70%, 108%]; balance-only: 98%, [74%, 124%]), but less-so when they did not view balance (total: 28%, [1%, 61%]; income-only: 52%, [16%, 96%]). In this latter case, the excess mass is potentially attributable to the ability to roughly track balance over time using income and spending information.



Figure 4—Visualizations of the income surplus (upper) and balance surplus (lower) across the conditions assigned in this experiment. Income information was either available (left column) or not (right column), and balance information was either available (top row) or not (bottom row). Non-negative surpluses are green and negative surpluses (deficits) are red. We plot only data on days with a non-zero amount of spending. We are especially interested in the discontinuities around zero, highlighted by the dashed outlines.

Daily attention to income versus balance affects daily spending (H3). Whereas study 2 (with endogenous attention) allowed for a clearer test of the relationship between attention to the larger (of income and balance) and daily spending, study 3 lacks daily variation in attention. However, we note that income was smaller than balance on 75% of days⁶. Therefore, we consider how condition assignment affects daily spending. There is a marginally significant negative effect of having only income information on spending ($b = -5.76$, $se = 3.06$, $t(209) = -1.87$, $p = .062$). Furthermore, there is a positive effect of having only balance information on spending ($b = 6.01$, $se = 2.14$, $t(224) = 2.80$, $p = .006$). There is no difference between having full information and having no information ($b = -.763$, $se = 4.00$, $t(205) = -.19$, $p = .849$) (table 3).

Attention to income leads to greater spending deviations (H4). How close were participants to their incentivized goal of spending their entire income without ending the game in debt? Compared to the Full Information condition (where the average spending deviation was \$181), spending deviations in the Income Only condition were \$279.43 larger at the end of the game ($se = 50.37$, $t(421) = 5.55$, $p < .001$). There was no difference between having full information and having only balance ($b = -37.65$, $se = 48.94$, $t(421) = -.77$, $p = .442$). Participants who had no information performed the worst, with the most deviant spending (\$439 worse than the full information condition; $se = 50.77$, $t(421) = 8.64$, $p < .001$). Table 4 presents the full aggregate-level regression results, including analyses on total spending (rather than spending deviations relative to income) and game score.

⁶ After day 1, where they were equivalent.

| | Spending Deviation (1) | Total Spending (2) | Score (3) |
|-------------------------|---------------------------|--------------------------------|-----------------------|
| Income Only | 279.431*** (50.369) | -115.260 ⁺ (68.243) | -644.027*** (114.880) |
| Balance Only | -37.646 (48.936) | 120.186 ⁺ (66.280) | 82.937 (111.575) |
| No Information | 438.845*** (50.774) | -15.268 (68.750) | -744.929*** (115.733) |
| Total Income | | 0.502** (0.189) | 1.564*** (0.318) |
| Constant | 181.124*** (34.603) | 1,317.704* (568.820) | 1,184.837 (957.541) |
| Observations | 425 | 425 | 425 |
| R ² | 0.223 | 0.043 | 0.201 |
| Adjusted R ² | 0.218 | 0.034 | 0.194 |
| Residual Std. Error | 367.838 (df = 421) | 498.039 (df = 420) | 838.391 (df = 420) |

Note: + p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Table 4—Aggregate-level regression results for spending deviations (col 1), total spending (col 2), and score (col 3).

Discussion

This experiment extends the study 2 results by independently manipulating attention to income and balance through the availability or absence of information. By exogenously manipulating income and balance separately, the current study investigates the causal role of attention to income and attention to balance on spending behaviors. The results are broadly consistent with those from the prior study, increasing our confidence in the set of results as well as the results from study 2.

Compared to study 2, the study 3 design both strengthens and limits our ability to test H2. The major benefit is that we move away from the endogenous proportional attention measure, which allows us to more cleanly analyze balance surpluses. Specifically, we observe that not having balance information (as in the Income Only and No Information conditions) leads to fewer balance surpluses. However, there was no effect of having both income and balance

information versus having only balance information. This seems initially at odds with our account, because having both income and balance information should *decrease* the relative attention to balance, compared to having only balance. But we cannot fully know this, without measures of attention. Hence, the exogenous manipulation of attention in study 3 also limits our ability to test H2, as we cannot be sure whether participants who were presented with both income and balance *actually attended* to both, or perhaps *only* attended to balance.

Similarly, without daily variation in attention, we lack a perfect test of H3 (attending to the relatively larger amount increases daily spending). However, we leverage the insight that balances generally exceeded income amounts (on 75% of days) and find that systematic attention to only income throughout the game marginally decreased daily spending, and systematic attention to only balance throughout the game increased daily spending (table 3).

Such limitations reflect the trade-off between endogenous and exogenous variation. The purpose of considering both studies 2 and 3 together is to observe the broadly consistent pattern between the two. Taken together, these studies provide convergent evidence on a core set of findings that participants' attention relates to their systematic avoidance of overspending the attended-to amount (H2), which impacts their daily spending (H3), and their ability to manage their accumulation over time (H4).

GENERAL DISCUSSION

Consumers constrain their spending in the present, and we consider how they arrive at their perceived level of constraint. Specifically, we propose and test that consumers will be insufficiently sensitive to the financial differences implied by income (a flow) and balance (a

stock). Rather than fully considering the underlying financial situation implied by a rate of change or a level, consumers will respond to the dollar amount of each metric. Consequently, consumers' attention to either metric increases the likelihood they perceive the amount of that metric as their amount of available funds (H1; study 1). Reference-dependent debt aversion implies consumers will avoid spending more than this amount (H2; studies 1-3), which in turn suggests that whichever metric is larger (in amount) will enable higher levels of spending (H3; study 2). Over time, consumers who attend to income may become more unaware and less calibrated regarding their prior accumulation, compared to consumers who attend to balance (H4; studies 2-3). Taken together, these findings suggest consumer judgments and decisions are sensitive to the specific metrics used to describe a given financial scenario.

Contributions

These findings offer multiple contributions to the literature. First, we advance the understanding of how consumers establish their spending constraints. Whereas much of the prior work has focused on limiting consumption (Krishnamurthy and Prokopec 2010; Shefrin and Thaler 1988; Thaler 1980, 1985, 1999; Wertenbroch 1998) or allocation of available funds through budgets or spending plans (Antonides, Manon de Groot, and Fred van Raaij 2011; Heath and Soll 1996; Stille, Inman, and Wakefield 2010; Zhang et al. 2022; Zhang and Sussman 2018a), we seek to clarify how consumers think about their available funds in the first place. We find consumers represent their available funds—at least in part—as they are presented, as either the amount of income or amount of balance. Whereas consumers could translate income to balance or balance to income, our findings suggest this is not the case.

Second, we contribute to the literature on accumulation and stock-flow reasoning by identifying and clarifying the role of attention on information usage. Whereas prior literature considers the importance of either stock versus flow presentation form on judgments and decisions (Cronin, Gonzalez, and Serman 2009; Fischer, Degen, and Funke 2015; Kainz and Ossimitz 2002; Korzilius et al. 2014; Newell et al. 2016; Ossimitz 2002; Reinholtz, Maglio, and Spiller 2021; Spiller, Reinholtz, and Maglio 2020; Sweeney and Serman 2000), we consider how the allocation of attention to stock versus flow information impacts judgments and decisions. This distinction is meaningful for situations in which people may be exposed to or have access to both stock and flow information. Our results suggest the more impactful presentation form will be the one that is relatively more attended to.

Third, we identify how different financial metrics (i.e., income and balance) may have different short-term versus long-term consumer impacts. In the present moment, consumers respond to the amount of the metric they attend to. This affects present spending as consumers avoid spending beyond that specific dollar amount. However, over time, income information and balance information can lead to very different levels of consumer financial awareness. We clarify that income versus balance differ greatly in their ability to remember past accumulation, which may directly impact consumers' progress towards their long-term financial goals.

Implications

Presentation of information. Consumers interpret their finances—in part—through the information that is presented to them. Therefore, financial service providers might evaluate presentation strategies, especially if current presentation strategies reflect somewhat arbitrary

decisions. Specifically, the present research suggests banks, fintech apps, and other financial service providers may be able to better serve their clients by leveraging which information is made available by default (as in study 3). We caution that our entire set of results may not directly generalize to each financial context and especially to each consumer segment. For example, constantly indebted or low-balance consumers might spend less in the short-term when reminded about their low balances, while the opposite may occur for high-balance consumers. However, financial service providers may use our key insight—that presentation form matters—to better understand how to provide tailored solutions to improve the experience of their own customer segments.

Aggregation of information. Another implication of the present work might involve how financial service providers choose to aggregate or disaggregate financial information. For example, different intervals might be used to calculate and display earnings information (e.g., daily income, weekly income, monthly income). To the extent our results suggest people are especially sensitive to the dollar amount conveyed by financial metrics, we expect a \$200 daily income versus a \$1,000 weekly income versus a \$4,000 monthly income would have different effects. Furthermore, account balances may include or exclude various financial components, and may be aggregated or disaggregated when consumers hold multiple accounts. Aggregating information—across intervals and accounts—reflects another decision that may appear arbitrary, but may have consequences for consumer judgments and decisions.

Limitations

Generalizability. As previously discussed, the observed effects are likely context dependent. Different consumers segments who differ along dimensions of income size, income variability, liquid balances, and savings goals may have different spending responses to income versus balance information. However, the previously stated goal of this research is not to prescribe a one-size-fits-all intervention. Instead, the purpose of the present research is to identify that there are two common ways consumers learn about their finances, and attention to one versus the other has a cascading set of implications for how consumers perceive constraint, attempt to constrain spending to avoid debt, how much they spend, and how accurately they manage their spending, over time. Therefore, while we caution that the results from our spending game are not intended to be generalizable, the theory (in the form of H1-H4) should be. We leave it to the information architects who understand their target audience and the segments they serve to apply our hypotheses to make specific predictions.

Spending vs. financial management. Although the game captures behavior over a number of trials, it is focused on repeated spending with limited opportunity for consumers to “take a step back” and consider management of their overall finances (e.g., through an annual budget-setting exercise). In addition to the impact of attention on spending we document here, attention also affects budget-setting (e.g., Mrkva & Van Boven, 2017). Some of the accumulation effects we observe may be different if consumers periodically assess their overall finances, leading to reevaluation of available funds. Given that such reevaluation is also likely sensitive to such attentional effects, this may change, rather than reduce, the cumulative effects of attention.

Small incentives. The maximum achievable bonus in the spending game was \$0.20. This is an admittedly modest amount, and future research may potentially benefit from raising the stakes to feel more consequential. Yet, reviews of the literature find little to no evidence that

incentive sizes alone predict decisions or performance in experimental contexts (Camerer and Hogarth 1999; Carpenter, Verhoogen, and Burks 2005), and participation in a portfolio of similar experiments on AMT over time would lead repeated earning vs. foregoing this sort of bonus to be equivalent to about \$1 per hour in earnings. An important distinction in our sample may be between excluded and included participants. Across both studies, 11% of participants were excluded on the basis of game performance (spending < \$1,500 or spending > \$4,500). By virtue of such erratic spending behavior, none of these participants earned any bonus. Therefore, it is plausible that a sizeable proportion of these participants were *not* motivated by the small stakes of our game. However, considering the participants included for analysis, their behaviors seem consistent with the incentivized, point-maximizing strategy.

Conclusion

The current work sheds further light on attention to different sources of funds and consumer spending behavior. It suggests minor details that direct attention to or from specific financial forms can play a major role in how consumers assess their funds and spend. This identifies a potential opportunity for information architects working with banks and other financial service providers to guide attention in ways that will help consumers towards their stated financial goals.

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