

ECONOMIC BEHAVIOR IN THE DIGITAL AGE

Yaron Levi and Shlomo Benartzi

The digital age has transformed the way people consume information. Usage surveys have found that the average American adult now spends between nine and ten hours a day staring at screens; the majority of our waking life involves interacting with some kind of technological device.¹ This represents a radical shift in information consumption, with Google now processing as much data as is contained in the Library of Congress every few minutes.² The digital age is also reshaping how we make choices. One dramatic change is the unprecedented degree of choice. Amazon, for example, offers more than 2,000,000 books, while Schwab offers 9,313 different mutual funds.

There is scattered evidence that digital devices can have a large effect on behavior. In the education space, Mueller, et al. find that the pen is mightier than the keyboard, as students taking notes by hand (and not on a computer) engage in deeper processing and perform better on follow-up assessments.³ Other research has focused on the health impacts of screens. Diners, for example, choose pizzas with 6.1 percent more calories when ordering online, suggesting that menus on screens might further exacerbate the obesity epidemic.⁴ On the positive side, however, patients are more likely to admit to binge drinking via text messaging than via the more traditional phone line.⁵ Lastly, lab experiments show that consumers demand 38 percent more for the exact same product after buying it on a tablet compared to a laptop; the touchscreen seems to trigger the endowment effect.⁶

This paper explores the effect of the digital age on one of the key economic decisions every household makes: to consume today or save for the future. Understanding this inter-temporal consumption decision has not only been the focus of many notable economists – for example, Nobel laureates Modigliani and Friedman – but also has important policy implications.^{7,8} If people save too little, then they will end up depending heavily on government benefit programs in retirement. On the other hand, if they save too much, then they are potentially compromising their personal well-being.

Our specific research question is how a digital intervention that provides consumers with mobile access to spending information affects consumption and saving decisions. We received our data from Personal Capital, a wealth management firm that offers free account aggregation services to the general public. Users first link all their assets, such as bank accounts and investment accounts, as well as their liabilities, such as credit cards and mortgages. Personal Capital then aggregates the accounts and provides a real time dashboard with the user's net worth, income and spending.

The novel aspect of our data is that Personal Capital has gradually expanded access to the information. While users initially had to log in to a web site to view their account, in 2012 Personal Capital gradually launched an app that made the information available on mobile devices. We study the effect of the mobile app on information consumption as well as inter-temporal consumption decisions. Our sample consists of users who have been accessing the information via the website for at least three months

prior to installing the mobile app. This suggests that subsequent changes in behavior primarily reflect the installation of the mobile app and not the general use of the spending dashboard.

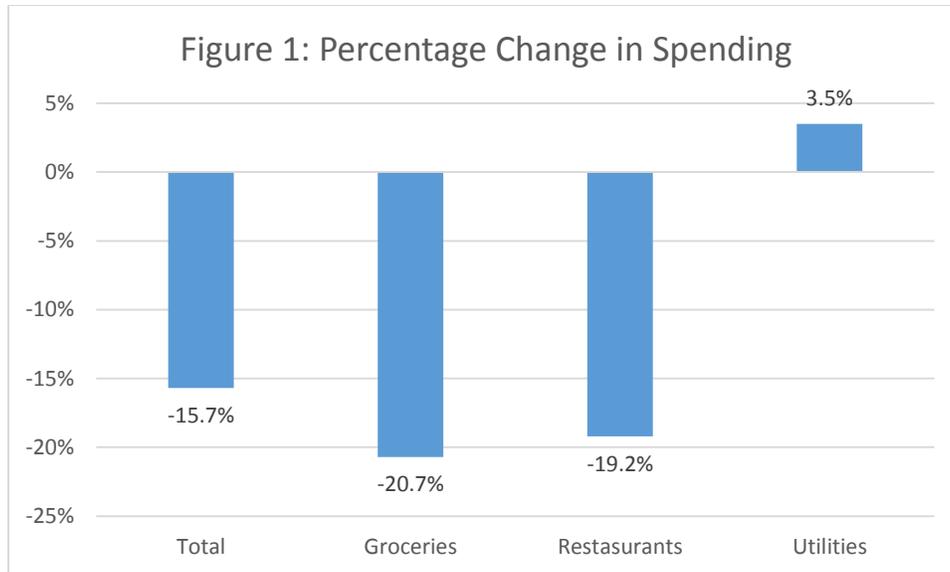
A simple comparison of spending patterns before and after the installation of the mobile app is obviously not sufficient to establish a causal relationship, since the installation itself might reflect a decision to put one's finances in order. Our identification strategy relies on the gradual release of the app. The web version was released on September 2011, the iPad app on March 2012, iPhone on May 2012 and Android on November 2012. To establish causal relationships, we only study users who installed the mobile app shortly after its release. Those users are more likely to have installed the app due to its release and not because of an independent decision to cut spending.

The rationale for the above identification strategy is as follows. It is unlikely that a large group of users decided independently to install a mobile app in any given week. It is even less likely that this specific week happens to coincide with the release of the mobile app. And, it is extremely unlikely that this same pattern arose in each of the different mobile app releases (iPhone, Android and iPad). Hence, we believe that the large number of users installing the mobile app right after its release was triggered by the app release and not by an independent decision to suddenly cut spending. Since the release date of the mobile app is not in the control of the users, it constitutes a natural experiment with exogenous variation.

We begin our analysis by exploring information consumption. Our data suggests that users who installed the mobile app sharply increased the frequency of views of their financial dashboard. While the typical user viewed their financials 2.14 times a month on the website, that frequency rose to 12.47 times a month after the app was installed ($t = 8.81$). Interestingly, mobile access to financial information does not substitute for web access to the same information, as web access remained fairly constant. Thus, the increased frequency primarily stems from new views on mobile devices.⁹

Next, we turn to our main variable of interest: the decision to spend or save. We regressed monthly spending, scaled by the average spending in the two-months preceding the mobile app installation, on a binary variable indicating if a mobile app is installed. We de-trended the data and allowed for user and calendar month fixed effects. (We also tested additional transformations of spending, such as log spending and standardized spending, which we describe in the online Appendix).

We find that spending decreases by 15.7 percent ($p < 0.05$) during the four months after installation of the app relative to the three months before installation. Figure 1 displays the change in spending by category. As expected, utilities are fairly constant over time (insignificant increase of 3.5%). The decrease in spending is concentrated in discretionary spending, such as dining out (decreased by 19.2%, $p < 0.05$) and groceries (decreased by 20.7%, $p < 0.10$).¹⁰ Our results are consistent with government surveys, indicating that 69 percent of mobile banking users check account balances or available credit before making a large purchase. Of those who check their balance or available credit, 50 percent decide not to buy an item because of the amount of money in their bank account or the amount of available credit.¹¹



To put our results in perspective, Choi et al (2002) investigated the effect of financial education on consumer behavior. Their sample consisted of employees who self-selected to attend a financial education seminar on retirement planning. While every single employee planned to start saving for retirement within two months, only 14 percent followed up on their good intentions six months later.¹² Assuming a typical 401(k) deferral rate of six percent or so, the average increase in savings for the entire population of seminar attendees is less than one percent of pay. Furthermore, a recent meta-analysis by Fernandes et al (2014) portrays an even more skeptical picture of the effect of financial education.¹³ Thus, the magnitude of the effect of the mobile app is large, at least relative to education interventions.

Our results suggest that the medium of information dissemination can have a large effect on the economic decisions of households. Intuitively, it seems that the decrease in spending associated with online feedback is a positive trend, as Choi et al (2002) found that less than one percent of employees believe they save too much. However, the evidence in Poterba et al (2011) suggests that some people, probably the wealthier segment of the population, might be too conservative in consuming their retirement assets.¹⁴ While such policy debates will continue, our main point is that mobile access to financial information can strongly influence financial behavior.

Although our data documents very large decreases in spending, important caveats remain. First, a controlled experiment is needed to explore whether the effects are short-term in nature or long-lasting. (Unlike our short-window event study, longer-window event studies are highly sensitive to the empirical specification and the base spending pattern assumptions, thus requiring a carefully designed control group.) Evidence from the domain of dieting suggests that powerful changes in behavior are often short-term in nature.¹⁵ Second, our sample of Personal Capital users is biased towards younger, wealthier and more tech-savvy individuals. In addition, early adopters of the mobile technology are possibly more eager to implement it into their everyday lives. Thus, more research is needed to test whether the magnitude of the results holds for the broader population.

This article is merely a first step to understanding the impact of the digital age, and mobile devices in particular, on economic decision-making. Given the scale of the digital environment, and the speed of technological change, policy makers should devote more resources to researching the impact of technology on key economic decisions. A vivid illustration of the potential impact comes from Kenya, where mobile banking has transformed access to basic financial services. In less than three years, almost 70 percent of Kenyan adults gained access to virtual bank accounts that are able to send and receive money (Jack and Suri, 2011).¹⁶ It seems highly likely that such technologies will have significant macroeconomic implications.

However, the need to better understand online behavior extends far beyond questions of economics. Excess consumer spending is often construed as a problem of limited self-control. Given the dramatic reduction in spending associated with mobile financial information, it seems possible that digital interventions might also enhance self-control in other domains. If true, this could provide policy makers with a novel means of dealing with expensive societal problems associated with a lack of self-control, such as obesity, substance abuse and criminal behavior.¹⁷ Given the magnitude of these problems – obesity alone costs society an estimated \$231 billion every year¹⁸ - we believe we should spend more resources understanding digital behavior and researching potential opportunities to drive positive behavior changes.

FOOTNOTES

- ¹ Ball State University, CRE, Nielsen, Sequent Partners (2009), *Video Consumer Mapping Study*; <http://www.researchexcellence.com/research.php#research-2009>.
- ² The Economist (2010), *All too much*; <http://www.economist.com/node/15557421>.
- ³ Pam A. Mueller and Daniel M. Oppenheimer, *The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking*, *Psychological Science* June 2014 25: 1159-1168.
- ⁴ McDevitt, Ryan C, *The Internet Lowers Inhibitions: Implications for the Long Tail*, University of Rochester working paper (2012).
- ⁵ <http://ns.umich.edu/new/releases/20394-omg-texting-ups-truthfulness-new-iphone-study-suggests>
- ⁶ Brasela, S. Adam, and James Gipsb, *Tablets, Touchscreens, and Touchpads: How Varying Touch Interfaces Trigger Psychological Ownership and Endowment*, *Journal of Consumer Psychology* (2013).
- ⁷ Modigliani, Franco, *The Life Cycle Hypothesis of Saving, the Demand for Wealth and the Supply of Capital*, *Social Research*, Vol. 33, No. 2, *Essays in Economic Theory in Honor of Adolph Lowe and Hans Neisser* (SUMMER 1966), pp. 160-217.
- ⁸ Friedman, Milton (1957), *A theory of the consumption function*, (Princeton University Press, Princeton, NJ).
- ⁹ For more details on the analysis, see the online Appendix.
- ¹⁰ For more details on the analysis, see the online Appendix.
- ¹¹ Board of Governors of the Federal Reserve System (2014), *Consumers and mobile financial services*; <http://www.federalreserve.gov/econresdata/consumers-and-mobile-financial-services-report-201403.pdf>.
- ¹² Choi, James J., David Laibson, Brigitte C. Madrian, and Andrew Metrick (2002), *Defined Contribution Pensions: Plan Rules, Participant Decisions, and the Path of Least Resistance*, *Tax Policy and the Economy Volume 16*, edited by James Poterba. Boston: MIT Press.
- ¹³ Daniel Fernandes, John G. Lynch Jr., Richard G. Netemeyer (2014), *Financial Literacy, Financial Education, and Downstream Financial Behaviors*, *Management Science*.
- ¹⁴ James Poterba, Steven Venti, David Wise (2011), *The Composition and Drawdown of Wealth in Retirement*, *Journal of Economic Perspectives*, vol. 25(4), pages 95-118.
- ¹⁵ Jeffery, Robert W., Leonard H. Epstein, G. Terence Wilson, Adam Drewnowski, Albert J. Stunkard, and Rena R. Wing. *Long-term maintenance of weight loss: current status*, *Health psychology* 19, no. 1S (2000): 5.
- ¹⁶ Jack, William, and Tavneet Suri. *Mobile money: the economics of M-PESA*, No. w16721. National Bureau of Economic Research, (2011).

¹⁷ Moffitt, Terrie E., Louise Arseneault, Daniel Belsky, Nigel Dickson, Robert J. Hancox, HonaLee Harrington, Renate Houts et al. *A gradient of childhood self-control predicts health, wealth, and public safety*. Proceedings of the National Academy of Sciences 108, no. 7 (2011): 2693-2698.

¹⁸ John Cawley, Chad Meyerhoefer, *The medical care costs of obesity: An instrumental variables approach*, *Journal of Health Economics*, Volume 31, Issue 1, January 2012, Pages 219-230.