Contents

Chapter 1

Introduction

Argument in a nutshell: - Financial wellbeing is important - Emergency savings and spending behaviour are key contributors to it - Both are understudied - Behavioural science can help understand them and suggest remedies - Data and fintech are crucial enablers in performing that reserach and implementing its solutions on a large scale - My thesis is an attempt in that direction: use large scale txn data to understand how people save and spend money, test whether fintech apps can have effect.

1.1 Theoretical context

1.1.1 Financial wellbeing and why it matters

Financial wellbeing is a state in which a person can make ends meet in the present, can feel comfortable about their financial future, can feel comfortable about money, and has the financial freedom to make choices that allow for the enjoyment of life. This includes having control over ones day-to-day and month-to-month finances, not having to borrow to meet ongoing obligations, being free of debt or being in control of it, having the capacity to meet unexpected expenses, and – for a working-age individual – being on track to build enough savings for retirement.[1]

[1]The US Consumer Financial Protection Bureau defines fiancial wellbeing as "a state of being wherein a person can fully meet current and ongoing financial obligations, can feel secure in their financial future, and is able to make choices that allow enjoyment of life" (CFPB 2015). The UK's Money and Pension service defines current financial wellbeing as "being able to pay the bills and feel comfortable about money" and longer-term financial security as "having the savings to deal with the expected, the unexpected and the longer-term; or having some form of loss protection such as home contents or life insurance" (MPS 2018). Both organisations also differentiate some aspects of financial wellbeing depending on whether an individual is in their working or retirement age. Throughout, this discussion, as well as in the analysis in the following chapters, I focus on working age individuals.

Financial wellbeing is important because a lack of it can have severe consequences both in the short-term and in the long-term. In the short-term, low financial wellbeing means a constant struggle to make ends meet, being overwhelmed by debt, having circumstances dictate ones of and approach to money, a higher likelihood of experiencing material hardship – which (CFPB 2017) defines as running out or worrying about running out of food, not being able to afford medical treatment or a place to live, or have utilities turned off – and the need to cut back on essentials for ones children.[2] All of these experiences can cause a decline in physical and mental health, a loss of productivity, and an overall deteriation in the quality of life.

In the long-term, the danger is that the situation is not only self-sustaining but leads to a viscious circle that becomes increasingly hard to escape. This can happen purely because having to borrow for regular expenses like food and bills – as, the Money and Pension service estimates, about 9 million adults in the UK do (MPS 2018) – can lead to a situation where an increasing amount has to be spent on servicing dept and thus increses monthly expenses and the borrowed amounts required to cover them. In addition, however, this could happen because of increasingly impaired decision making. A literature on mental scarcity documents that our minds tend to focus on what is scarce and neglect what is not, concentrating our mental resources where they are most needed but reducing cognitive bandwith in other domains, which can lead to poorer decision making.[3] For instance, Mani et al. (2013) find that low-income shoppers in New Jersey perform worse on cognitive tasks when first promoted to think about their financial situation while the same prompts had no effect for wealthier shoppers, and sugarcane farmers in India perform worse on similar cognitive tasks shortly before the annual harvest (when money is scarce) than shortly thereafter (when money is plentiful). There is also evidence that scarcity might lower preductivity in the present: Kaur et al. (2021) randomise the timing of wage payments to low-income piece-rate manufacturing workers and find that workers that receive their wages early and are thus no longer liquidity constrained make fewer mistakes and increase their output by 7 percent. Hence, if the anxiety caused by having little money to cover current expenses lowers individuals' productivity in the present and makes it harder to engage in rational planning for the future – how to reduce spending, how to build skills that would help find a higher-paying job, how to transition to a healthier lifestyle that would help them feel and perform better physically and mentally – then low financial wellbeing in the present might beget

[2]For more detailed descriptions about the consequences of financial hardship, see CFPB (2017), MPS (2018), and Step Change (2017).

[3]See Shah et al. (2012), Mullainathan and Shafir (2013), and Haushofer and Fehr (2014) for excellent summaries of the litearature.

low financial wellbeing in the future.

The determinants of financial wellbeing are a combination of circumstantial and external factors as well as the capabilities, believes, and behaviours of the individual. MPS (2018) provides a useful categorisation that sees financial wellbeing as a function of four broad factors: external factors that include economic conditions, demographics, and other external factors such as a person's social environment; enablers that include financial confidence and numeracy, a sense of control, ones spending and savings mindset, and ones engagement with money, advice, and technology; day-to-day behaviours like managing the use of credit, avoiding to borrow for everyday spends, active saving, keeping track of and making adjustments to ones spending, and shopping around; and, finally, planning ahead behaviours like building financial resilience through saving and planning for retirement.[4]

While no one factor is deterministic for fiancial wellbeing, research from the US (CFPB 2017) and the UK MPS (2018) agrees that, as expected, external economic factors such as access to education and higher paying jobs are important. In the UK, for insteance, individuals with an annual income of £20,000 or below account for 41 percent of the working age population but for 69 percent of those with less than £100 of savings. Similarly, 50 percent of people who borrow to cover everyday expenses earn less than £17,000. So, clearly, a search for and support of effective economic and social policy measures should be an important part of any effort to improve societal financial wellbeing. But the same research also shows that higher incomes are not sufficient. In the UK, 18 percent of individuals with less than £100 in savings have a household income of £30,000 or higher, and 20 percent of those who borrow to cover everyday expenses have an income of £50,000 or higher. In the US, too, there ia large variation in the characteristics of individuals at each level of financial wellbeing; the financial wellbeing of the top quarter of people with a high-school degree, for instance, is higher than that of the bottom half of those with graduate degrees.

In both countries, research shows that the level of savings is a key contributor to financial wellbeing. In the US, it is the one factor that discriminates between different levels of financial wellbeing better than any other examined factor (CFPB 2017). In the UK, it is, together with behaviour towards credit, the strongest predictor of financial wellbeing (MPS 2018). In fact, research by a UK charity suggests that having £1,000 in liquid savings could reduce the probability of being in dept by almost half. In particular, having a habit of saving regulary – even more so than the amounts saved – has been found to be a key

[4]The US Consumer Financial Protection Bureau uses a similar classification in its definition of financial wellbeing (CFPB 2015).

determinant. Other factors that are posivitely associated with higher financial wellbeing are confidence in ones ability to achieve ones financial goals, not using debt to cover everyday expenses, paying ones bills on time, staying withing ones budget and spending plan, paying credit card balances in full, and checking bank statements for errors.[5]

But many people struggle with these behaviours. For instance, in the UK, 21 percent of the working-age population (10.7 million adults) report to raraly or never save, and 22 percent of the population have less than £100 in savings, with those holding that amount in a formal savings account being even lower. Unsurprisingly, then, one in four adults could not pay an unexpected bill of £300 from their own money. In the US, the situation is similar, with 30 percent of adults saying they would be unable to cover a bill of $400. This is problematic because many households do face unexpected financial shocks over the course of a year. Also, many households experience high income volatility: in the US between 2013 and 2018, the median month-to-month change in household income was 36 percent, with low-income households experiencing more frequent and larger income dips (Chase 2019). The same research finds that while families need roughly six weeks of take-home income in liquid assets to weather a simultaneous income dip and expenditure shock, 65 percent of households lack such a buffer. In line with these findings, Roll and Despard (2020) find that during the coronavirus pandemic, households with liquid asses of above $2,000 had significantly lower risk to experience financial distress (indicators like skipping essential bills, being behind on credit card debt, being in overdraft) than households with lower savings.

Managing debt is similarly challenging for many. 9 million people in the UK also borrow to cover expenses for food and bills (MPS 2018), and many struggle to stay on top of their credit card debt: 2 million cards were in arrears or default, another 2 million carried persistent debt, and for another 1.6 million cards, owners were persistently making minimum payments only. Altogether, the study found that 5 million accounts (9 percent of the total) that were active in January 2015 would, under their current repayment pattern and without further borrowing, take 10 years to repay their balance (FCA 2016). In addition to holding high and persistent balances, a large body of research also indicates that individuals make other mistakes in debt management, especially in dealing with credit cards: they choose suboptimal credit card contracts (Agarwal, Chomsisengphet, Liu, et al. 2015), sometimes because they are overly susceptible to temporarily low teaser rates (Shui and Ausubel 2004, Ausubel 1991); they borrow on payday

[5]For details on contributors to financial wellbeing see (CFPB 2017) for the US and MPS (2018) for the UK.

loans before fully using using their credit card limits (Agarwal, Skiba, et al. 2009), their repayment amount is overly influenced by stated minimum payments (Sakaguchi et al. 2022), they pay down debt across different cards proportionally to outstanding balances instead of prioritising high-interest cards (Gathergood, Mahoney, et al. 2019), and they sometimes hold credit card debt and liquid assets at the same time (Gross and Souleles 2002, Gathergood and Olafsson 2020).[6]

1.1.2 Role of behavioural science

Behavioural science can contribute to higher financial wellbeing in three ways. First, as a discipline we have learned a fair amount about the psychological factors that drive financial decisions and accumulated a large body of knowledge about the effectiveness of different solutions that can make it easier for people to avoid mistakes and achieve their own goals. Second, a large body of research has used a subset of these insights and solutions to help people save more for retirement, and we have learned important lessons from that endeavour, at least some of which translate to other behaviours that promote financial wellbeing. Third, behavioural science might be able to help understand and – ultimately – circumvent the barriers that stand in the way of economic and social policies that shape the financial wellbeing of many people to a large degree but is largely outside of their control.

Over the past two decades, researchers have documented a large number of factors that influence financial decision making: cognitive limitations and financial literacy (Agarwal, Driscoll, et al. 2009, Agarwal and Mazumder 2013, Korniotis and Kumar 2011, Agarwal, Amromin, et al. 2010, Fernandes et al. 2014, Jørring 2020); time-preferences and self-control (Frederick et al. 2002, Read et al. 2018, Ericson and Laibson 2019, Cohen et al. 2020); attitude towards money and spending (Rick, Cryder, et al. 2008, Rick, Small, et al. 2011); ones perceived locus of control (Perry and Morris 2005), degree of optimism (Puri and D. T. Robinson 2007), ability to frame decisions broadly rather than narrowly (Kumar and S. S. Lim 2008), and propensity to gamble (Kumar 2009); ones social network (Bailey et al. 2018, Kuchler and Stroebel 2021); the degree of financial planning (Ameriks et al. 2003); and habits (Blumenstock et al. 2018, Schaner 2018, De Mel et al. 2013).[7]

Researchers have also developed and tested a large number of approaches aimed to help people make better decisions. One main area of research here aims

[6] See Agarwal, Chomsisengphet, and C. Lim (2017) for a more complete review of a large body of research documenting consumer choice inefficiencies and suboptimal financial behaviour.

[7] For two thorough reviews, see Agarwal, Chomsisengphet, and C. Lim (2017) and Greenberg and Hershfield (2019).

to address limited self-control – the difficulty most of us face at least occasionally to act, moment-by-moment, in our own best interest and according to our own goals.

In their review of these approaches, **duckworth2019beyond** classify them into four quadrants formed by two dimensions: self vs other deployed – whether the intervention is implemented by the individual itself or by a third party –, and situational vs cognitive – whether the intervention aims to change specific situations or the individual's cognition.

One extensively studied self-deployed and situational intervention are commitment devices, whereby an individual restricts their future choice set in order to avoid choosing a self-defeating action. While not everybody makes use of them when offered the opportunity (Bryan et al. 2010), and while they have found to not work in certain contexts (Laibson 2015, C. D. Robinson et al. 2018), they have been found to help people increase their savings rates (Ashraf et al. 2006), quit smoking (Giné et al. 2010), make healthier food choices (Schwartz et al. 2014), and exercise more regularly (Royer et al. 2015).

Another well-studied intervention...

- Self-control solutions: duckworth2019beyond

- Financial product design agarwal2017shapes

- Regulation agarwal2017shapes

- Retirement planning: among working age, 14 pct report to have done substantial amount of retirement planning, 44 pct at least a good amount. Among those between 45-65, this is 47 percent. 20 pct of that latter group have no plan at all. - agarwal2017shapes 2.3 for review

- buyalskaya2021golden for opportunities of new data for social research

- stachl2020predicting show that using sensor and log data from smartphones to predict peoples' Big Five personality traits is about as accurate as using social media footprints.

- montjoye2013predicting also predict personality (big five) from mobile log data and find predictions to be considerably better than random.

- Current applications: simpler dashboards (Monzo, Money Dashboard), robo advising (philippon2019fintech, dacunto2021frontiers)

- Challenges: what is good advise (sabat2019rules)

- Adaptation in financial sector (boe2019machine)

- McKenzie and Liersch (2011) find that people systematically underestimate the exponential growth, and that showing them difference in long term outcome from regular savings left to compound makes them more motivated

to save more for retirement. This is something fintech apps can easily help with by showing projections - or offering to show them - what is my wealth if I save x, or y, or z.

- Soman and Cheema (2011) find that earmarking part of salary as savings increases savings rates. Fintech apps could suggest automatically transferring fixed amount into labelled savings pot.

- De Montjoye et al. (2015) find that it's easy to reidentify users based on credit card metadata.

Exception: Philipps et al. (2021) - Automatic payroll deduction seems to be valued by employees and has helped people from the squeezed and struggling segments

This is why I'm focusing on it... Discuss in next section.

1.2 Objectives and research questions

- I use a single dataset, provided by Money Dashboard, for all three papers.
- The data presented a number of challenges.
- Handling data of this size.
- Secure storage with easy remote access (AWS).
- Consistenc and efficient preprocessing (my process).
- Open science contribution: all work available on Github, code available for preprocessing from beginning to end.

Motivation: My experience as a researcher in well-known academic and private-sector institutions has made clear to me over the years that careful, reliable, and replicable data preprocessing is undervalued in many settings.

The result are plain data errors that overturn results (Reinhard and Rogoff) and replication issues (see Ariely controversies). Given my experience, I'd think that all we know is the tip of the iceberg.

In the vast majority of empirical research projects there is no good reason to not make the code public, even when the data is proprietary. And yet, for the vast majority of papers, there is no code available to replicate findings and check precise implementation details, which often matter but are not described in papers.

All of this harms science - the quality of it and the trust in it.

I have dedicated a lot of time during my PhD to ensure that I can rectify at least some of those issues.

The code for all my projects is available online and includes scripts that can be used to easily run the entire analysis.

1.3 Chapter summaries

There is a lot more work to be done in characterising spending profiles. From entropy paper: There are a number of alternative ways to characterise spend profiles. We could calculate profiles based on the distribution of transaction values rather than counts. We could also calculate profiles based on inter-temporal rather than intra-temporal distributions, focusing on consistency of purchasing behaviour over time rather than on predictability at any given time (Krumme et al. 2013). Further, we could focus on time-based rather than category-based measures, focusing, for instance, on whether purchases of the same type tend to occur on the same day of the week (Guidotti et al. 2015). Finally, one could also create composite measures based on principal component analysis, an approach used in Eagle et al. (2010). We leave these extensions for future research.

1.4 Contribution

1.5 Limitations and directions for further research

Data - Sample representativeness

- Can often only use small fraction of users for study because of incomplete data for many. One reason: mps2018building points out that many people use budgeting tools to achieve short term goals. Hence, no intention of long-term use.

Chapter 2

Conclusion

This thesis consists of three independent research studies on ...

In the first part of this conclusion, I will summarise the three chapters, before discussing challenges...

2.1 Summary

The two applied studies presented in Chapters 1 and 2 are purely exploratory. A natural next step to exploring their generalisability is a pre-registered replication on new data (Van den Akker et al., 2019). We did not pre-register any studies presented here since many analysis decisions were taken conditional on the data observed. It is a well-known problem that such data-dependent decisions can affect the conclusions drawn from the research (Simmons, Nelson, and Simonsohn, 2011; Gelman and Loken, 2014). The studies are thus a useful first step in exploring the questions of ethnic bias and domestic abuse and will require further, pre-registered analyses.

2.2 Discussion

Bibliography

Agarwal, Sumit, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet, and Douglas D Evanoff (2010). "Learning to cope: Voluntary financial education and loan performance during a housing crisis". In: *American Economic Review* 100.2, pp. 495–500.

Agarwal, Sumit, Souphala Chomsisengphet, and Cheryl Lim (2017). "What shapes consumer choice and financial products? A Review". In: *Annual Review of Financial Economics* 9, pp. 127–146.

Agarwal, Sumit, Souphala Chomsisengphet, Chunlin Liu, and Nicholas S Souleles (2015). "Do consumers choose the right credit contracts?" In: *The Review of Corporate Finance Studies* 4.2, pp. 239–257.

Agarwal, Sumit, John C Driscoll, Xavier Gabaix, and David Laibson (2009). "The age of reason: Financial decisions over the life cycle and implications for regulation". In: *Brookings papers on Economic activity* 2009.2, pp. 51–117.

Agarwal, Sumit and Bhashkar Mazumder (2013). "Cognitive abilities and household financial decision making". In: *American Economic Journal: Applied Economics* 5.1, pp. 193–207.

Agarwal, Sumit, Paige Marta Skiba, and Jeremy Tobacman (2009). "Payday loans and credit cards: New liquidity and credit scoring puzzles?" In: *American Economic Review* 99.2, pp. 412–17.

Ameriks, John, Andrew Caplin, and John Leahy (2003). "Wealth accumulation and the propensity to plan". In: *The Quarterly Journal of Economics* 118.3, pp. 1007–1047.

Ashraf, Nava, Dean Karlan, and Wesley Yin (2006). "Tying Odysseus to the mast: Evidence from a commitment savings product in the Philippines". In: *The Quarterly Journal of Economics* 121.2, pp. 635–672.

Ausubel, Lawrence M (1991). "The failure of competition in the credit card market". In: *The American Economic Review*, pp. 50–81.

Bailey, Michael, Ruiqing Cao, Theresa Kuchler, and Johannes Stroebel (2018). "The economic effects of social networks: Evidence from the housing market". In: *Journal of Political Economy* 126.6, pp. 2224–2276.

Blumenstock, Joshua, Michael Callen, and Tarek Ghani (2018). "Why do defaults affect behavior? Experimental evidence from Afghanistan". In: *American Economic Review* 108.10, pp. 2868–2901.

Bryan, Gharad, Dean Karlan, Scott Nelson, et al. (2010). "Commitment devices". In: *Annual review of Economics* 2.1, pp. 671–698.

CFPB, Consumer Financial Protection Bureau (2015). "Financial well-being: the goal of financial educaion". Tech. rep. URL: https://files.consumerfinance.gov/f/201501_cfpb_report_financial-well-being.pdf.

— (2017). "Financial Well-being in America". Tech. rep. URL: https://www.consumerfinance.gov/data-research/research-reports/financial-well-being-america/.

Chase, J.P. Morgan (2019). "Weathering Volatility 2.0". Tech. rep. URL: https://www.jpmorganchase.com/content/dam/jpmc/jpmorgan-chase-and-co/institute/pdf/institute-volatility-cash-buffer-report.pdf.

Cohen, Jonathan, Keith Marzilli Ericson, David Laibson, and John Myles White (2020). "Measuring time preferences". In: *Journal of Economic Literature* 58.2, pp. 299–347.

De Mel, Suresh, Craig McIntosh, and Christopher Woodruff (2013). "Deposit collecting: Unbundling the role of frequency, salience, and habit formation in generating savings". In: *American Economic Review* 103.3, pp. 387–92.

De Montjoye, Yves-Alexandre, Laura Radaelli, Vivek Kumar Singh, and Alex "Sandy" Pentland (2015). "Unique in the shopping mall: On the reidentifiability of credit card metadata". In: *Science* 347.6221, pp. 536–539.

Eagle, Nathan, Michael Macy, and Rob Claxton (2010). "Network diversity and economic development". In: *Science* 328.5981, pp. 1029–1031.

Ericson, Keith Marzilli and David Laibson (2019). "Intertemporal choice". In: *Handbook of Behavioral Economics: Applications and Foundations 1*. Vol. 2. Elsevier, pp. 1–67.

FCA, Financial Conduct Authority (2016). "Credit card market study - final findings report". Tech. rep. URL: https://www.fca.org.uk/publication/market-studies/ms14-6-3-credit-card-market-study-final-findings-report.pdf.

Fernandes, Daniel, John G Lynch Jr, and Richard G Netemeyer (2014). "Financial literacy, financial education, and downstream financial behaviors". In: *Management Science* 60.8, pp. 1861–1883.

Frederick, Shane, George Loewenstein, and Ted O'Donoghue (2002). "Time discounting and time preference: A critical review". In: *Journal of economic literature* 40.2, pp. 351–401.

Gathergood, John, Neale Mahoney, Neil Stewart, and Jörg Weber (2019). "How do individuals repay their debt? The balance-matching heuristic". In: *American Economic Review* 109.3, pp. 844–75.

Gathergood, John and Arna Olafsson (2020). "The co-holding puzzle: New evidence from transaction-level data". In:

Giné, Xavier, Dean Karlan, and Jonathan Zinman (2010). "Put your money where your butt is: a commitment contract for smoking cessation". In: *American Economic Journal: Applied Economics* 2.4, pp. 213–35.

Greenberg, Adam Eric and Hal Hershfield (2019). "Financial decision making". In: *Consumer Psychology Review* 2.1, pp. 17–29.

Gross, David B and Nicholas S Souleles (2002). "Do liquidity constraints and interest rates matter for consumer behavior? Evidence from credit card data". In: *The Quarterly journal of economics* 117.1, pp. 149–185.

Guidotti, Riccardo, Michele Coscia, Dino Pedreschi, and Diego Pennacchioli (2015). "Behavioral entropy and profitability in retail". In: *2015 IEEE International Conference on Data Science and Advanced Analytics (DSAA)*. IEEE, pp. 1–10.

Haushofer, Johannes and Ernst Fehr (2014). "On the psychology of poverty". In: *Science* 344.6186, pp. 862–867.

Jørring, Adam (2020). "Financial sophistication and consumer spending". Tech. rep. Working Paper.

Kaur, Supreet, Sendhil Mullainathan, Suanna Oh, and Frank Schilbach (2021). "Do Financial Concerns Make Workers Less Productive?" Working Paper 28338. National Bureau of Economic Research. DOI: 10.3386/w28338. URL: http://www.nber.org/papers/w28338.

Korniotis, George M and Alok Kumar (2011). "Do older investors make better investment decisions?" In: *The Review of Economics and Statistics* 93.1, pp. 244–265.

Krumme, Coco, Alejandro Llorente, Manuel Cebrian, Alex Pentland, and Esteban Moro (2013). "The predictability of consumer visitation patterns". In: *Scientific reports* 3.1, pp. 1–5.

Kuchler, Theresa and Johannes Stroebel (2021). "Social finance". In: *Annual Review of Financial Economics* 13, pp. 37–55.

Kumar, Alok (2009). "Who gambles in the stock market?" In: *The Journal of Finance* 64.4, pp. 1889–1933.

Kumar, Alok and Sonya Seongyeon Lim (2008). "How do decision frames influence the stock investment choices of individual investors?" In: *Management science* 54.6, pp. 1052–1064.

Laibson, David (2015). "Why don't present-biased agents make commitments?" In: *American Economic Review* 105.5, pp. 267–72.

Mani, Anandi, Sendhil Mullainathan, Eldar Shafir, and Jiaying Zhao (2013). "Poverty impedes cognitive function". In: *science* 341.6149, pp. 976–980.

McKenzie, Craig RM and Michael J Liersch (2011). "Misunderstanding savings growth: Implications for retirement savings behavior". In: *Journal of Marketing Research* 48.SPL, S1–S13.

MPS, Money and Pension Service (2018). "Building the Financial Capability of UK Adults". Tech. rep. URL: https://moneyandpensionsservice.org.uk/2019/02/06/adult-financial-capability-building-the-financial-capability-of-uk-adults-survey/.

Mullainathan, Sendhil and Eldar Shafir (2013). *Scarcity: Why having too little means so much*. Macmillan.

Perry, Vanessa G and Marlene D Morris (2005). "Who is in control? The role of self-perception, knowledge, and income in explaining consumer financial behavior". In: *Journal of consumer affairs* 39.2, pp. 299–313.

Philipps, Jo, Annick Kuipers, and Will Sandbrook (2021). "Supporting emergency savings: early learnings of the employee experience of workplace sidecar savings". Tech. rep.

Puri, Manju and David T Robinson (2007). "Optimism and economic choice". In: *Journal of financial economics* 86.1, pp. 71–99.

Read, Daniel, Rebecca McDonald, and Lisheng He (2018). "Intertemporal choice: Choosing for the future". In: *The Cambridge handbook of psychology and economic behavior*, pp. 167–197.

Rick, Scott I, Cynthia E Cryder, and George Loewenstein (2008). "Tightwads and spendthrifts". In: *Journal of consumer research* 34.6, pp. 767–782.

Rick, Scott I, Deborah A Small, and Eli J Finkel (2011). "Fatal (fiscal) attraction: Spendthrifts and tightwads in marriage". In: *Journal of Marketing Research* 48.2, pp. 228–237.

Robinson, Carly D, Gonzalo A Pons, Angela L Duckworth, and Todd Rogers (2018). "Some middle school students want behavior commitment devices (but take-up does not affect their behavior)". In: *Frontiers in Psychology* 9, p. 206.

Roll, Stephen and Mathieu Despard (2020). "Income loss and financial distress during COVID-19: The protective role of liquid assets". In: *Available at SSRN 3733862*.

Royer, Heather, Mark Stehr, and Justin Sydnor (2015). "Incentives, commitments, and habit formation in exercise: evidence from a field experiment with workers at a fortune-500 company". In: *American Economic Journal: Applied Economics* 7.3, pp. 51–84.

Sakaguchi, Hiroaki, Neil Stewart, John Gathergood, Paul Adams, Benedict Guttman-Kenney, Lucy Hayes, and Stefan Hunt (2022). "Default effects of credit card minimum payments". In: *Journal of Marketing Research*, p. 00222437211070589.

Schaner, Simone (2018). "The persistent power of behavioral change: Long-run impacts of temporary savings subsidies for the poor". In: *American Economic Journal: Applied Economics* 10.3, pp. 67–100.

Schwartz, Janet, Daniel Mochon, Lauren Wyper, Josiase Maroba, Deepak Patel, and Dan Ariely (2014). "Healthier by precommitment". In: *Psychological science* 25.2, pp. 538–546.

Shah, Anuj K, Sendhil Mullainathan, and Eldar Shafir (2012). "Some consequences of having too little". In: *Science* 338.6107, pp. 682–685.

Shui, Haiyan and Lawrence M Ausubel (2004). "Time inconsistency in the credit card market". In: *Available at SSRN 586622*.

Soman, Dilip and Amar Cheema (2011). "Earmarking and partitioning: Increasing saving by low-income households". In: *Journal of Marketing Research* 48.SPL, S14–S22.

Step Change (2017). "Strengthening the saving safety net". Tech. rep. URL: https://www.stepchange.org/Portals/0/documents/media/reports/strengthening-the-saving-safety-net-stepchange-debt-charity-response-paper-to-the-pensions-policy-institute.pdf.