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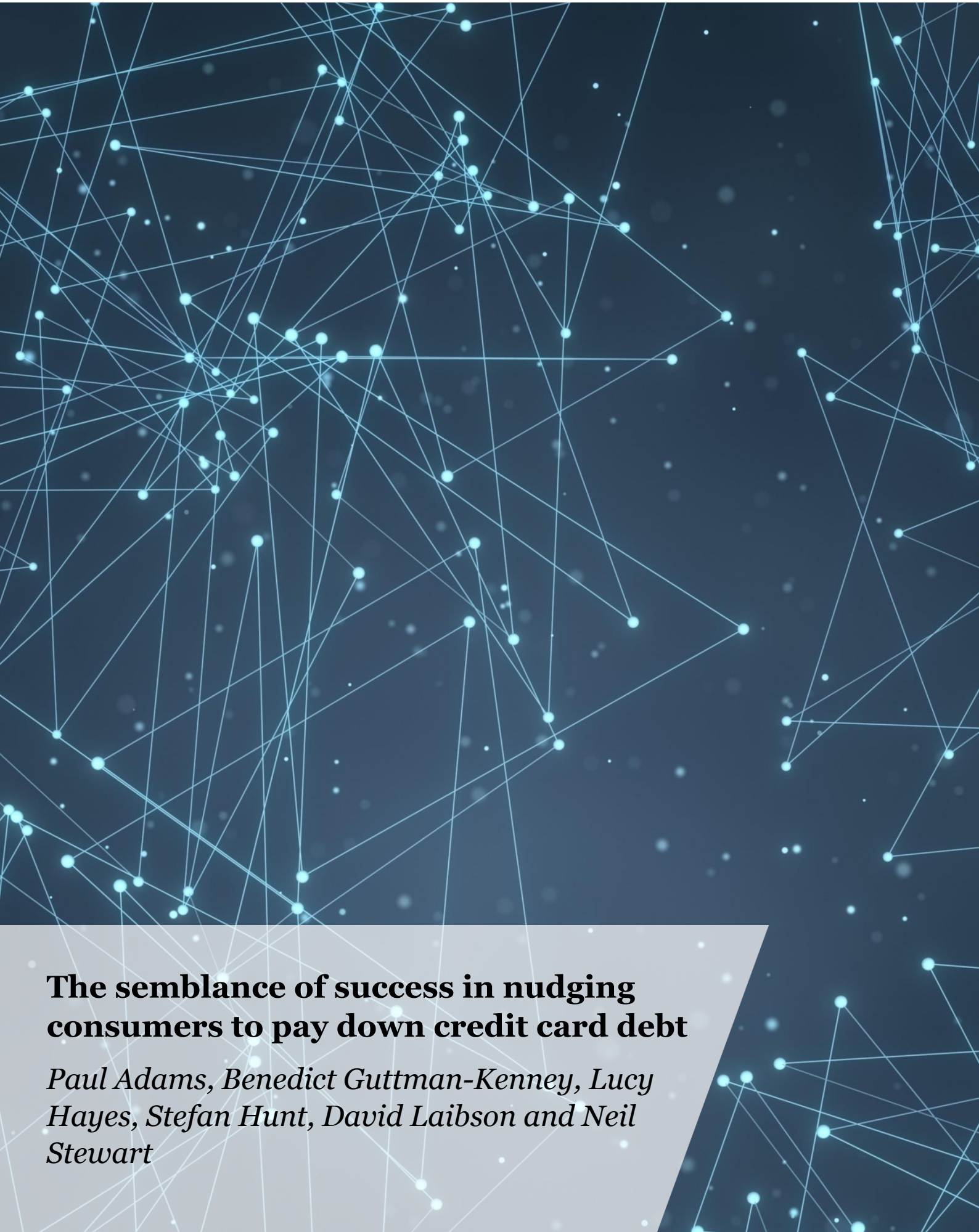

The semblance of success in nudging consumers to pay down credit card debt

Paul Adams, Benedict Guttman-Kenney, Lucy Hayes, Stefan Hunt, David Laibson and Neil Stewart

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Contents

Abstract

We study consumer responses to a randomised field experiment on credit card debt repayment. This intervention shrouds the option to automatically pay the contractual minimum at the end of each pay cycle. This increases the salience of the other automatic payment option: cardholders can select a fixed monthly payment, which is typically more than the contractual minimum. The intervention results in a very large increase in the amounts consumers select for automatic payment. However, it has no effect on other, more important outcomes: *total* debt repayments (including both automatic and non-automatic – ie manual – payments), credit card spending, borrowing costs or debt net of payments. These null effects arise primarily because consumers in the treatment group offset their increased automatic payments by reducing the value of their (infrequent) manual payments. The intervention also causes a modest reduction in consumers selecting any type of automatic payments, which leads to a small increase in arrears.

1 Introduction

A decade on from the financial crisis, household debt remains a topic of debate across both the UK and US, with concern whether borrowers can sustainably pay back such debt.[1] Of household debt, credit card debt attracts particular public attention given its widespread use, high interest rates and large quantities of debt outstanding – over £900 billion across the UK and US by the end of 2017.[2] Whether people are able to pay back their credit card debt matters for both a country's macroeconomic performance – for example, default rates on lending, effects on levels and composition of consumption. It also matters for microeconomic consumer welfare, such as the financial costs of borrowing relative to other uses and the effects of borrowing on psychological wellbeing.

We tested whether a '*choice architecture'* intervention (Johnson et al., 2012) — changing the way options are presented — could increase credit card payments. Our design followed the increasing government use of '*nudge'* interventions (Thaler & Sunstein, 2008) that often change consumer behaviour — such as increasing retirement savings (Benartzi & Thaler, 2004) in a way designed to increase welfare (Bernheim & Rangel, 2007; Bernheim, Fradkin, & Popov, 2015; Madrian et al., 2017; Sunstein, 2014).

The credit card options we vary are '*automatic payment*' choices which typically allow consumers to opt-in to select to automatically pay the full amount owed, a fixed amount of their choice or the contractual minimum each month. We conduct a RCT field experiment on 40,708 newly issued UK credit cards where we remove the appearance of an automatic minimum payment option during credit card activation. We chose to intervene in this way because consumers on automatic minimum payments often repeatedly only pay the contractual minimum, so barely pay down their credit card debt and incurring high interest costs (Sakaguchi, Stewart, & Gathergood, 2018). Automatic payments are used in the UK by over 30% of cards and these are often set up at card activation (FCA, 2016). By removing the appearance of an automatic payment option we increase the salience of the automatic fixed payment option which would amortise debt faster, assuming no other changes in behaviour.

We find that this intervention caused a large initial effect on automatic payment choices. It causes the holders of one in five credit cards to choose an automatic fixed payment instead of an automatic minimum payment. While this has a significant effect on reducing the likelihood of only making contractual minimum payments it does not have an effect, on average, on outcomes of broader economic importance. We observe no effects, on average, on spending, payments, outstanding debt or borrowing costs.

Such a large, initial effect which would appear a success, not translating into real outcomes is puzzling. It cannot be explained by consumers changing their initial payment choices, as this rarely happens. Conditional on a consumer having an automatic payment

[1] https://www.parliament.uk/business/committees/committees-a-z/commons-select/treasury-committee/news-parliament-2017/household-finances-launch-17-19/

http://thehill.com/blogs/pundits-blog/finance/347973-americas-1-trillion-in-credit-card-debt-is-terrible-news

[2] www.newyorkfed.org/newsevents/news/research/2018/rp180213

www.bankofengland.co.uk/-/media/boe/files/statistics/money-and-credit/2018/february-2018.pdf

set-up, the intervention results in significantly higher automatic payments (these automatic payments were the mechanism we aimed the intervention to primarily work through). However, the same group of consumers are immediately making significantly lower manual payments (eg online payments). These manual payments are often large, round numbers paid on an infrequent and ad hoc basis. Among consumers with automatic payments set up, manual payments account for over 40% of the total value of payments made. This is despite fewer than one in ten making a manual payment in a particular month. The average value of a manual payment when made is large - over £400 - compared to automatic payments which average nearer £50. Combining these automatic and manual payments shows these two effects almost perfectly offset one another.

The intervention also causes more consumers to not have any type of automatic payment set up. This results in these consumers being more likely to forget payments and fall into arrears. The level of the arrears rate is what would be expected among consumers without automatic payments, based on the control group. The increasing rate of arrears caused by the intervention is temporary. Consumers recover from a missed payment as opposed to entering more severe arrears. Yet such temporary arrears are not costless, as consumers often incur late payment fees as a result of missing a payment.

Our findings fit into a broader literature – beyond financial products - on evaluating the effectiveness of nudges (and other) interventions (Allcott & Kessler, 2017; Beshears, Choi, Madrian, & Laibson, 2017; Butera, Metcalfe, & Taubinsky, 2018; Chetty, Friedman, Leth-Petersen, Nielsen, & Olsen, 2014; Egan, 2018). While early studies found these to be effective — often using short-term, easily observed, direct changes in consumer choices — this paper demonstrates the importance of assessing real economic outcomes observable in field or natural experiments over time.

2 Credit card payments

Credit cards have an important role in the economy. They enable consumers to manage temporary liquidity constraints that may occur, for example, within a monthly pay cycle. This could be due to income being received later than expenditures such as rent payments (Gathergood & Guttman-Kenney, 2016). Enabling consumers to borrow when liquidity constrained and therefore smooth consumption over their life-cycle can result in increased consumer spending, wellbeing and growth (Bertola et al., 2006; Browning & Crossley, 2001; Laibson, Repetto, & Tobacman, 2007). But these benefits may not be realised if consumers are unable to pay off their debts, as this would result in lenders incurring costs of writing off debts which could lead to credit being restricted (Agarwal et al., 2017; Mian, Sufi, & Rao, 2013; Mian & Sufi, 2017; Zinman, 2014; Zinman, 2015).

At the microeconomic-level, if people are barely paying down their credit card debt (ie in effect servicing the interest payments rather than substantially paying down their debt) then they incur large borrowing costs (Ausubel, 1991). Credit card interest rates in 2018 are typically close to 20% (at a time when central bank base rates are under 1%), and rates for higher credit risk borrowers are often 30% or more. This can mean that the interest costs can quickly add up without a salient event happening to help consumers learn — in contrast to late fees from missed payments (Agarwal et al., 2013; Gathergood, Sakaguchi, Stewart & Weber, 2018).

As credit card borrowers are often liquidity constrained there are potentially large welfare gains from paying debt down faster to lower interest costs and enable greater consumption (Agarwal et al., 2015; Agarwal et al., 2017; Carroll, 2001; Fulford & Shuh, 2015; Gross & Souleles, 2002).

Persistently holding large credit card debts can also indicate a lack of ability to withstand an economic shock. Firms factor in high and persistent debts as an increased credit risk input to their credit scoring models used for deciding whether to, and the price of, extending credit. Therefore persistently holding high debts can sometimes negatively affect consumers' credit scores. This limits the amount and price consumers are able to borrow at. If an economic shock occurs they may be especially vulnerable and default on their credit card debt.

Aside from the financial costs, survey measures of those struggling to pay debts have found a strong negative relationship with psychological well-being when following individuals over time and controlling for a broad range of socio-economic factors (Gathergood, 2012; Gathergood & Guttman-Kenney, 2016; Richardson et al., 2013).

With most forms of borrowing (eg mortgages, personal loans or motor finance agreements) people are on fixed debt repayment schedules with fixed monthly payments (unless base rates change). Here, the consumer decision is largely whether or not to strategically default (or seek some form of forbearance).[3] Unless severely liquidity constrained, strategic default is rarely desirable (Fay, Hurst, & White, 2002). For most

[3] There are a variety of other related decisions not focused on here such as whether to take out a new product or refinance onto a better rate, how to allocate payments across multiple debts and how to allocate funds between assets and liabilities (Campbell, 2006, 2016; Campbell, Jackson, Madrian & Tufano, 2011).

people, most of the time the payment choice is therefore fairly simple – make the required payment. There may be some occasions when consumers make additional payments such as on mortgages when interest rates are high or in response to one-off positive income shocks.

With credit cards the consumer payment decision is more complex. The minimum amount required to pay — the '*contractual minimum payment*' due — varies monthly depending on how much the credit card is used and each month there is a wide amount of discretion in the consumers' choice of payment.

Similar to the US (as shown in Agarwal et al., 2015; Keys & Wang, 2016; Medina & Negrin, 2017), in the UK this is typically calculated by a formula such as **Equation 1**.[4] Such an equation means that for consumers with a balance of £500, their minimum payment may be £13 (£5 as 1% of outstanding balance + £7 interest). If the balance drops a little under £200 then the minimum payment remains at £5, as 1% of outstanding balance + interest would be less than £5.[5]

Equation 1

$$contractual\ minimum\ payment\ due = max\{£5, total\ interest + total\ fees + 1\%\ oustanding\ balance\}$$

This formula ensures that, if contractual payments are met, the borrowing costs do not compound and credit card debt will reduce. Yet this debt repayment only happens if there is no further spending and such debt repayment schedules are often decades long. People are therefore faced each month with a decision whether to strategically default (as with other products) but also whether to pay more than the contractual minimum and, if so, how much more.

When faced with this choice, approximately one in four credit card accounts in the UK pay at or near the contractual minimum (Financial Conduct Authority, 2016) similar to three in ten US cards (Keys & Wang, 2016). The overall distribution of payments is similar across both countries with most cards either paying off debt in full or making payments at or very close to the contractual minimum.

Such a distribution of payments have been shown to be partially due to the '*anchoring effect*' (Adams, Guttman-Kenney, Hunt, & Stewart, 2018; Guttman-Kenney, Leary, & Stewart, 2018; Jiang & Dunn, 2013; Keys & Wang, 2016; Medina, 2017; Navarro-Martinez et al., 2011; Stewart, 2009) or '*targeting effect*' (Bartels & Sussman, 2016) whereby the mere appearance of the minimum payment amount due heavily distorts payment choices. It results in more people paying exactly the minimum and the broader distribution of payments being anchored down towards the minimum. Other factors, such as present bias and self-control problems (Heidhues & Koszegi, 2010; Kuchler & Pagel, 2017; Laibson, 1997; Meier & Sprenger, 2010; O'Donoghue & Rabin, 1999; Shui & Ausubel, 2005) or a lack of financial sophistication (Agarwal et al., 2009; Disney &

[4] For cards with balances £5 or less the minimum payment is the statement balance – if the balance is zero (or less) no payment is due. Some UK credit cards, typically issued to higher risk credit applicants with high APRs and low credit limits, have higher percentages of outstanding balances in their minimum payment rules. Some UK credit card brands have a minimum of £25 rather than £5. A few credit cards issued before 2011 have minimum payment rules which may not pay off debt.

[5] This is a simplified example assuming zero fees. It is not a global solution as the precise threshold this kink occurs varies with the interest rate.

Gathergood, 2013; Lee & Hogarth, 1999; Lusardi, & Mitchell, 2013; McHugh & Ranyard, 2016; Kinsey & McAlister, 1981; Raynard & Craig, 1993; Soll et al., 2013; Stango & Zinman, 2007, 2009), may also contribute to consumers holding more credit card debt than traditional economic models predict and using heuristics (rules of thumb) to decide how much debt to pay (Gathergood, Mahoney, Stewart, & Weber, 2017).

In UK data, people who repeatedly only make the contractual minimum payment, and so incur especially high borrowing costs from barely paying off their debt, have commonly used '*Direct Debits*' (sometimes referred to as '*autopay*'), set to automatically only pay the contractual minimum each month (Sakaguchi, Stewart & Gathergood, 2018).[6] These payments are automatically attempted each month directly from consumers' bank accounts. Throughout this paper we refer to '*Direct Debits*' as '*automatic payments*'. These can either be set to only pay the contractual minimum ('*automatic minimum payment*'), the full amount ('*automatic full payment*') or a fixed amount of their choice ('*automatic fixed payment*'). The latter group covers the contractual minimum payment in circumstances when this exceeds the fixed amount of their choice and would typically not be more than the amount owed.[7] For example, if a consumer had an automatic fixed payment set up for £25 and their minimum payment was £25 (or less) then £25 would automatically be attempted to be taken from their account that month. If, instead, their minimum payment was higher, say £50, which is greater than their automatic fixed payment of £25 then £50 would automatically be attempted to be taken from their account.

There is no requirement to have an automatic payment set-up. Consumers have to opt in if they would like to pay by this method. Often consumers are offered the opportunity to opt in during the credit card activation process. People can make manual payments instead of or as well as automatic payments throughout the credit card statement cycle. As a result, people' monthly credit card payment decisions are more complex than for instalment-based lending products: Should I make a payment this month? How much should I pay? What mechanism should I pay by?

People commonly use automatic payments to pay household bills (eg mortgage, rent, credit cards, utilities), which can typically be easily set-up at account opening which means there is no need to make manual monthly payments.[8] Anecdotally, automatic payments are seen as a way for consumers to avoid having to incur the mental cost of remembering to make payments each month. As Sakaguchi, Stewart, and Gathergood (2018) describe, an automatic minimum payment insures people against forgetting to repay the bill while leaving them completely free to make additional manual payments if they choose to do so. UK credit card data shows us that consumers often set-up automatic payments on opening a new account and rarely change this initial choice. Communications with behaviourally-informed personalized disclosures only results in an additional 2 in 100 people changing from automatic minimum to automatic fixed payments (Adams, Guttman-Kenney, Laibson, Hayes, Hunt & Stewart, 2018). Selecting an automatic minimum payment option may initially appear a somewhat sophisticated strategy because it avoids the borrower forgetting to make a payment. Such

[6] Or the cumbersome jargon could also be described as an Automated Clearing House (ACH) transfer initiated by the biller.

[7] All automated payments are subject to the card-holder having sufficient funds in their checking account for an automated payment request transaction to be fulfilled. There are processing time lags in UK automated payments which means that if a manual payment is made shortly before an automated payment is already due to go through it would not replace it.

[8] Compared to the US, UK payment infrastructure is more advanced. This means that 'automatic payments' are commonly used as a means of payments for credit cards, other financial products and household bills payments. Bank transactions are cleared quickly in the UK (typically within two hours) and cheques are declining in use and are much more rare than in the US.

forgetfulness would result in costly fees and an adverse missed payment mark on their credit file (Agarwal et al., 2013; Gathergood, Sakaguchi, Stewart & Weber, 2018; Medina, 2017). However, such an automatic minimum payment strategy means the borrower never needs to consciously make a payment decision again. Instead it is easy to slip into the inert behaviour of only paying the minimum with interest costs building up each month in a way that is less salient than a one-off missed fee charge.

Can such inertia in automatic payment decisions be harnessed to enable people to carry lower credit card debt?

3 Experimental design

Experimental design

We conduct a randomized controlled trial (RCT) in the field on 40,708 credit cards newly issued in 2017 by a large UK lender between February and May 2017. We chose this sample size to have sufficient statistical power to differentiate economically meaningful effects from null results.

We also ran this experiment with another lender. This second lender stopped the experiment after one week due to concern over the large size of the initial effects on automatic payment choices. The experiment was not restarted and the agreed target sample size was not reached. Only gathering results until a significant effect is found is known as p-hacking and is not a robust way to conduct research to test whether effects are statistically significant or not. The achieved sample size of 1,531 cards is too small to be sufficiently powered to distinguish between null results and real effects. We include results from the experiment in Annex 3. The research in the rest of this paper (including Annexes 1 and 2) is based on the experiment conducted with the first lender.

Before putting the RCT into the field, we carried out qualitative consumer testing to ensure people would understand how to navigate the intervention and conducted an ethical review to consider the potential for unintended consumer harm. Following best practice in conducting field experiments (Duflo & Banerjee, 2017; Harrison & List, 2004; Levitt & List, 2009) we pre-registered our empirical methodology before analysing data.[9] This pre-registration outlined the structure of analysis including the regression specifications and statistical significance tests we planned to run. In line with Benjamin et al. (2018), we regard a p value of 0.005 as the threshold for statistical significance but also highlight where results are '*suggestively significant*' at the 0.01 and 0.05 levels. This approach reduces the false positive rates by applying a tougher threshold than the typical 0.05 significance level historically used. It therefore acts in a similar way to applying Bonferroni or familywise error corrections for testing multiple hypotheses. It also aligns with Bayes factors of 14+ considered as substantial evidence for a hypothesis.

We structured our overall analysis in three parts – primary, secondary and tertiary. This structure limits the potential issues for data mining or p-hacking (Simmons et al., 2011). The primary analysis focuses on ten outcomes measuring the effects on: any minimum payment, any full payment, any missed payment and outstanding debt as a percent of statement balance (to normalise in order to deal with fat tailed credit card balances). We apply this for both the card in the trial and peoples' portfolio of credit cards – the final two primary outcomes were the cost of borrowing as a percent of statement balance and

[9] As this research was designed to inform potential Financial Conduct Authority rule-making, legal constraints meant we were unable to externally pre-register. Instead we documented this via a PDF time-stamped document stored on the FCA's file storage system.

total purchases as a percent of statement balance.[10] The secondary analysis was pre-registered. Secondary analysis considers a broader set of outcomes and empirical approaches to check the robustness of the primary results and understand the mechanisms driving the results in greater detail. Conducting secondary analysis depended on the results from the primary outcomes. Finally, we designed and implemented the tertiary analysis after examining the data.

The trial varies the '*choice architecture*' (Johnson et al., 2012; Thaler et al., 2014) of how options for automatic payments are presented to people at card activation. When a consumer takes out a new credit card they typically have the option to opt-in to set-up an automatic payment. If they decide to do so they are normally presented with three automatic payment options: full, fixed or minimum.

As displayed in Figure 1, the treatment (Panel B) removes the appearance of the automatic minimum payment option shown to the control group (Panel A).

This increases the prominence of the automatic fixed payment option. While there is no longer an explicit automatic minimum payment option, people can choose an option which is mathematically identical to it if the set an automatic fixed payment at £5. These two are equivalent because, given **Equation 1**, the minimum payment is always greater than or equal to £5. This means that where the minimum payment due in a particular month is more than £5, the automatic payment attempted to be taken will adjust accordingly, regardless of whether a consumer has an automatic fixed payment of £5 or an automatic minimum payment (two worked examples of this are in the footnote).[11] This equivalence is not highlighted to consumers and we do not expect them to be aware of this or work this out, nor is there a strong reason why they should. We explain this here to show that the intervention does not restrict consumer choice of an automatic minimum payment option, instead such an option is just no longer prominently labelled.

The rationale of this intervention is that if people move from an automatic minimum payment to an automatic fixed payment it will significantly shorten the hypothetical repayment schedule if there are no other changes in behaviour (eg changes in spending).[12] This is because while the contractual minimum payment (and therefore automatic minimum payment) typically declines with balances, a fixed payment sticks to the higher amount. For example, a typical credit card balance of £1,000 would take 18 years and 6 months to pay off if only the minimum was paid each month (which would start around £25 and then reduce to £5). However, by fixing to £25 each month it could be dramatically reduced to 5 years and 1 month, saving over £750 in interest costs.

[10] Variables as a percent of statement balance are bounded between zero and one.

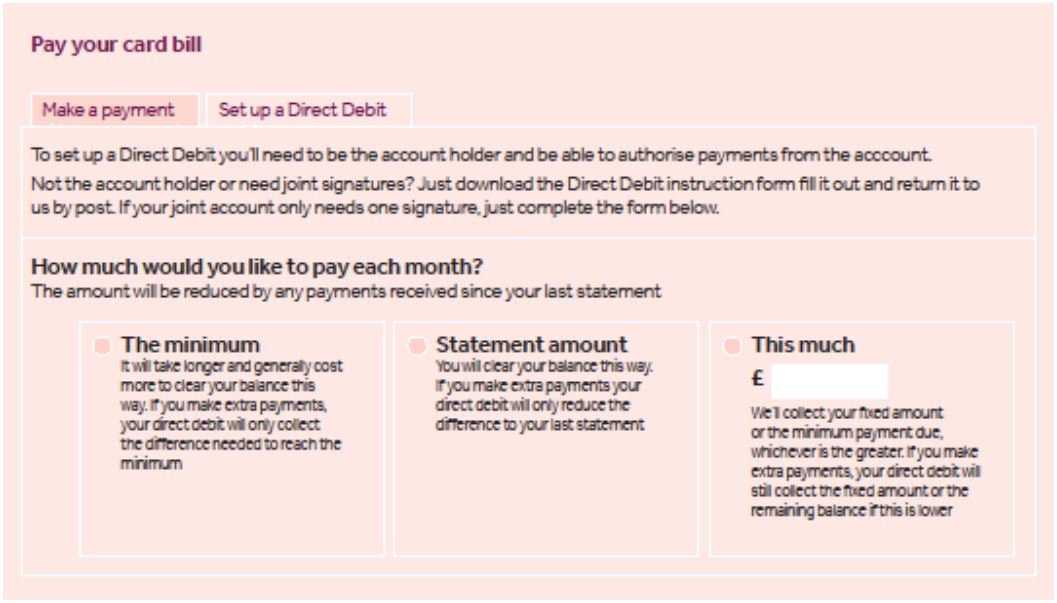
[11] Example 1: If a consumer had a £5 minimum payment due then £5 would be attempted to be taken if the consumer had an automatic minimum payment set up. If a consumer had an automatic fixed payment of £5 then £5 would be attempted.

Example 2: If a consumer had a £10 minimum payment due then £10 would be attempted to be taken if the consumer had an automatic minimum payment set up. If a consumer had an automatic fixed payment of £5 then £10 would be attempted (as the minimum was higher than the fixed amount).

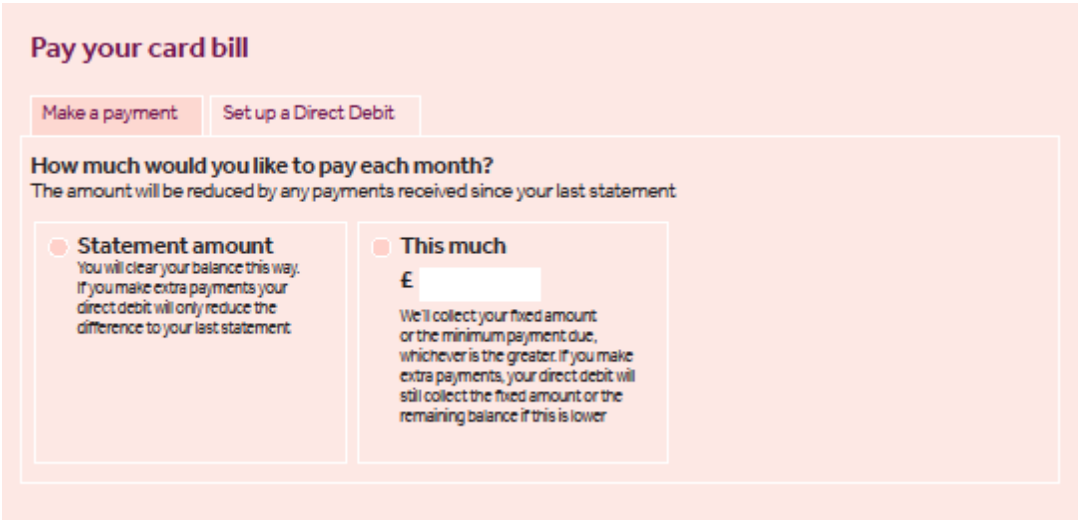
[12] This is unless the contractual minimum payment constantly binds to the card-holders' budget constraint in which case they would be equivalent. As the contractual minimum payment calculation applies in the same way across card-holders and the contractual minimum payment amount varies each month it appears highly improbable that such a scenario would occur except in rare cases.

Figure 1: Automatic payment options presented to control (Panel A) and treatment (Panel B) groups

A. Control



B. Treatment



Further, over and above having a fixed payment which does not reduce with the balance, choosing a slightly higher payment also greatly reduces amortisation times and borrowing costs. For example, a balance of £1,000 is paid off in 5 years and 1 month with an interest cost of £509 with a monthly fixed payment of £25, but with a monthly payment of £50 the balance is paid off in 2 years with an interest for of £191.[13] When choosing a payment manually, if card holders don't choose the minimum they have a tendency to choose round-numbered payments above the minimum (Sakaguchi, Stewart, & Gathergood, 2018). £50 is amongst the most prominent of these round numbers. So, holding all else constant, we would expect higher automatic payments to yield lower debt and borrowing costs. This would also possibly result in second order effects of increased

[13] Scenarios are assuming 18.9% APR and no further card spending.

consumer spending from increased credit limit availability, given the findings of consumer responses to credit limit increases (Agarwal et al., 2017; Aydin, 2018; Gross & Souleles, 2002). Without an automatic minimum payment option consumers are forced to consider how much they can afford to regularly pay each month – although such choices appear to be distorted by the anchoring effect of minimum payment information.[14]

We apply this intervention to new credit cards with the randomisation process carried out 'live' after the consumer's card application has been accepted. When a consumer is applying for a credit card online and has been provisionally accepted they have the option to set-up automatic payments on this new card. If a consumer selected the option confirming that they wanted to sign-up for automatic payments they were included in the experiment.[15] At this point they were navigated to treatment or control group screens.[16] Once allocated to control or treatment they would view these same choices if they returned to the pages to set-up or change their automatic payment choices within 30 days of applying for the card. One reason for doing so may be that they have wanted to sign-up for automatic payments but did not have bank details to hand so returned later on. If a consumer phoned the lender's call centre they had the normal automatic payment options available to them.

Data

Our data was gathered by the UK financial regulator — the Financial Conduct Authority (FCA). These contain detailed microdata on every credit card in the experiment. We observe data recorded at card origination (eg opening date, interest rates, initial credit limit) and which varies with statements (eg statement balances, transactions, borrowing costs). We observe seven statements for effectively all cards (99.9%) and up to eleven for the cards opened earliest in the trial. As a new card's first statement often does not last a full month or have a payment due this means we observe all cards for at least six full-length statements. Each payment made against these statements is observed including the date, amount and channel (eg automatic or manual).

Credit files were gathered for all the individuals in the trial enabling us to observe effects across the portfolio of credit cards held by a consumer. These provide monthly, product-level data on up to six years of credit use. These show credit limits, balances, payments and missed payment statuses. For credit cards we also observe additional data on statement balances and binary indicators for whether a card only made a minimum payment. These UK credit files are richer than US credit files used for some research as we observe statement balances and payments made against credit cards. US credit files typically show credit card debt at a point-in-time each month. For two points-in-time we observe credit risk scores and income estimates where available - the month before the card was granted and nine months afterwards.

[14] See Keller, Harlam, Loewenstein, & Volpp (2011) for a review of active choice literature. Carroll et al. (2009) study active choice in pension saving and Haggag & Paci (2014) in taxi tips.

[15] We also observe data for consumers who did not select this option and therefore were not included in the experiment

[16] This was carried out through a random number generator JAVA script created by the lender.

For 8,000 people in the trial we also observe daily data on checking and savings accounts held with that provider for the duration of the trial. This displays balances and overdraft limits.

Empirical Methodology

We construct an unbalanced panel with one observation for each credit card (i) for each statement cycle (t) observed. This panel is unbalanced as some cards are opened earlier than others. We estimate an OLS regression with standard errors clustered at the card-level. The regression specification used to derive average treatment effects (ATEs) is displayed in **Equation 2**.

Equation 2

$$y_{i,t} = \alpha_0 + \sum_{k=1}^{K} \beta_k TI\_CONTROLS_{k,i} + \sum_{v=1}^{V} \theta_v MONTH_v + \sum_{t=1}^{T} (\gamma_t CYCLE_t + \delta_t TREATMENT_i CYCLE_t) + \varepsilon_{i,t}$$

This regression includes a constant (α_0) a series of (K) time-invariant control variables $(TI\_CONTROLS_{k,i})$ constructed using information on the target credit card and card-holder from before the start of the trial and dummies for the month and year $(MONTH_v)$ the outcome is observed.[17] In this specification δ_t shows the average treatment effect t cycles $(CYCLE_t)$ since the start of a trial. We hypothesised that treatment effects will vary over time but we did not impose a functional form because it was unclear what the appropriate functional form would be. For our primary analysis we focus on the outcomes from the last cycle where the panel is balanced.

Summary Statistics and Balance Checks

Table 1 displays summary statistics on the characteristics of consumers taking out cards in this trial compared to the population of cards issued in the UK during this time. As these are new cards we cannot show pre-treatment behaviour on the card itself. Instead, we show summary statistics from the control group during their first seven cycles of using their card. This shows that in the control group, 19% of cards have made payments only equal to the contractual minimum payment for at least six of their first seven statements.

Consumers with automatic payments generally make close to one payment (mean 1.1, median 1) in total (automatic or manual) per monthly credit card statement cycle.

[17] CONTROLS were Gender, Age, Age squared, Log Estimated Income, Credit Score, Unsecured Debt-to-Income (DTI) Ratio, Any Mortgage Debt, Log Credit Card Credit Limit, Credit Card Purchases Rate, Subprime Credit Card, Any Credit Card Promotional Rate, Any Credit Card Balance Transfer, Credit Card Open Date, Credit Card Statement Day, Any Credit Card Secondary Cardholder.

These were all from the time of card origination (or month preceding card origination where consumer rather than Credit Card specific variables). For outcomes constructed from credit reference agency (CRA) data up to eleven dummies for lags of outcomes were included for months preceding the start of the trial.

CYCLE and MONTH are both included because statement cycles do not perfectly align with calendar months and trials went into the field at different points-in-time.

Consumers with automatic minimum payments rarely make additional payments – fewer than one in ten in the control group do so in a particular month.

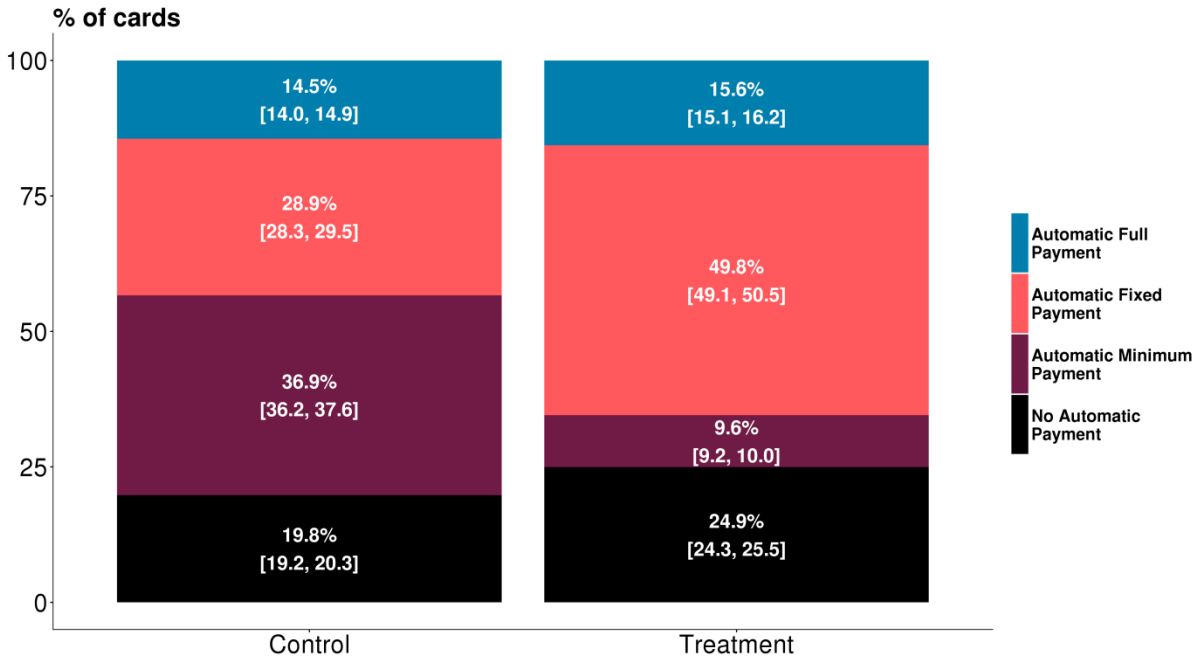
Allocation of consumers to the treatment group is balanced, on average, and across the distributions. However, we do see some small differences. The likelihood of being in the treatment group slightly varies with credit limit as shown in Table 2. Investigation of why this is reveals that the 'live' randomisation code used by the lender was not completely random – 526 more consumers (0.65%) were allocated to control than treatment. As people applying for credit cards were unaware (and unable to manipulate) their likelihood of being allocated treatment we can recover balance between treatment and control without a selection bias through conditioning on covariates. Conditioning on observables does not change our overall results and their implications when compared against results from unconditional means.[18] This is an example of the importance of carrying out thorough balance checks across both the means and distributions of a variety of variables when conducting randomized controlled trials to follow best practice in experimental design (Deaton & Cartwright, 2017)

[18] Annex 2, Table 6 displays comparison of unconditional means.

4 Experimental results

The first effect we examine is on the type of automated payment choices people have made by the time of their second (first full) credit card statement. Figure 2 shows a large initial effect. The intervention raises the fraction of cardholders enrolling in fixed-payment automatic payments by 20 percentage points. Almost all of this mass is redistributed from the fraction of cardholders enrolling in automatic minimum payments in the control group. The intervention also causes a very small increase in the proportion of people selecting the automatic full payment. Automatic minimum payments are not entirely eliminated as it was possible for individuals in the treatment group to sign-up for these through other ways (eg telephoning the call centre).[19]

Figure 2: Selection of automatic payment type for control and treatment groups at the second statement cycle



Numbers in bars are the percentage selecting each type of automatic payment, 95% confidence intervals in [].

The automatic fixed payment amounts people initially choose are frequently round numbers that are rarely revised.[20] As card balances accumulate over the first few months of card ownership, the minimum required payment amount rises, causing the minimum payment amount to exceed many of the fixed payments. After seven statement cycles, the proportion of people in the treatment group with an automatic fixed payment set at

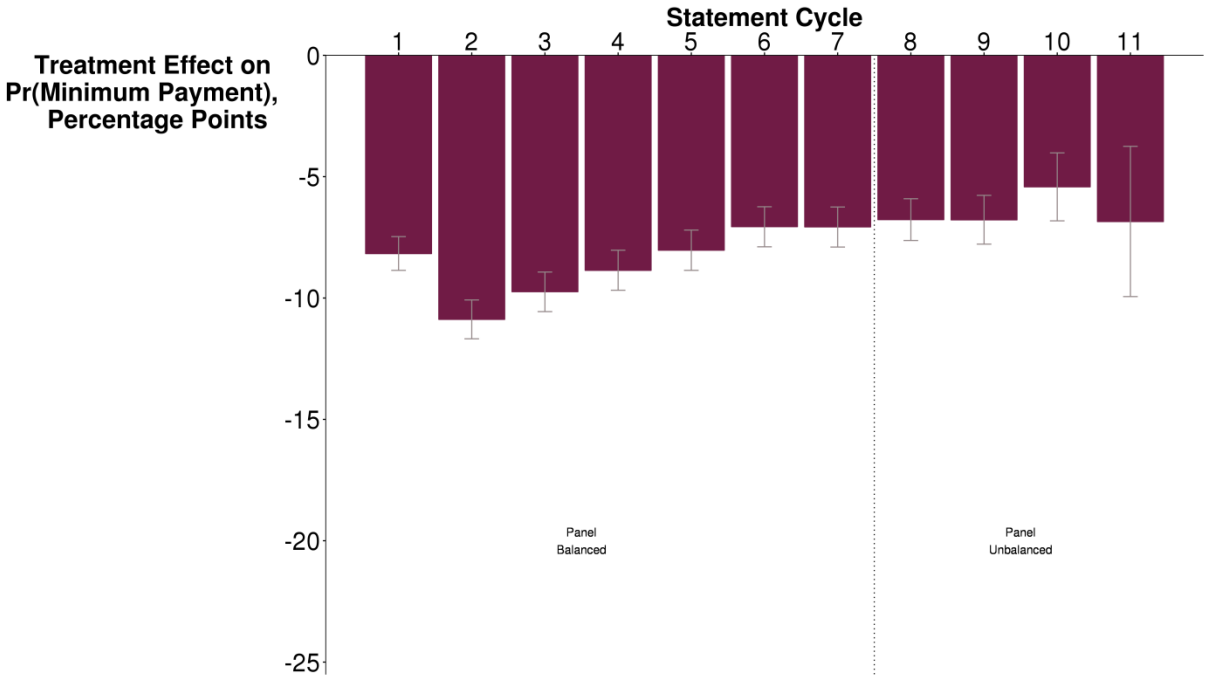
[19] The treatment results in no significant difference in the amount of people setting an automatic fixed payment of £5 which is identical to an automatic minimum payment. As effectively no one sets an automatic fixed payment of £5 this distinction does not affect the results if we code such choices as automatic minimum payments.

[20] 62% select, in descending order of frequency chosen: £100, £50, £200, £150, £30, £20 or £25

an amount that exceeds the minimum required payment is 73%, slightly down from 78% in the second cycle.[21]

When we examine our primary outcomes of interest in Table 3, seven statement cycles after card-opening (δ_7 in **Equation 2**), we observe that the intervention causes a significant reduction in the likelihood of only making exactly the minimum contractual payments (Figure 3). The effect on minimum contractual payments is smaller than the initial effect on automatic minimum payment choices but remains large. This is because some people with automatic minimum payments make additional manual payments to pay more than the minimum and some people have no minimum payment due (and therefore no payment is taken). The treatment effect falls over time from 10.9 to 7.1 percentage points from statement two to statement seven.

Figure 3: Treatment effect on minimum payments (for one to eleven completed statement cycles)



Error bars are 95% confidence intervals.

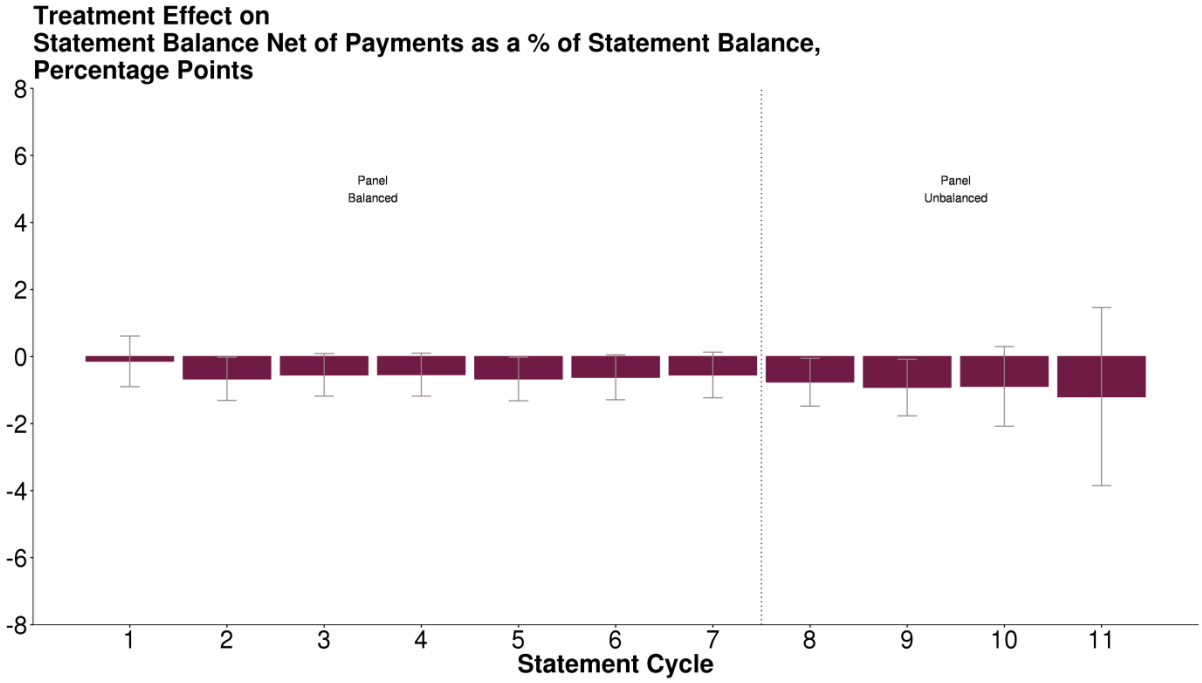
We look at how this effect translates to the fraction of all a cardholder's credit cards where minimum contractual payments are made. This reveals an average treatment effect a third of the size on the card for which the treatment was targeted. This smaller overall effect across the credit card portfolio is due to consumers holding multiple cards – only one of which would be in the trial. We do not observe significant spill overs that show the intervention changes behaviour on other cards consumers hold.

Beyond the effects on minimum contractual payments we find no significant average treatment effects on other outcomes of interest for the card in the trial (see Table 3). We find no average treatment effects on the likelihood of paying debt in full, debt net of payments, borrowing costs or purchases. We similarly find no significant effects on the likelihood of paying in full, missing payments or outstanding debt when aggregating across the portfolio of credit cards held.

[21] Annex 2, Figure 6 recreates Figure 2 based on automatic payment choices at the seventh cycle. Annex 2, Figures 7-11 display treatment effects on automatic payment choices cycle-by-cycle.

Our intervention does not appear to be reducing credit card debt by the seventh statement cycle (Figure 4). As the means are persistently, slightly (but statistically insignificantly) below zero, we check the robustness of this by aggregating across all statement cycles to provide more statistical power. By doing so we can say that, if the intervention has any average effect on debt, the average effect of the intervention reducing debt is not larger than a 0.8 percentage point reduction (given 95% confidence intervals).[22]

Figure 4: Treatment effect on debt net of payments as a percent of statement balance (for one to eleven completed statement cycles)



Error bars are 95% confidence intervals.

The lack of average treatment effects in consumer outcomes in spite of a seemingly large, initial change in choices is surprising. It is robust to a broader variety of outcomes displayed in Table 5.

So we have a conundrum. How can it be that the treatment is not, on average, reducing debt or borrowing costs if one in five people are moving from automatic minimum payments to higher automatic fixed payments and are spending no more on their card?

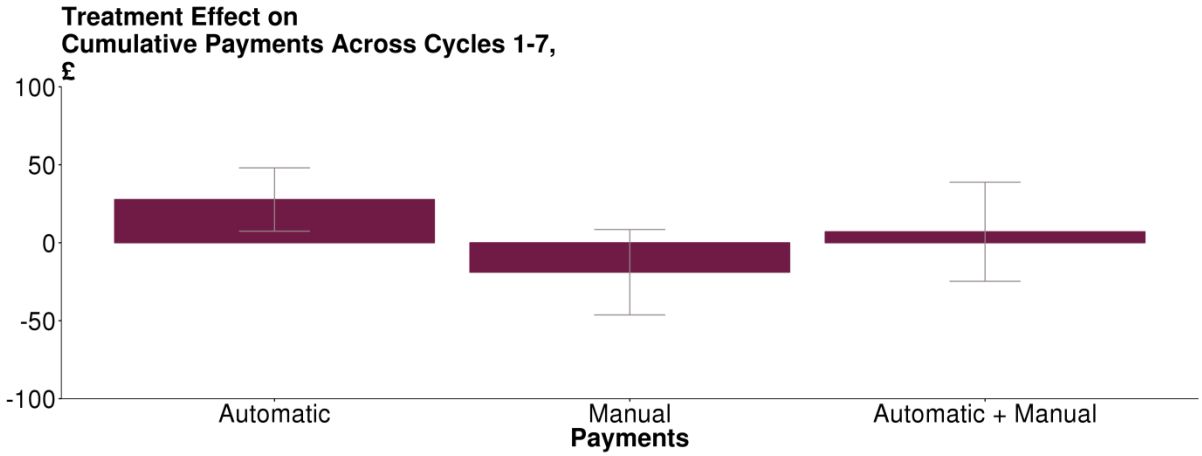
The primary mechanism our treatment was designed to apply was raising automatic payments. We investigated this by conducting tertiary analysis by disaggregating payments based on whether they are made automatically or manually. These payments are cumulated across cycles to observe patterns more clearly. We show the result of this in the top panel (A) of Figure 5. Here we can see that the intervention results in the value of automatic payments increasing, but these are almost totally offset by manual payments decreasing.[23] Thus when aggregating manual and automatic payments (ie total payments) we see a zero overall effect.

[22] Annex 2, Figure 13 displays treatment effects on outstanding debt in pounds cycle-by-cycle.

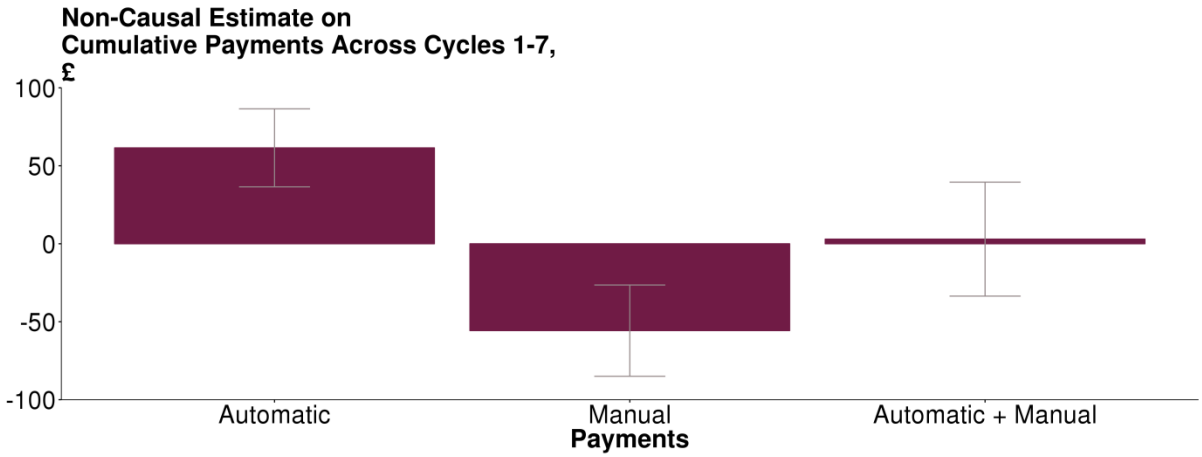
[23] Annex 2, Figure 14 displays treatment effects on payments cycle-by-cycle.

Figure 5: Treatment effect on cumulative credit card payments, decomposed by automatic payment choice (after seven completed statement cycles)

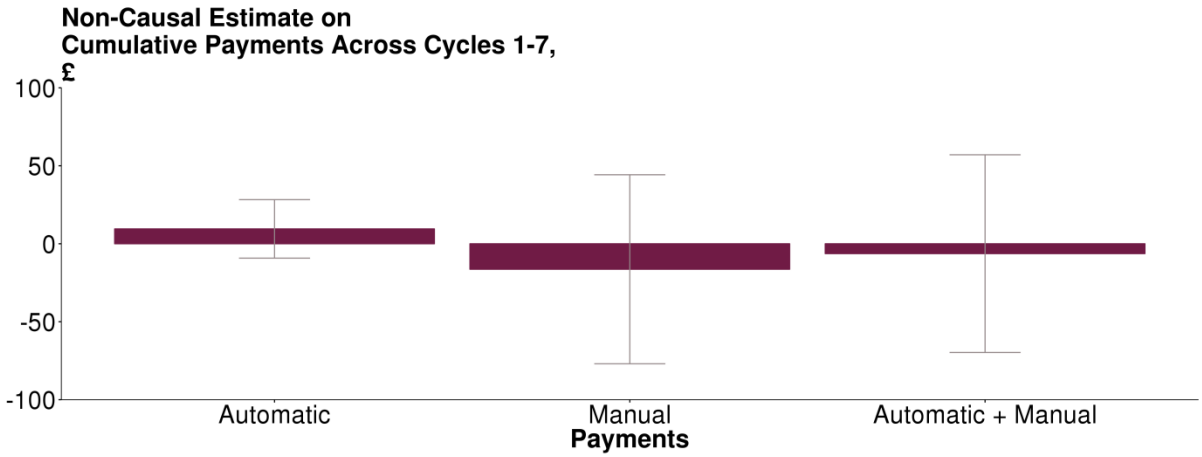
A. Causal Estimate: All Cards (N=40,693)



B. Non-Causal Decomposition Estimate: Cards With Automatic Payments (N=31,052)



C. Non-Causal Decomposition Estimate: Cards Without Automatic Payments (N=9,641)



Error bars are 95% confidence intervals.

We further examine this by cutting the data on an endogenous variable to examine the subset of consumers with and without automatic payments set-up at statement cycle 7. This approach takes **Equation 2** and conditions upon use of automatic payments ($AUTOPAY_t$) as shown in **Equation 3**. We also disaggregate payments into those made by automatic and manual methods.

Equation 3

$$y_{i,t} = \alpha_0 + \sum_{k=1}^{K} \beta_k \, TI\_CONTROLS_{k,i} + \sum_{v=1}^{V} \theta_v MONTH_v + \sum_{t=1}^{T} (\gamma_t CYCLE_t + \delta_t TREATMENT_i CYCLE_t) + \varepsilon_{i,t} \;\; if \; AUTOPAY_t == 0$$

$$y_{i,t} = \alpha_0 + \sum_{k=1}^{K} \beta_k \, TI\_CONTROLS_{k,i} + \sum_{v=1}^{V} \theta_v MONTH_v + \sum_{t=1}^{T} (\gamma_t CYCLE_t + \delta_t TREATMENT_i CYCLE_t) + \varepsilon_{i,t} \;\; if \; AUTOPAY_t == 1$$

Table 5 reports the treatment effects conditional upon adopting an automatic payment. Given an automatic payment is set up, it is 26.5 percentage points less likely to be for the minimum and 24.7 percentage points more likely to be for a fixed payment. We find consumers with an automatic payment are slightly, 2.3 percentage points, more likely to make a manual payment as a result of the treatment. This is an average treatment effect of 1.3 percentage points as not all cards in the experiment have automatic payments set up – this increase is in spite of the treatment reducing sign-up to automatic payments.

Figure 5 plots the cumulative payments across the first seven cycles. The middle panel (B) shows, for cards with automatic payments, the increase in automatic payments in the treatment condition is offset by a reduction in the manual payments made. The effect on overall payments (automatic and manual) is zero. We are confident (95% confidence interval) that any increase is no greater than £50 – this can be evaluated relative to average cumulative payments of £1,280.[24] The treatment is causing people to increasingly choose automatic fixed payments instead of automatic minimum payments. Yet these same types of people reduce the value of their additional manual payments. This effect is in spite of the proportion of consumers having made any additional manual payments increasing as a result of the intervention. Combining automatic and manual payments shows these two effects almost perfectly offset one another. Credit card purchases remain unchanged for this sub-group of consumers.

Not everyone in the experiment opts-in to setting up an automatic payment after being allocated to control or treatment. The lower panel (C) of Figure 5 shows that, for card holders who did not set up an automatic payment, the treatment has no effect on payments.[25]

Our findings also hold if we use an alternative measure previously used in Figure 5 – payments as a percentage of statement balance. This measure normalises effects across

[24] £1,280 is the average cumulative payments by cycle seven in the control group for consumers with automatic payments as of cycle seven.

[25] It is not a precise zero effect on automatic payments because some consumers without automatic payments at cycle seven had automatic payments in earlier cycles and then cancelled them or set them up after their seventh cycle was issued but before payments were made.

cards with high and low balances and is bounded to address fat tails of the distribution of payments. After seven payment cycles, there is a 3 percentage point initial increase in automatic payments which is offset by a 3 percentage point decrease in manual payments which nets out at a zero effect on overall payments.

Manual payments by consumers with automatic payments may be infrequent – just 8.5% of those with automatic payments in the control group make a manual payment in the seventh statement cycle.[26] But they account for 40.3% of the total value of payments made over seven cycles by those in the control group with automatic payments set up.[27]

When consumers make infrequent manual payments they are substantially larger in value than automatic payments. In months where manual payments are made by those with automatic payments set up, the average (mean) value of the manual payment is £436.40, with a typical (median) value of £120.00 (Annex 2, Figure 15 displays the distributions of these variables). Automatic payments in those same months average £106.98 with a median of £54.74 and are similar in months where consumers are not making manual payments.

Most manual payments (by those with automatic payments set up) do not clear a consumer's debt – just 18.4% do so in the control group.[28] 23.0% of manual payments are for round numbers (£50, £100, £150, £200, £250 or £500). It does not appear that consumers are adding up the values of their manual and automatic payments to target particular round numbers. The distribution of total payments (automatic plus manual payments) in months where consumers with automatic payments set up are making manual payments is fairly smooth(Annex 2, Figure 15). The round numbers found to prominently appear in manual payments appear with far less frequency in total payments – just 6.6%.[29]

It does not appear that consumers with automatic payments decide to make manual payments in response to crossing particular heuristic thresholds. We find the distributions of credit card statement balances and utilisation rates before payments are deducted to be smooth and similar in the months with and without manual payments being made. We also do not find evidence that consumers are making manual payments to target keeping their credit card debt or utilisation below particular values (Annex 2, Figure 16).

There are no effects as a result of the intervention on consumption or card activity in either our causal average effects or when examining the subsample of consumers with automatic payments.[30] These are robust across a variety of measures presented in Table 5: cumulative value of spending, any spending on card in cycle, spending as a percent of statement balance and any positive statement balance on card.

The intervention initially causes one in twenty more people to drop-out of having any type of automatic payment set-up. Without automatic payments set-up consumers need to remember to make a payment and not all do so. This lower automatic payment use therefore results in a slight increase in arrears as people forget to make payments. While this increase is borderline statistically significant when examining any particular

[26] 6.7% of all consumers in the control group (ie with and without automatic payments set up). 9.2% for consumers on automatic fixed or minimum payments set up. 6.3% if focus on consumers with automatic minimum payments. 12.7% for consumers with automatic fixed payments.

[27] 54.0% for those with automatic fixed or minimum payments set up.

[28] For consumers with any automatic payment also making a manual payment in the seventh statement cycle.

[29] 8.6% of times where consumers are not paying the minimum or full amount.

[30] Annex 2, Figure 12 displays treatment effect on purchases cycle-by-cycle.

statement cycle, it is clearly significant when conducting a joint significance test across statement cycles (while still clustering at the card-level) as displayed in Table 4.

The intervention itself appears to have an effect on arrears through this change in automatic payment use and not via other potential mechanisms (eg automatic fixed payments at unsustainably high amounts which consumers could not maintain). The effect on arrears is solely on missing a single payment. Such temporary arrears does not appear in the credit reference agency (CRA) outcome for missed credit card payments – this is because temporary arrears is not always reported to credit bureaus so would not affect people's credit scores. The intervention does not lead to consumers being classified as being in more severe arrears which is often defined as being two, three (or more) payments behind. This indicates that not having an automatic payment means consumers forget to make a payment which has a temporary impact, most notably incurring a late payment fee, rather than causes consumers to spiral into a terminal state of financial distress that they cannot recover from.

5 Concluding discussion

We nudged credit card holders to adopt automatic fixed payments instead of automatic minimum payments at card activation. The proximal treatment effect was large. Automatic fixed payment use was an absolute 17% higher in the treatment group and automatic minimum payment use was an absolute 22% lower in the treatment group. But the more distal treatment effect was a precise null. Although automatic payments rose for those responding to the treatment, the additional manual payments in each month were reduced so the overall effect on cumulative payments was a precise zero.

Our findings fit into the broader literature — beyond credit cards and financial products — on the effect of behaviourally-informed nudge interventions. While early studies found these to be effective — often using short-term, easily observed changes in choices — this paper demonstrates how important it is to monitor whether initial effects on changing choices translate into longer-term real economic outcomes.

One remarkable aspect of this finding is the persistence of the effects. We are causing a persistent change in the methods of payments (increasing use of automatic fixed payments, reducing use of automatic minimum payments and rate of sign-up to automatic payments) across the statements observed. The automatic fixed payment was set in month one. Consumers seem very inert rarely changing this initial automatic payment choice which has been greatly influenced by the choice architecture they were presented with. But manual payments were reduced in each and every month as a result.

Maybe such consumers are not as inert as they first appear? In spite of the large, persistent effect on automatic payment choices we do not observe effects on longer-term outcomes of economic importance. Consumers are substituting the type of payments they make but not the amounts of payments. The intervention does not cause changes to credit card purchasing behaviour. Average outstanding debt remains unchanged. The subgroup of consumers who the treatment causes to no longer use automatic payments may arguably be slightly worse-off due to forgetting to make payments. It may be coincidence that in this experiment the heterogeneous effects net out at such a precise zero. The disappearance of the large, initial effect is very clearly a real and important effect. As Abadie (2018) highlights, the reporting of null results such as these are highly informative for furthering empirical economics more generally.

When considering these findings in the theoretical literature two potential explanations come to mind. Behavioural models could explain the differences in initial automatic payment choices (eg automatic minimum payment option operates like a focal point) but need to be combined with a cost-adjustment type model (Bertola & Caballero, 1990) to explain subsequent payment behaviour. Alternatively, a rational inattention model could explain behaviour: consumers regard their initial automatic payment choice as unimportant because they intend to make manual payments later on. If so, consumers are indifferent between automatic minimum payments and automatic fixed payments for amounts above the minimum. For some consumers it may be that the mental cost of selecting an automatic fixed amount is too great and so they opt out of making a decision at all.

Annex 1: Main Tables

Table 1: Summary statistics

	Outcome	Mean	P10	P25	P50	P75	P90
1	Age (years)	36.46	23	27	34	45	54
2	Female (% cards)	46.06					
3	Credit Limit (£)	4,312.49	400	1200	3800	6300	9000
4	Credit Score (0-100)	65.27	55.65	60.62	65.58	70.38	74.49
5	Purchases Rate (%)	22.85	18.9	18.9	18.9	29.9	34.9
6	Balance Transfer (% cards)	29.00					
7	Any Automatic Payment Set-up (% cards)	78.33					
8	Any Automatic Full Payment Set-up (% cards)	13.09					
9	Any Automatic Fixed Payment Set-up (% cards)	29.77					
10	Any Automatic Minimum Payment Set-up (% cards)	35.47					
11	Credit Card Statement Balance (£)	2,164.49	0	372.51	1289.82	3273.7	5436.64
12	Credit Card Statement Balance Net of Payments (£)	1,962.52	0	40.61	1085.54	3069.9	5162.06
13	Full Payment (% cards)	23.97					
14	Between Full and Min Payment (% cards)	42.22					
15	Minimum Payment (% cards)	30.12					
16	Missed Payment (% cards)	3.69					
17	Number of Full Payments Across Cycles 1-7	1.90	0	0	1	3	7
18	Number of Minimum Payments Across Cycles 1-7	2.04	0	0	0	4	7
19	Full Payments For 6+ Cycles (% cards)	18.05					
20	Minimum Payments For 6+ Cycles (% cards)	19.18					
21	Credit Card Statement Balance Net of Payments as a % Statement Balance (£)	69.36	0	17.92	95.04	97.75	97.75
22	Payments Across Cycles 1-7 (£)	1,277.27	154.28	353.00	703.57	1420.23	2937.46
23	Purchases Across Cycles 1-7 (£)	350.92	0	0	0	122.54	866.94
24	Costs Across Cycles 1-7 (£)	76.02	0	5.23	45.32	109.95	191.65
25	Interest Across Cycles 1-7 (£)	19.77	0	0	0	14.92	63.16
26	Fees Across Cycles 1-7 (£)	56.26	0	1.81	30.00	80.10	147.20
27	Total Credit Card Statement Balances (£)	2,364.92	0	0	878.00	3168.00	6636.20
28	Total Credit Card Statement Balances Net of Payments (£)	2,001.35	0	0	360.00	2708.00	5945.20
29	All Cards - Age (years)	42.41	25	31	40	52	63
30	All Cards - Credit Limit (£)	3,500.30	250	800	2500	5000	8000
31	All Cards - Credit Card Statement Balance Net of Payments (£)	1,216.18	0	0	262	1618	3858

Rows 1-28 for control group using data as of the end of their first seven statement cycles after card opening. Rows 29-31 are calculated using a representative sample of credit reference agency (CRA) data to illustrate the population of credit cards opened January – May 2017 evaluated at their seventh statement cycle after opening.

Table 2: Balance checks between treatment and control

Outcome	Mean (Control)	Mean (Treatment)	Mean Difference (Treatment-Control)	Percentage Difference Relative to Control	CI Lower (Treatment-Control)	CI Upper (Treatment-Control)	P Value	T Statistic
Age (years)	36.46	36.61	0.15	0.41	-0.09	0.39	0.231	1.197
Female (% cards)	46.05	46.13	0.08	0.16	-0.89	1.04	0.878	0.153
Credit Limit (£)	4,312.64	4,384.31	71.66*	1.66	5.30	138.02	0.034	2.116
Credit Score (0-100)	65.27	65.39	0.12	0.18	-0.03	0.26	0.116	1.570
Purchases Rate (%)	22.85	22.82	-0.03	-0.13	-0.15	0.09	0.614	0.504
Balance Transfer (% cards)	28.99	29.76	0.77	2.67	-0.11	1.66	0.087	1.714
Total Credit Card Statement Balances (£)	2,364.66	2,439.02	74.36	3.14	-0.57	149.29	0.052	1.945
Total Credit Card Statement Balances Net of Payments (£)	2,000.92	2,072.44	71.52*	3.57	2.95	140.09	0.041	2.044

N (control) = 20,617 cards, N (treatment) = 20,091. *** P value < 0.005, ** < 0.01, * < 0.05.

Table 3: Treatment effects on primary outcomes after seven completed statement cycles

Outcome	Estimate (Standard Error)	95% Confidence Interval	P Value	Adjusted R Squared
Any minimum payment	-0.0707* * * (0.0042)	[-0.0790, -0.0625]	0.0000	0.0841
Any full payment	0.0044 (0.0037)	[-0.0028, 0.0116]	0.2286	0.2971
Any payment less than minimum payment	0.0038* (0.0019)	[0.0001, 0.0074]	0.0436	0.0333
Statement balance net of payments (% statement balance)	-0.0055 (0.0035)	[-0.0123, 0.0013]	0.1125	0.3292
Costs (% statement balance)	-0.0003 (0.0006)	[-0.0015, 0.001]	0.6852	0.0170
Transactions (% statement balance)	0.0027 (0.0031)	[-0.0035, 0.0089]	0.3885	0.2345
CRA share of credit cards only paying minimum	-0.0264* * * (0.0027)	[-0.0318, -0.0211]	0.0000	0.1818
CRA share of credit cards making full payment	0.0013 (0.0033)	[-0.0052, 0.0078]	0.6891	0.2967
CRA share of credit cards missing payment	-0.0001 (0.0013)	[-0.0026, 0.0024]	0.9485	0.0609
CRA total credit card statement balances net of payments (% statement balances)	-0.0056 (0.0031)	[-0.0117, 0.0006]	0.0768	0.4115

N=40,708 cards, 368,043 observations. *** P value < 0.005, ** < 0.01, * < 0.05.

Table 4: Treatment effects on primary and selected secondary outcomes pooling across completed statement cycles

Outcome	Estimate	95% Confidence Interval	P Value	Adjusted R Squared
Any automatic payment set-up	-0.0470* * * (0.0037)	[-0.0543, -0.0397]	0.0000	0.0633
Any automatic full payment set-up	0.0098* * * (0.0027)	[0.0045, 0.0151]	0.0003	0.2966
Any automatic fixed payment set-up for greater than contractual minimum payment that statement	0.1022* * * (0.0039)	[0.0946, 0.1098]	0.0000	0.1029
Any automatic fixed payment set-up	0.1797* * * (0.0041)	[0.1717, 0.1878]	0.0000	0.1565
Any automatic minimum payment set-up	-0.2365* * * (0.0037)	[-0.2438, -0.2293]	0.0000	0.1076
Any minimum payment	-0.0809* * * (0.0033)	[-0.0874, -0.0745]	0.0000	0.0824
Any full payment	0.0044 (0.0028)	[-0.0011, 0.01]	0.1135	0.2869
Any payment less than minimum payment	0.0040* * * (0.0011)	[0.0018, 0.0061]	0.0003	0.0332
Statement balance net of payments (% statement balance)	-0.0060* (0.0027)	[-0.0114, -0.0007]	0.0261	0.32
Costs (% statement balance)	-0.0001 (0.0002)	[-0.0006, 0.0003]	0.5435	0.0166
Transactions (% statement balance)	0.0015 (0.002)	[-0.0024, 0.0055]	0.4505	0.2089
CRA share of credit cards only paying minimum	-0.0267* * * (0.0017)	[-0.0299, -0.0234]	0.0000	0.1632
CRA share of credit cards making full payment	0.0005 (0.0023)	[-0.0040, 0.0050]	0.8345	0.2576
CRA share of credit cards missing payment	0.0004 (0.0007)	[-0.0009, 0.0017]	0.5742	0.0589
CRA total credit card statement balances net of payments (% statement balances)	-0.0039 (0.0022)	[-0.0082, 0.0003]	0.0692	0.368
New purchases (£)	-2.3147 (2.7125)	[-7.6312, 3.0017]	0.3935	0.1583
Statement balance (£)	2.4572 (14.9844)	[-26.9122, 31.8267]	0.8697	0.4912
Statement balance net of payments (£)	2.7276 (14.9526)	[-26.5795, 32.0347]	0.8553	0.4765
Log (statement balance)	-0.0054 (0.0157)	[-0.0362, 0.0253]	0.7297	0.3174
Log (statement balance net of payments)	-0.0225 (0.0207)	[-0.0631, 0.0181]	0.2778	0.3962
Any payments via both automatic AND manual	0.0166* * *	[0.0136,	0.0000	0.0095

	(0.0015)	0.0196]		
Total payments (£)	-0.2703 (2.2469)	[-4.6743, 4.1337]	0.9042	0.0397
Automatic payments (£)	3.1668* (1.4652)	[0.2950, 6.0386]	0.0307	0.0726
Manual payments (£)	-3.1976 (1.9311)	[-6.9825, 0.5874]	0.0978	0.0118
Any arrears (2+ payments behind)	0.0004 (0.0007)	[-0.0010, 0.0018]	0.5681	0.0273
Any arrears (3+ payments behind)	0.0001 (0.0005)	[-0.0009, 0.0012]	0.7862	0.0204

N=40,708 cards, 368,043 observations. *** P value < 0.005, ** < 0.01, * < 0.05

Table 5: Treatment effects on primary and selected secondary outcomes after seven completed statement cycles, decomposed by automatic payment choice

	Estimates (Standard Errors)		
Outcome	**Causal Estimate: All Cards**	**Non-Causal Decomposition Estimate: Cards With Automatic Payments**	**Non-Causal Decomposition Estimate: Cards Without Automatic Payments**
Any automatic payment set-up	-0.0427* * * (0.0041)	N/A	N/A
Any automatic minimum payment set-up	-0.2173* * * (0.0041)	-0.2653* * * (0.0049)	N/A
Any automatic fixed payment set-up	0.1678* * * (0.0045)	0.2473* * * (0.0051)	N/A
Any automatic full payment set-up	0.0069* (0.0028)	0.0176* * * (0.0034)	N/A
Any automatic fixed payment set-up for greater than contractual minimum payment that statement	0.0865* * * (0.0043)	0.1341* * * (0.0052)	N/A
Any minimum payment	-0.0707* * * (0.0042)	-0.0880* * * (0.0050)	0.0178* * (0.0066)
Any full payment	0.0044 (0.0037)	0.0078* (0.0039)	-0.0116 (0.0088)
Any payment less than minimum payment	0.0038* (0.0019)	-0.0003 (0.0007)	-0.0088 (0.007)
Statement balance net of payments (% statement balance)	-0.0055 (0.0035)	-0.0096* * (0.0037)	0.012 (0.0083)
Costs (% statement balance)	-0.0003 (0.0006)	-0.0007 (0.0006)	-0.0004 (0.0018)
Transactions (% statement balance)	0.0027 (0.0031)	0.0071* (0.0035)	-0.0049 (0.0067)
Total payments (% statement balance)	0.0064 (0.0034)	0.0123* * * (0.0037)	-0.0064 (0.008)
Automatic payments (% statement balance)	0.0075* * (0.0027)	0.0167* * * (0.0032)	0.0019 (0.0011)
Manual payments (% statement balance)	-0.0005 (0.003)	-0.0032 (0.0031)	-0.0081 (0.008)
Payments via both automatic AND manual	0.0131* * * (0.0026)	0.0235* * * (0.0033)	0.0002 (0.0012)
Automatic payments as a % of total payments	-0.0061 (0.0051)	0.0306* * * (0.0044)	-0.0021 (0.0033)

Outcome	Causal Estimate: All Cards	Non-Causal Decomposition Estimate: Cards With Automatic Payments	Non-Causal Decomposition Estimate: Cards Without Automatic Payments
Statement balance (£)	-1.6073 (17.2714)	-9.4396 (19.7173)	41.8898 (33.9096)
Statement balance net of automatic payments (£)	-1.0893 (17.1123)	-13.3362 (19.5279)	41.7003 (33.9016)
Statement balance net of payments (£)	2.7377 (17.2434)	-3.3432 (19.7232)	40.8693 (33.5576)
Log (statement balance)	-0.0111 (0.0216)	-0.0137 (0.0224)	0.0760 (0.0544)
Log (statement balance net of payments)	-0.0227 (0.0264)	-0.0463 (0.0282)	0.0946 (0.0627)
Any positive statement balance	-0.0004 (0.0029)	0.0011 (0.0030)	0.0072 (0.0073)
Any use of card (cash advances or purchases)	0.0057 (0.0041)	0.0085 (0.0046)	-0.0072 (0.0092)
Statement balance as a % of credit limit	-0.0002 (0.0032)	-0.007* (0.0033)	0.0167* (0.0082)
Cumulative purchases across statements (£)	-19.5082 (12.7219)	-26.9291 (14.9544)	-4.4421 (24.3599)
Cumulative payments across statements (£)	7.0689 (16.219)	2.9775 (18.646)	-6.3296 (32.3425)
Cumulative automatic payments across statements (£)	27.7215* * (10.364)	61.501* * * (12.7604)	9.5325 (9.5681)
Cumulative manual payments across statements (£)	-18.8880 (13.9749)	-55.7081* * * (14.9303)	-16.3532 (30.9214)
CRA share of credit cards only paying minimum	-0.0264* * * (0.0027)	-0.0355* * * (0.0032)	0.0151* * * (0.0052)
CRA share of credit cards making full payment	0.0013 (0.0033)	0.0048 (0.0036)	-0.004 (0.0076)
CRA share of credit cards missing payment	-0.0001 (0.0013)	-0.0009 (0.0006)	-0.0094* (0.0047)
CRA total credit card statement balances net of payments (% statement balances)	-0.0056 (0.0031)	-0.0092* * (0.0034)	0.0046 (0.0075)
CRA total credit card statement balance (£)	25.4282 (31.2595)	29.9528 (37.2276)	34.2918 (55.1172)
CRA total credit card statement balance net of payments (£)	9.0636 (31.1348)	10.3639 (36.957)	47.1523 (55.8298)
CRA total credit card payments (£)	9.0376 (9.3864)	6.7686 (11.0392)	2.0523 (17.4438)
CRA total credit card payments (% statement balance)	0.0020 (0.0032)	0.0048 (0.0035)	-0.0056 (0.0078)

*** P value < 0.005, ** < 0.01, * < 0.05.

Annex 2: Additional Figures & Tables

Table 6: Unconditional mean comparison of treatment effects on primary and selected secondary outcomes after seven completed statement cycles

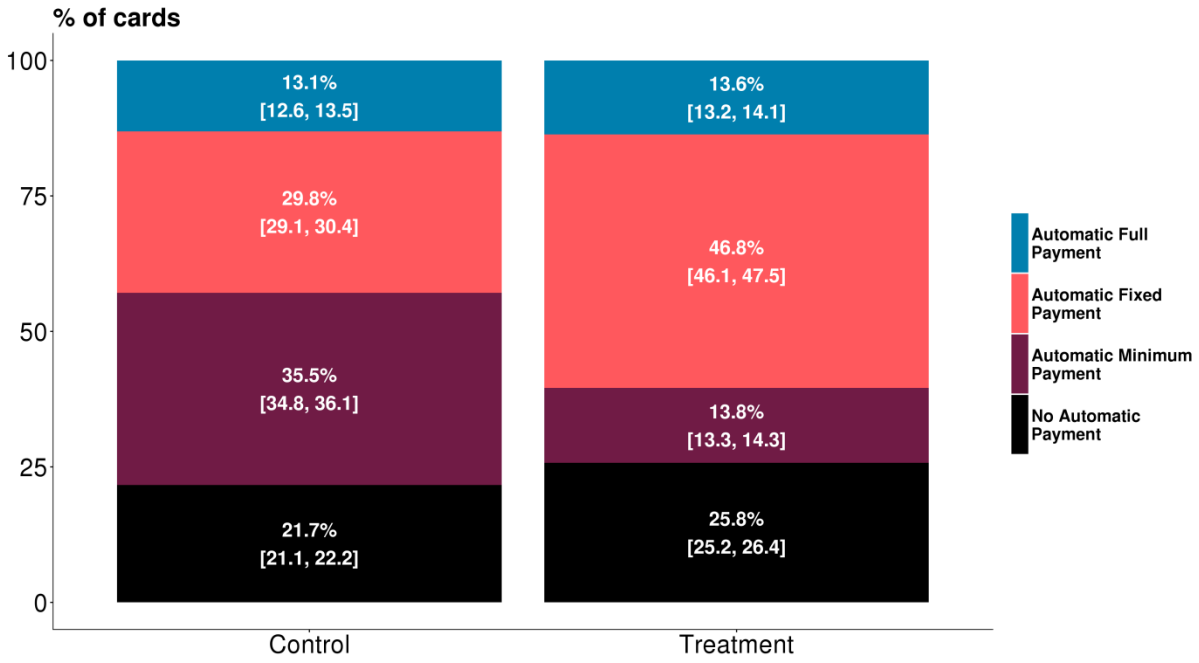
Outcome	Mean (Control)	Mean (Treatment)	Mean Difference (Treatment-Control)	Percentage Difference Relative to Control	CI Lower (Treatment-Control)	CI Upper (Treatment-Control)	P Value	T Statistic
Any automatic payment set-up	0.783	0.742	-0.041***	-5.230	-0.049	-0.033	0.000	9.721
Any automatic minimum payment set-up	0.355	0.138	-0.217***	-61.100	-0.225	-0.209	0.000	52.520
Any automatic fixed payment set-up	0.298	0.468	0.170***	57.170	0.161	0.180	0.000	35.847
Any automatic full payment set-up	0.131	0.136	0.006	4.250	-0.001	0.012	0.099	1.648
Any automatic fixed payment set-up for greater than contractual minimum payment that statement	0.253	0.341	0.088***	34.900	0.079	0.097	0.000	19.561
Any minimum payment	0.301	0.232	-0.069***	-22.880	-0.078	-0.060	0.000	15.770
Any full payment	0.240	0.242	0.002	0.810	-0.006	0.010	0.648	0.456
Any payment less than minimum payment	0.037	0.040	0.003	9.230	-0.0003	0.007	0.075	1.782
Statement balance net of payments (% statement balance)	0.694	0.691	-0.003	-0.370	-0.011	0.005	0.525	0.636
Costs (% statement balance)	0.011	0.011	-0.0004	-3.360	-0.002	0.001	0.560	0.584
Transactions (% statement balance)	0.201	0.201	0.001	0.320	-0.006	0.008	0.853	0.185
Total payments (% statement balance)	0.227	0.230	0.003	1.480	-0.004	0.011	0.369	0.899

Outcome	Mean (Control)	Mean (Treatment)	Mean Difference (Treatment-Control)	Percentage Difference Relative to Control	CI Lower (Treatment-Control)	CI Upper (Treatment-Control)	P Value	T Statistic
Automatic payments (% statement balance)	0.110	0.116	0.006*	5.650	0.001	0.012	0.028	2.192
Manual payments (% statement balance)	0.121	0.119	-0.002	-1.900	-0.008	0.004	0.441	0.770
Payments via both automatic AND manual	0.067	0.080	0.012***	18.630	0.007	0.018	0.000	4.836
Automatic payments as a % of total payments	0.664	0.662	-0.002	-0.290	-0.012	0.008	0.698	0.388
Statement balance	2,164.495	2,203.763	39.268	1.810	-7.975	86.511	0.103	1.629
Statement balance net of automatic payments	2,077.546	2,116.668	39.122	1.880	-7.519	85.762	0.100	1.644
Statement balance net of payments	1,962.519	2,005.404	42.885	2.190	-3.459	89.229	0.070	1.814
Log (statement balance)	6.401	6.413	0.012	0.200	-0.037	0.062	0.621	0.494
Log (statement balance net of payments)	5.569	5.579	0.010	0.180	-0.054	0.074	0.761	0.304
Positive statement balance	0.897	0.898	0.001	0.060	-0.005	0.006	0.854	0.184
Any use of card (cash advances or purchases)	0.283	0.287	0.004	1.520	-0.004	0.013	0.336	0.961
Statement balance as a % of credit limit	0.522	0.522	-0.001	-0.110	-0.008	0.006	0.877	0.155
Cumulative purchases across statements	350.922	330.647	-20.274	-5.780	-46.475	5.926	0.129	1.517
Cumulative payments across statements	1,277.267	1,288.312	11.045	0.860	-22.899	44.989	0.524	0.638
Cumulative automatic payments across statements	573.790	605.264	31.474**	5.490	9.636	53.311	0.005	2.825

Outcome	Mean (Control)	Mean (Treatment)	Mean Difference (Treatment-Control)	Percentage Difference Relative to Control	CI Lower (Treatment-Control)	CI Upper (Treatment-Control)	P Value	T Statistic
Cumulative manual payments across statements	711.968	693.183	-18.785	-2.640	-46.711	9.141	0.187	1.318
CRA share of credit cards only paying minimum	0.201	0.178	-0.024***	-11.760	-0.030	-0.018	0.000	8.000
CRA share of credit cards making full payment	0.441	0.442	0.001	0.240	-0.006	0.008	0.774	0.288
CRA share of credit cards missing payment	0.024	0.023	-0.0004	-1.770	-0.003	0.002	0.749	0.320
CRA total credit card statement balances net of payments (% statement balances)	0.695	0.691	-0.004	-0.600	-0.012	0.003	0.280	1.080
CRA total credit card statement balance	3,916.955	4,018.944	101.989*	2.600	1.103	202.875	0.048	1.981
CRA total credit card statement balance net of payments	3,431.685	3,510.780	79.095	2.300	-15.626	173.815	0.102	1.637
CRA total credit card payments	485.704	508.164	22.460*	4.620	0.859	44.061	0.042	2.038
CRA total credit card payments (% statement balance)	0.256	0.256	-0.0005	-0.190	-0.008	0.007	0.893	0.135

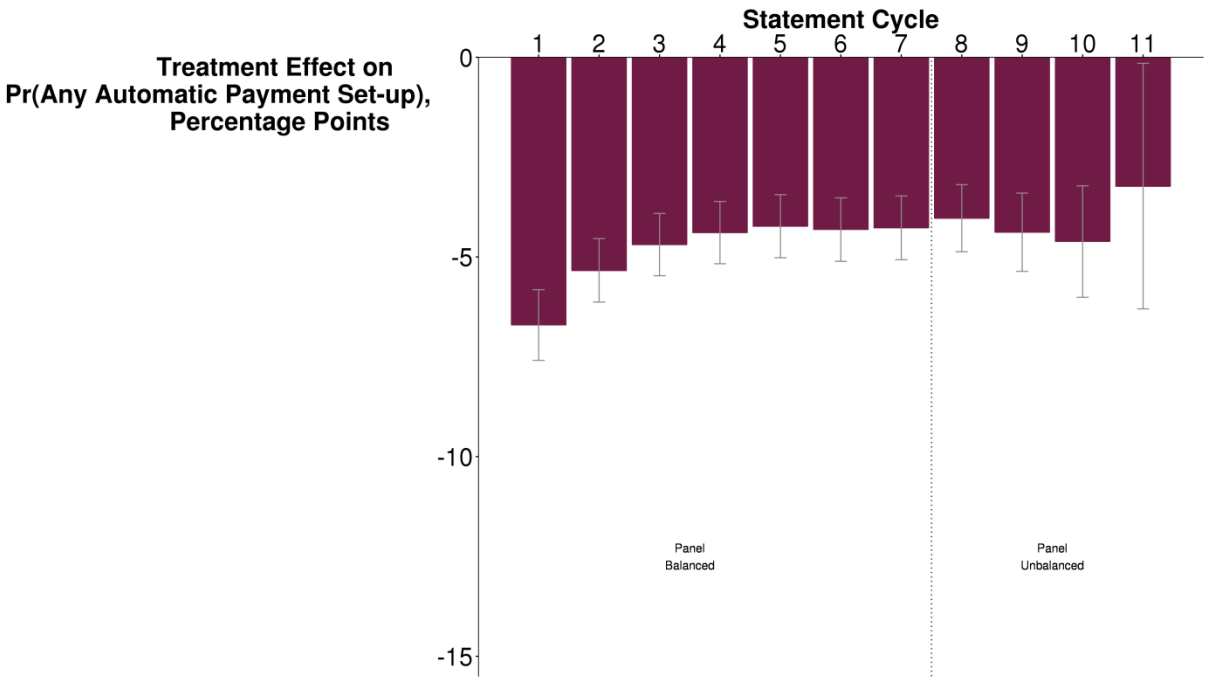
N (control) = 20,609 cards, N (treatment) = 20,084. *** P value < 0.005, ** < 0.01, * < 0.05.

Figure 6: Selection of automatic payment type for control and treatment groups at the seventh statement cycle



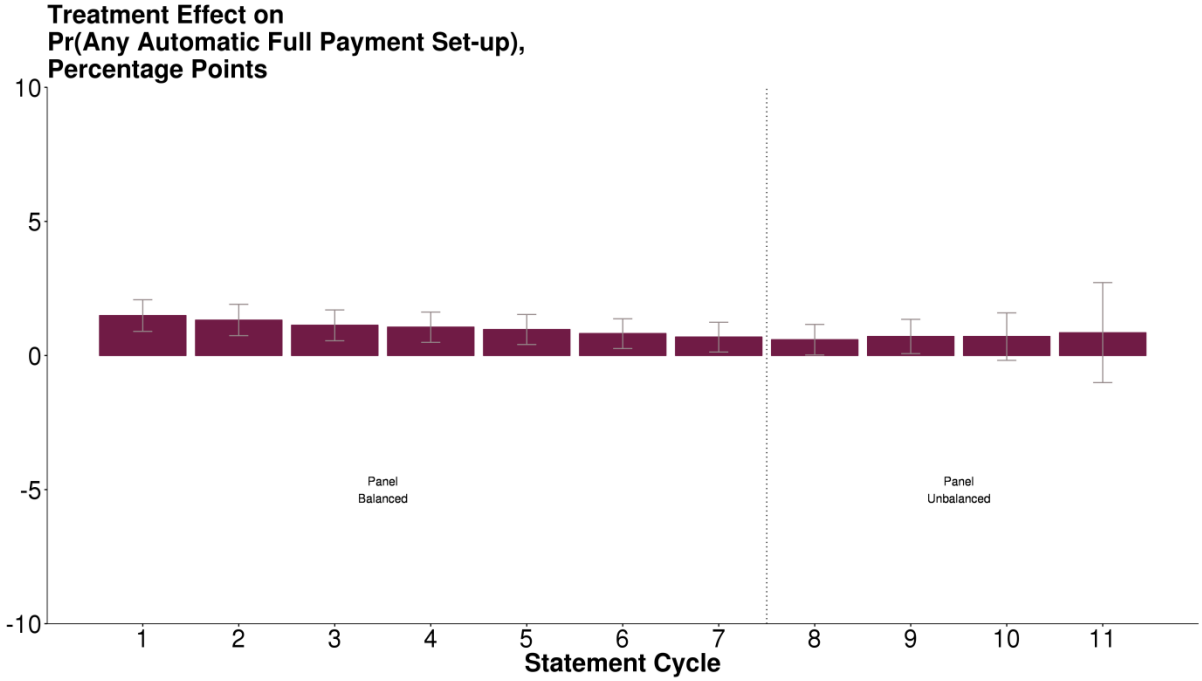
Numbers in bars are the percentage selecting each type of automatic payment, 95% confidence intervals in [].

Figure 7: Treatment effect on any automatic payment set up (for one to eleven completed statement cycles)



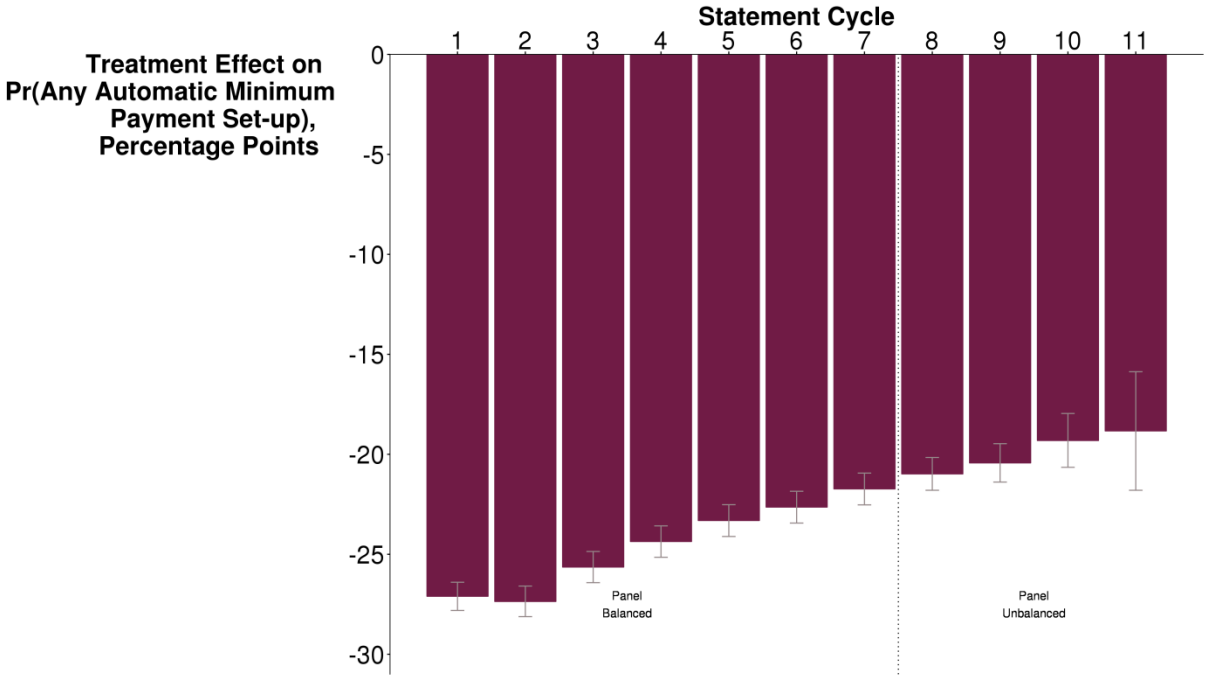
Error bars are 95% confidence intervals.

Figure 8: Treatment effect on automatic full payment set up (for one to eleven completed statement cycles)



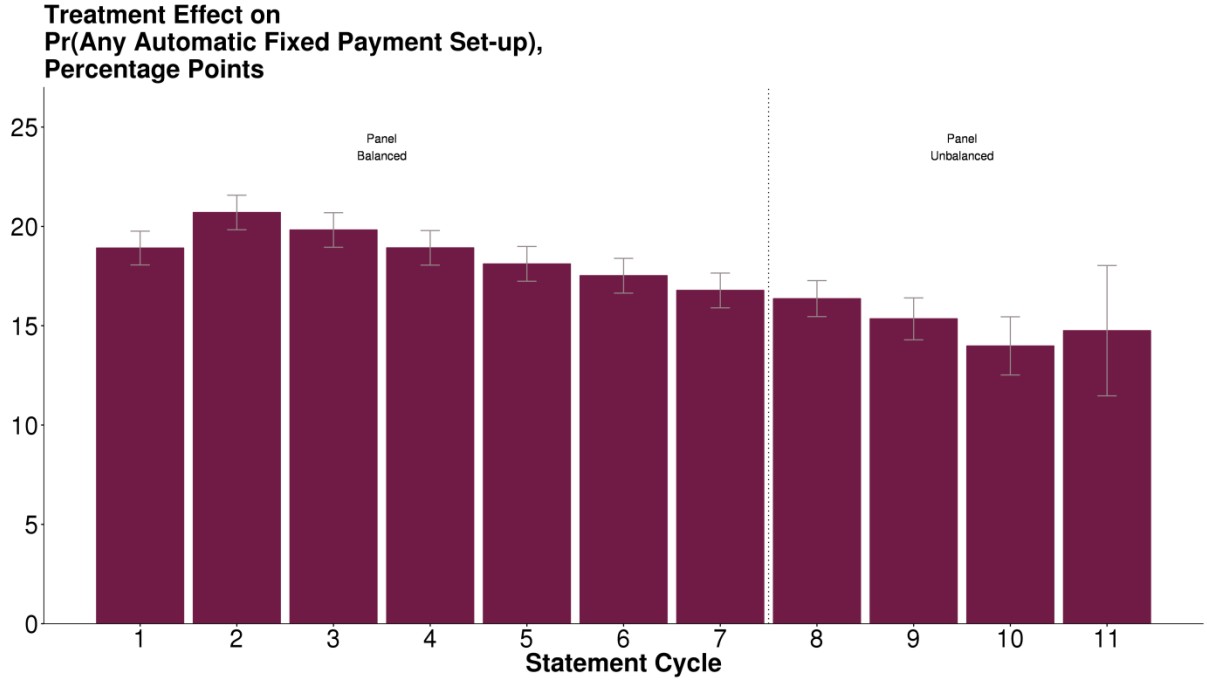
Error bars are 95% confidence intervals.

Figure 9: Treatment effect on automatic minimum payment set up (for one to eleven completed statement cycles)



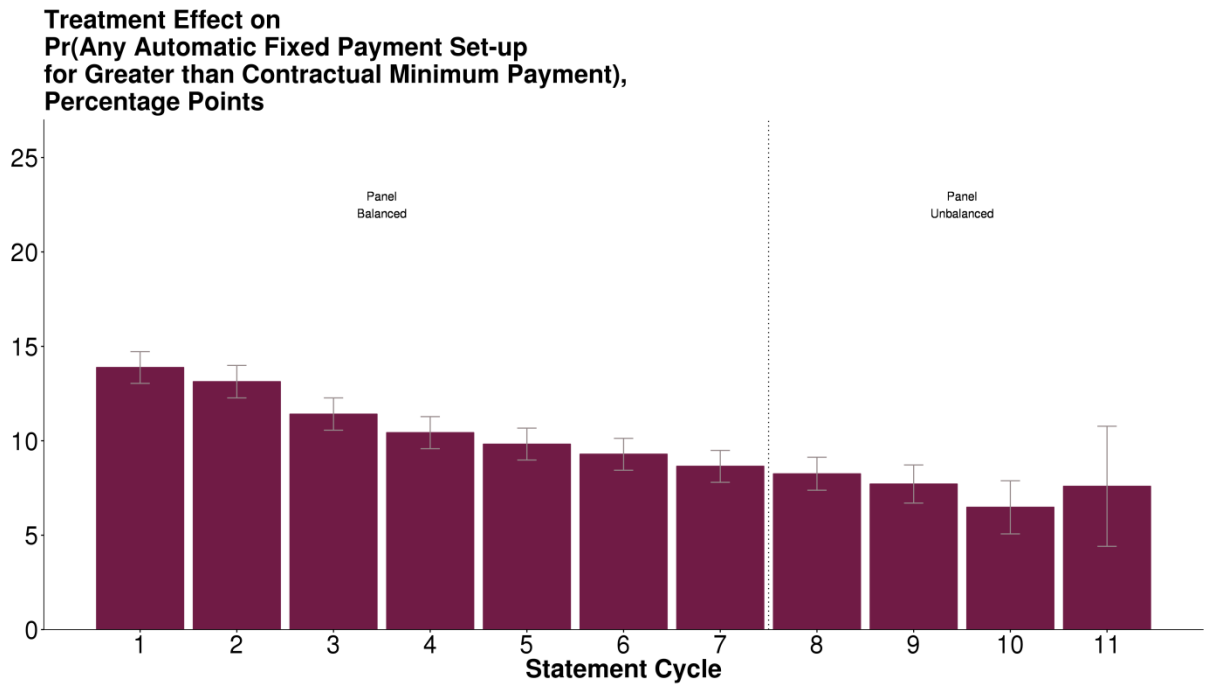
Error bars are 95% confidence intervals.

Figure 10: Treatment effect on automatic fixed payment set up (for one to eleven completed statement cycles)



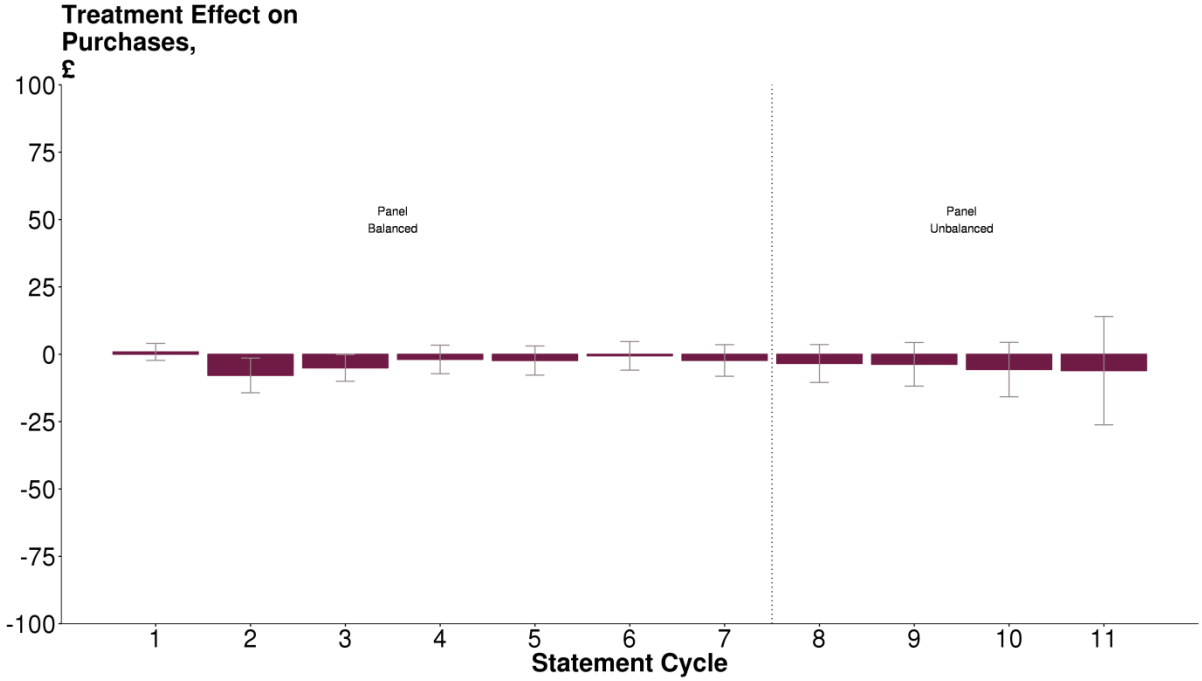
Error bars are 95% confidence intervals.

Figure 11: Treatment effect on automatic fixed payment set up for greater than contractual minimum that statement (for one to eleven completed statement cycles)



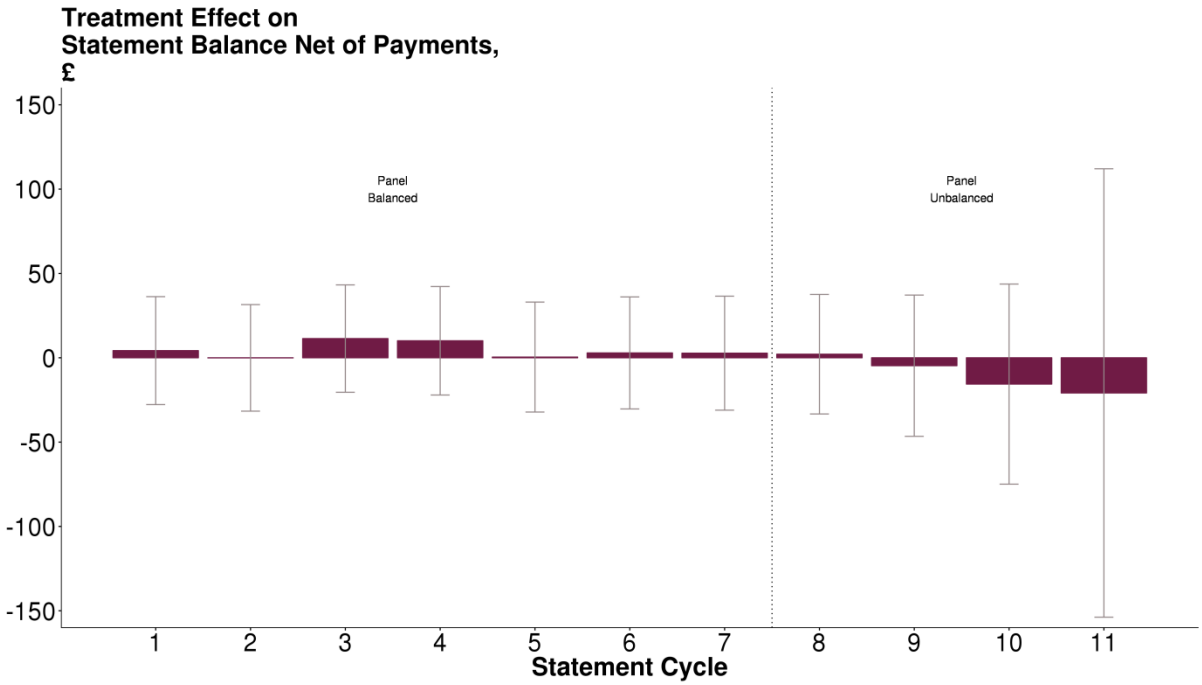
Error bars are 95% confidence intervals.

Figure 12: Treatment effect on purchases (for one to eleven completed statement cycles)



Error bars are 95% confidence intervals.

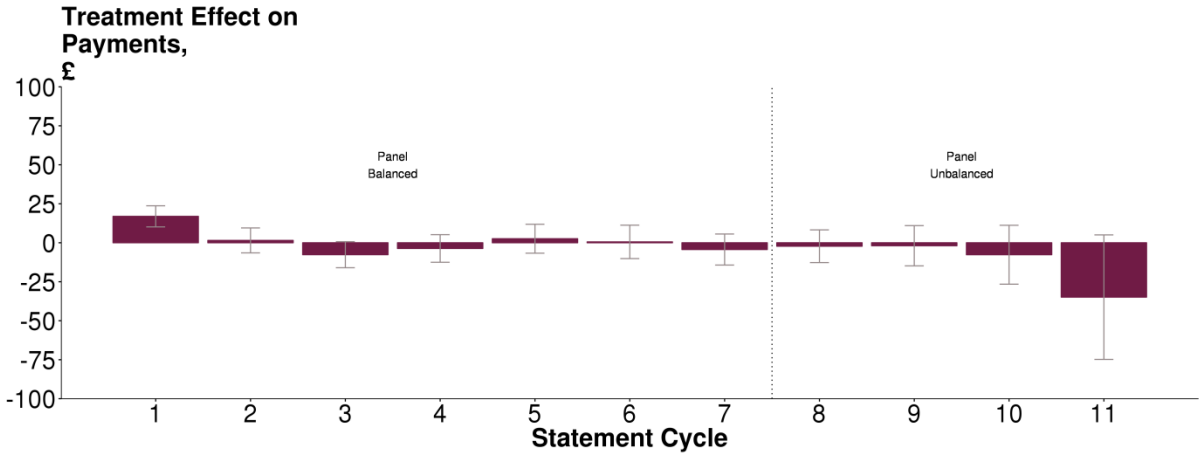
Figure 13: Treatment effect on statement balance net of payments (for one to eleven completed statement cycles)



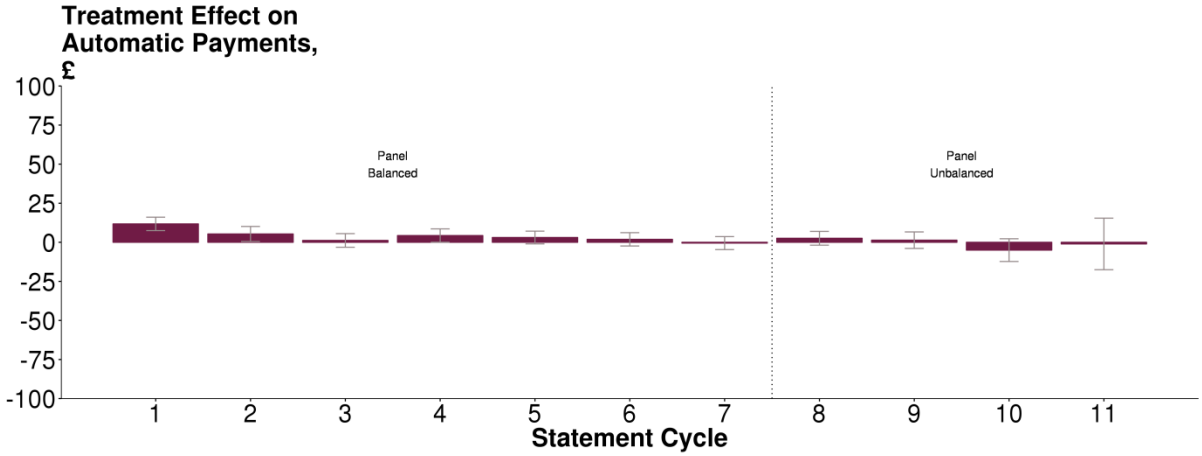
Error bars are 95% confidence intervals.

Figure 14: Treatment effects on payments (for one to eleven completed statement cycles), decomposed by payment mechanism

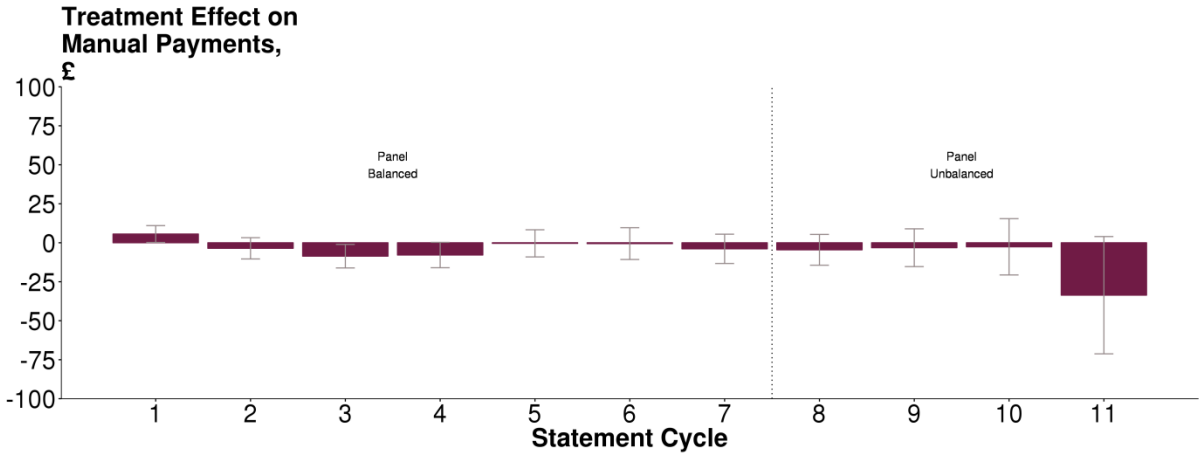
A. Automatic + Manual Payments



B. Automatic Payments



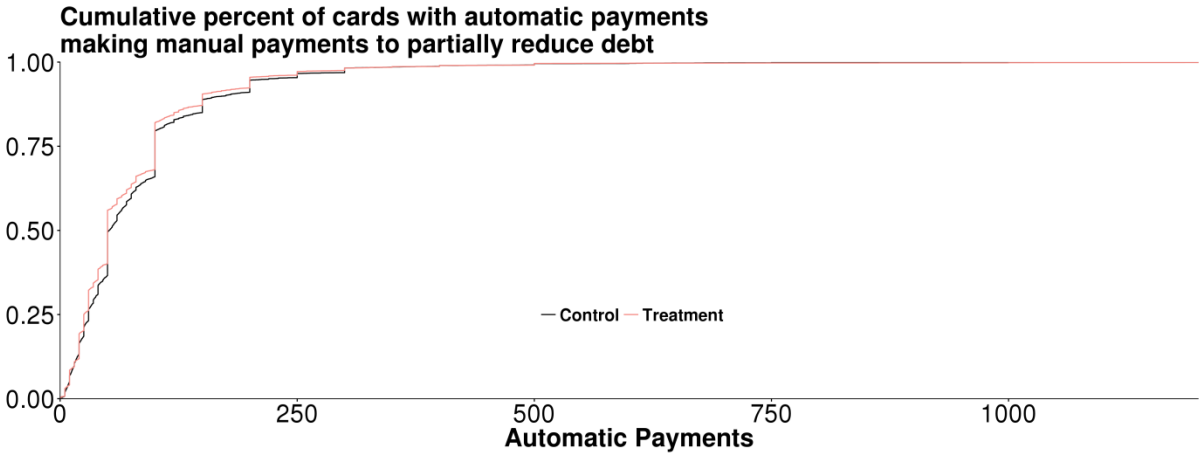
C. Manual Payments



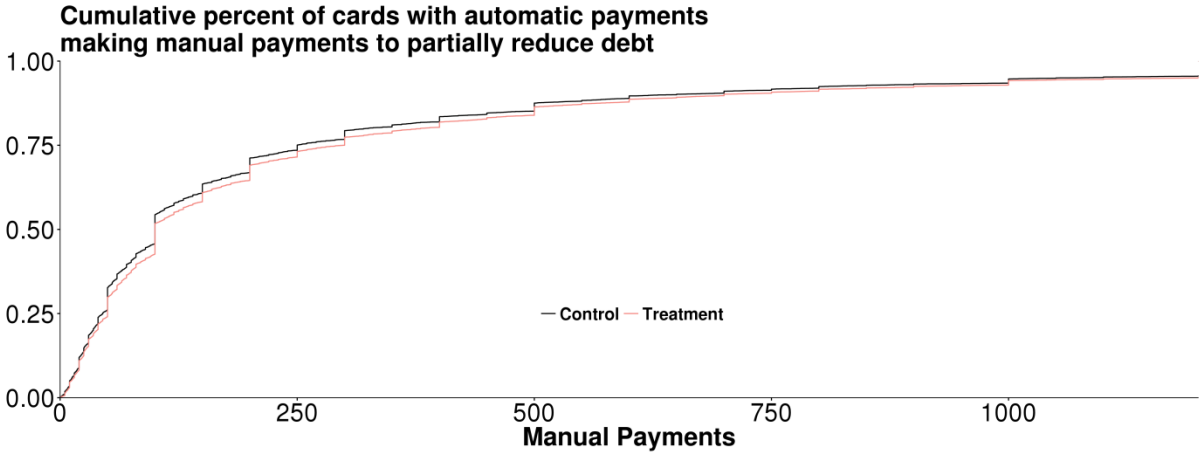
Error bars are 95% confidence intervals.

Figure 15: Cumulative distributions of payments in cycles where consumers with automatic payments set up also make manual payments that partially reduce debt

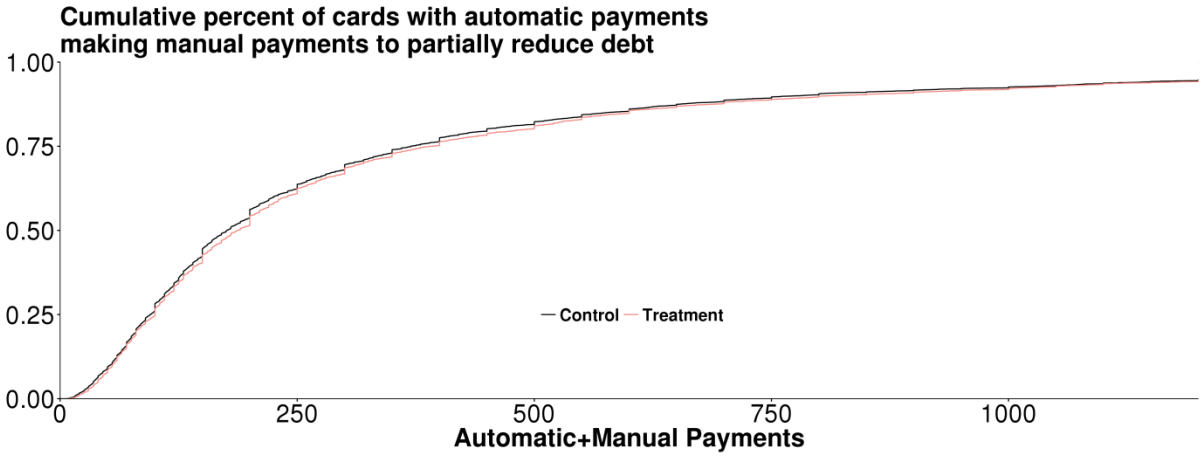
Panel A. Automatic Payments



Panel A. Manual Payments



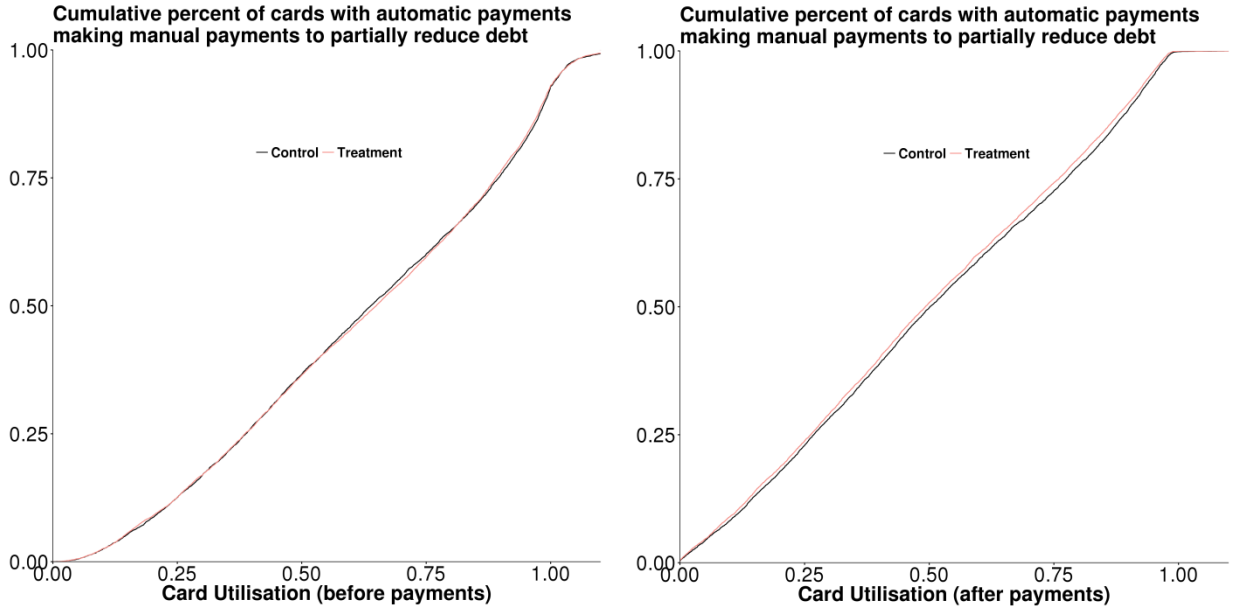
Panel C. Automatic + Manual Payments



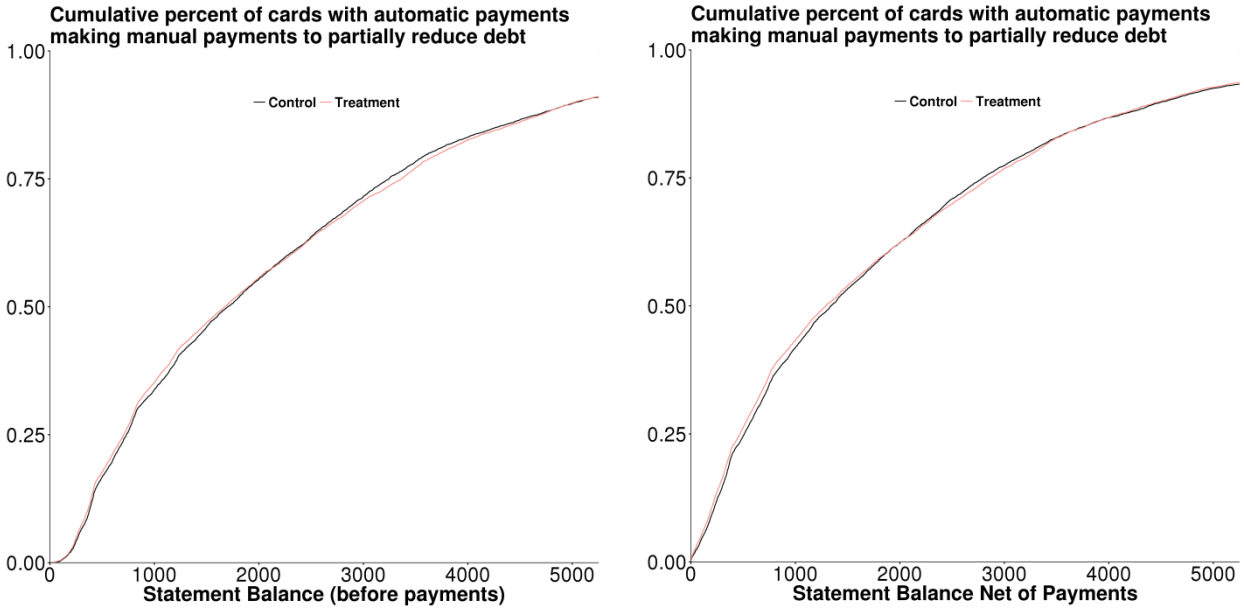
All statements from cycles 1-7 included where cards have automatic payments set up and manual payments are made for an amount less than to pay off debt in full. N=18,680 out of 161,618 card statements with automatic payments.

Figure 16: Cumulative distributions of utilisation rates and balances in cycles where consumers with automatic payments set up also make manual payments that partially reduce debt

Panel A. Utilisation rates before (left) and after (right) payments



Panel B. Balances before (left) and after (right) payments



All statements from cycles 1-7 included where cards have automatic payments set up and manual payments are made for an amount less than to pay off debt in full. N=18,680 out of 161,618 card statements with automatic payments.

Table 7: Automatic minimum payment nudge – survey responses for why use automatic payments, by control and treatment and type of automatic payments

Question	Response	Mean [95% Confidence Interval]							
		All Cards	**Control**	**Treatment**	**No Automatic Payments**	**Automatic Minimum Payments**	**Automatic Fixed Payments**	**Automatic Full Payments**	**Any Automatic Payments**
N		8,490	1,469	1,359	2,843	1,931	2,652	846	5,429
Q1: How well are you keeping up with your bills and commitments at the moment?	Keeping up, no problem (%)	0.5246 [0.514,0.5352]	0.5459 [0.5205,0.5714]	0.5327 [0.5062,0.5593]	0.5072 [0.4888,0.5256]	0.4495 [0.4273,0.4717]	0.5238 [0.5047,0.5428]	0.7849 [0.7572,0.8126]	0.538 [0.5248,0.5513]
	Keeping up, occasional struggle (%)	0.3676 [0.3574,0.3779]	0.3526 [0.3282,0.3771]	0.3591 [0.3336,0.3846]	0.3859 [0.368,0.4038]	0.3993 [0.3774,0.4211]	0.3876 [0.3691,0.4062]	0.1667 [0.1415,0.1918]	0.3573 [0.3446,0.3701]
	Keeping up, constant struggle (%)	0.0735 [0.0679,0.079]	0.0728 [0.0595,0.0861]	0.0721 [0.0584,0.0859]	0.0725 [0.0629,0.082]	0.1056 [0.0919,0.1194]	0.0675 [0.0579,0.077]	0.0165 [0.0079,0.0252]	0.0731 [0.0662,0.0801]
	Falling behind with some (%)	0.0192 [0.0163,0.0221]	0.0150 [0.0088,0.0212]	0.0206 [0.013,0.0282]	0.0232 [0.0177,0.0288]	0.028 [0.0206,0.0353]	0.0109 [0.007,0.0149]	0.0047 [0.0001,0.0094]	0.0160 [0.0127,0.0194]
	Having real problems and fallen behind with many (%)	0.0085 [0.0065,0.0104]	0.0075 [0.0031,0.0119]	0.0059 [0.0018,0.01]	0.0084 [0.0051,0.0118]	0.0145 [0.0092,0.0198]	0.0053 [0.0025,0.008]	0.0035 [-0.0005,0.0076]	0.0083 [0.0059,0.0107]
	No commitments (%)	0.0066 [0.0049,0.0083]	0.0061 [0.0021,0.0101]	0.0096 [0.0044,0.0147]	0.0028 [0.0009,0.0048]	0.0031 [0.0006,0.0056]	0.0049 [0.0022,0.0076]	0.0236 [0.0134,0.0339]	0.0072 [0.0049,0.0094]
Q2a: Why do you have an automatic payment on your credit card?	Never thought why (%)		0.0255 [0.0174,0.0335]	0.0250 [0.0167,0.0333]		0.0425 [0.0335,0.0515]	0.0479 [0.0398,0.056]	0.0544 [0.0391,0.0697]	0.047 [0.0413,0.0526]
	Prevents credit score impact (%)		0.5048 [0.4792,0.5304]	0.5040 [0.4774,0.5306]		0.4873 [0.465,0.5096]	0.4517 [0.4328,0.4707]	0.4681 [0.4344,0.5017]	0.4669 [0.4537,0.4802]
	Prevents late fee (%)		0.5016 [0.476,0.5272]	0.5022 [0.4756,0.5288]		0.5205 [0.4982,0.5427]	0.4208 [0.402,0.4396]	0.4823 [0.4486,0.516]	0.4658 [0.4526,0.4791]
	Unstable finances (%)		0.0772 [0.0636,0.0909]	0.0715 [0.0578,0.0852]		0.0886 [0.0759,0.1012]	0.0788 [0.0686,0.0891]	0.0532 [0.0381,0.0683]	0.0783 [0.0711,0.0854]
	Prefer this control (%)		0.3877 [0.3628,0.4127]	0.3870 [0.361,0.4129]		0.2885 [0.2682,0.3087]	0.3974 [0.3788,0.4161]	0.3109 [0.2797,0.3421]	0.3452 [0.3325,0.3578]
	Easy (%)		0.2325 [0.2109,0.2541]	0.2324 [0.2099,0.2548]		0.1989 [0.1811,0.2167]	0.2021 [0.1868,0.2174]	0.2281 [0.1998,0.2564]	0.2050 [0.1943,0.2158]

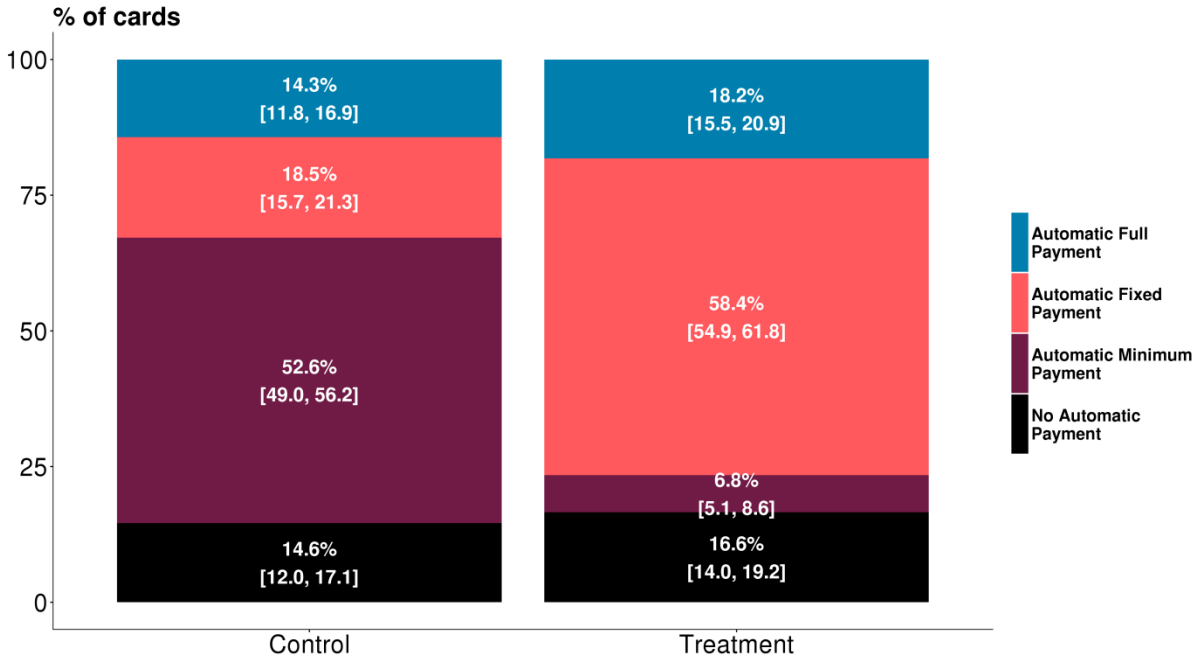
		All Cards	Control	Treatment	No Automatic Payments	Automatic Minimum Payments	Automatic Fixed Payments	Automatic Full Payments	Any Automatic Payments
	Wanted to cancel, didn't get around to (%)		0.0024 [-0.0001,0.0049]	0.0054 [0.0015,0.0092]		0.0078 [0.0039,0.0117]	0.0038 [0.0014,0.0061]	0.0047 [0.0001,0.0094]	0.0053 [0.0034,0.0073]
	Other (%)		0.0207 [0.0134,0.028]	0.0277 [0.019,0.0364]		0.0342 [0.0261,0.0423]	0.0509 [0.0425,0.0593]	0.0461 [0.0320,0.0602]	0.0442 [0.0387,0.0497]
Q2b: Why do you have no automatic payment on your credit card (rather than a minimum, fixed or full automatic payment)?	Never thought why (%)		0.0867 [0.0723,0.1012]	0.0806 [0.0661,0.0951]	0.0665 [0.0573,0.0756]				
	No point (%)		0.0459 [0.0352,0.0566]	0.0711 [0.0574,0.0848]	0.0542 [0.0458,0.0625]				
	Unstable finances (%)		0.1071 [0.0913,0.123]	0.09 [0.0748,0.1053]	0.0911 [0.0805,0.1017]				
	Prefer other control (%)		0.6837 [0.6598,0.7075]	0.6872 [0.6625,0.7119]	0.7467 [0.7308,0.7627]				
	Wanted to cancel, didn't get around to (%)		0.0459 [0.0352,0.0566]	0.0616 [0.0488,0.0744]	0.0517 [0.0436,0.0598]				
	Worried about bouncing payment (%)		0.0663 [0.0536,0.0791]	0.0284 [0.0196,0.0373]	0.0295 [0.0233,0.0358]				
	Other (%)		0.0816 [0.0676,0.0957]	0.0616 [0.0488,0.0744]	0.0485 [0.0406,0.0564]				
Q3a: Why do you have an automatic minimum payment rather than an automatic fixed payment?	Never thought why (%)		0.0478 [0.0369,0.0587]	0.0615 [0.0487,0.0743]		0.0559 [0.0457,0.0662]			
	No benefit (%)		0.0582 [0.0462,0.0702]	0.0646 [0.0515,0.0777]		0.0575 [0.0471,0.0679]			
	Didn't know could (%)		0.1102 [0.0942,0.1262]	0.1077 [0.0912,0.1242]		0.1196 [0.1051,0.1341]			
	Didn't understand (%)		0.0374 [0.0277,0.0471]	0.0369 [0.0269,0.047]		0.0409 [0.0321,0.0497]			
	Prefer min (%)		0.185 [0.1652,0.2049]	0.2031 [0.1817,0.2245]		0.1802 [0.1631,0.1974]			
	Easy (%)		0.1726 [0.1532,0.1919]	0.1415 [0.123,0.1601]		0.1476 [0.1318,0.1634]			
	Prefer this control (%)		0.4636 [0.4381,0.4891]	0.4277 [0.4013,0.454]		0.4371 [0.4149,0.4592]			

		All Cards	Control	Treatment	No Automatic Payments	Automatic Minimum Payments	Automatic Fixed Payments	Automatic Full Payments	Any Automatic Payments
	Unstable finances (%)		0.0936 [0.0786,0.1085]	0.0985 [0.0826,0.1143]		0.1088 [0.0949,0.1226]			
	Wanted to cancel, didn't get around to (%)		0.0062 [0.0022,0.0103]	0.0062 [0.002,0.0103]		0.0078 [0.0039,0.0117]			
	Only afford min (%)		0.1393 [0.1216,0.157]	0.1785 [0.1581,0.1989]		0.1491 [0.1333,0.165]			
	Faster amortisation (%)		0.0395 [0.0295,0.0495]	0.04 [0.0296,0.0504]		0.0363 [0.0279,0.0446]			
	Other (%)		0.0437 [0.0332,0.0541]	0.0462 [0.035,0.0573]		0.0347 [0.0265,0.0429]			
Q3b: Why do you have an automatic fixed payment rather than an automatic minimum payment?	Never thought why (%)		0.0301 [0.0214,0.0389]	0.0298 [0.0207,0.0388]			0.0422 [0.0346,0.0499]		
	No benefit (%)		0.2447 [0.2227,0.2667]	0.2132 [0.1914,0.235]			0.224 [0.2081,0.2399]		
	Didn't know could (%)		0.0071 [0.0028,0.0114]	0.0198 [0.0124,0.0273]			0.0151 [0.0104,0.0197]		
	Didn't understand (%)		0.0071 [0.0028,0.0114]	0.0033 [0.0003,0.0064]			0.0094 [0.0057,0.0131]		
	Prefer paying fixed amount (%)		0.3032 [0.2797,0.3267]	0.3174 [0.2926,0.3421]			0.2934 [0.276,0.3107]		
	Easy (%)		0.1915 [0.1713,0.2116]	0.1636 [0.144,0.1833]			0.1493 [0.1358,0.1629]		
	Prefer this control (%)		0.2748 [0.252,0.2977]	0.2595 [0.2362,0.2828]			0.2545 [0.2379,0.2711]		
	Unstable finances (%)		0.0762 [0.0627,0.0898]	0.0628 [0.0499,0.0757]			0.0739 [0.0639,0.0839]		
	Wanted to cancel, didn't get around to (%)		0.0018 [-0.0004,0.0039]	0.0000 [0.00000,0.0000]			0.0008 [-0.0003,0.0018]		
	Faster amortisation (%)		0.5567 [0.5313,0.5822]	0.5686 [0.5422,0.5949]			0.4981 [0.4791,0.5171]		

Other (%)	0.0142 [0.0081,0.0202]	0.0182 [0.0111,0.0253]	0.0328 [0.026,0.0396]

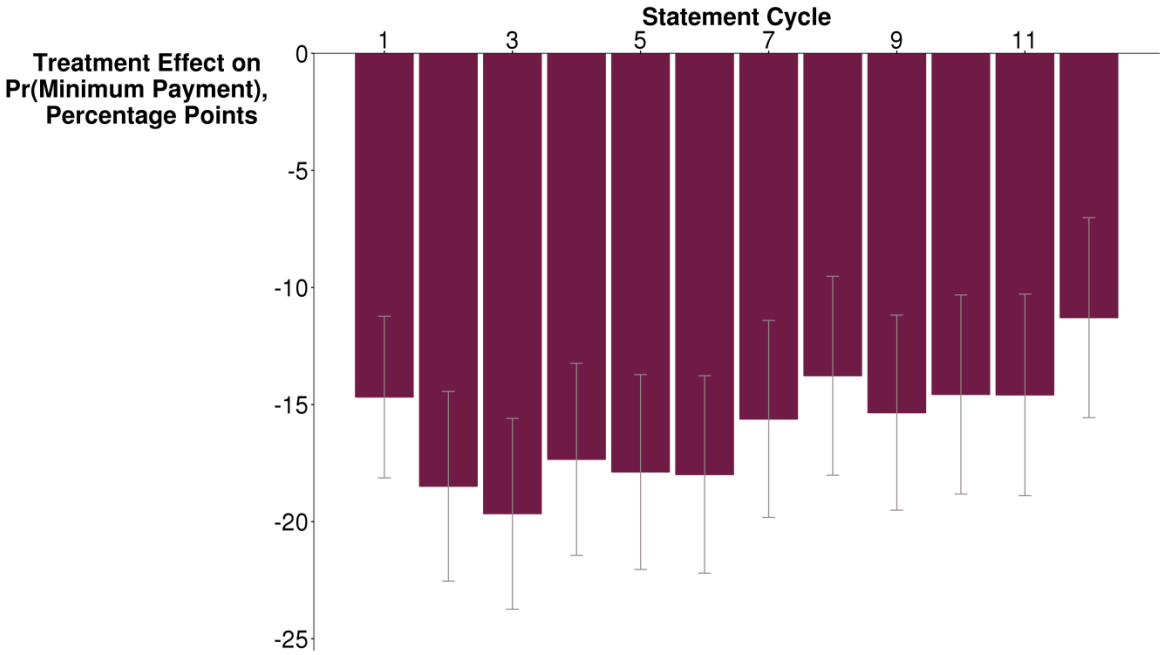
Annex 3: Second Lender Figures and Tables

Figure A1: Second lender - selection of automatic payment type for control and treatment groups at the second statement cycle



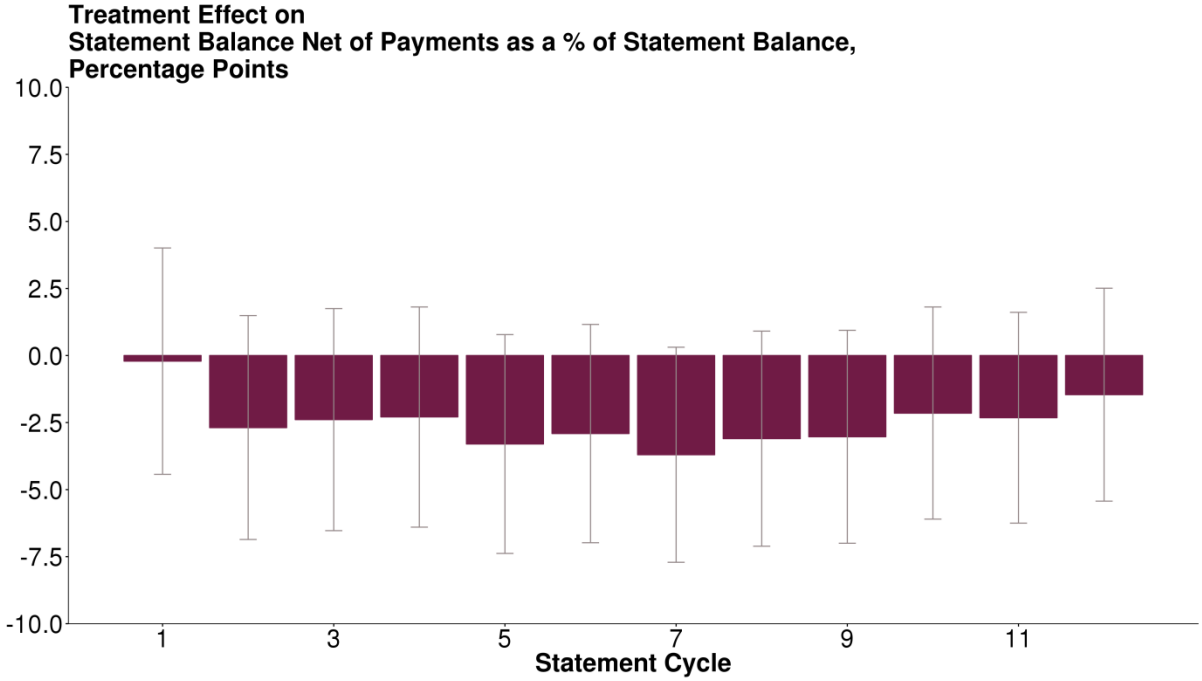
Numbers in bars are the percentage selecting each type of automatic payment, 95% confidence intervals in [].

Figure A2: Second lender - Treatment effect on minimum payments (for one to eleven completed statement cycles)



Error bars are 95% confidence intervals.

Figure A3: Second Lender - Treatment effect on debt net of payments as a percent of statement balance, (for one to eleven completed statement cycles)



Error bars are 95% confidence intervals.

Table A1: Second Lender – Balance checks between treatment and control

Outcome	Mean (Control)	Mean (Treatment)	Mean Difference (Treatment-Control)	Percentage Difference Relative to Control	CI Lower (Treatment-Control)	CI Upper (Treatment-Control)	P Value	T Statistic
Age (years)	37.04	36.41	-0.63	-1.70	-1.83	0.57	0.301	1.034
Female (% cards)	47.70	52.21	4.51	9.45	-0.50	9.52	0.078	1.764
Credit Limit (£)	571.49	538.31	-33.18	-5.81	-90.28	23.92	0.254	1.140
Credit Score (0-100)	53.75	54.20	0.44	0.83	-0.48	1.37	0.346	0.943
Purchases Rate (%)	22.93	23.46	0.53	2.31	-0.64	1.70	0.376	0.886
Balance Transfer (% cards)	17.43	17.57	0.14	0.80	-3.67	3.95	0.942	0.072
Total Credit Card Statement Balances (£)	956.90	885.60	-71.30	-7.45	-279.39	136.79	0.502	0.672
Total Credit Card Statement Balances Net of Payments (£)	871.52	813.65	-57.87	-6.64	-253.60	137.87	0.562	0.580

N=1,531 cards, 19,449 observations. *** P value < 0.005, ** < 0.01, * < 0.05.

Table A2: Second Lender – Treatment effects on automatic payment choices and primary outcomes after seven completed statement cycles

Outcome	Estimate	95% Confidence Interval	P Value	Adjusted R Squared
Any automatic payment set-up	-0.0504* (0.0214)	[-0.0924, -0.0084]	0.0188	0.1756
Any automatic full payment set-up	0.03160 (0.0163)	[-0.0003, 0.0636]	0.0524	0.1182
Any automatic fixed payment set-up for greater than contractual minimum payment that statement	0.2050* * * (0.0220)	[0.1618, 0.2482]	0.0000	0.1469
Any automatic fixed payment set-up	0.3053* * * (0.0228)	[0.2606, 0.3500]	0.0000	0.204
Any automatic minimum payment set-up	-0.3873* * * (0.0209)	[-0.4282, -0.3464]	0.0000	0.234
Any minimum payment	-0.1562* * * (0.0214)	[-0.1982, -0.1141]	0.0000	0.0926
Any full payment	0.0242 (0.0219)	[-0.0188, 0.0671]	0.2702	0.13
Any payment less than minimum payment	0.0083 (0.0170)	[-0.025, 0.0415]	0.6251	0.3044
Statement balance net of payments (% statement balance)	-0.0370 (0.0205)	[-0.0771, 0.0031]	0.0708	0.1513
Costs (% statement balance)	-0.0089* (0.0040)	[-0.0168, -0.001]	0.0267	0.0221
Transactions (% statement balance)	0.0121 (0.0185)	[-0.0242, 0.0485]	0.5136	0.1877
CRA share of credit cards only paying minimum	-0.0820* * * (0.0136)	[-0.1085, -0.0554]	0.0000	0.224
CRA share of credit cards making full payment	0.0094 (0.0187)	[-0.0273, 0.0461]	0.6152	0.5422
CRA share of credit cards missing payment	0.0120 (0.0124)	[-0.0123, 0.0363]	0.3329	0.1143
CRA total credit card statement balances net of payments (% statement balances)	-0.0280 (0.0180)	[-0.0633, 0.0073]	0.1200	0.5748

N=1,531 cards, 19,449 observations. *** P value < 0.005, ** < 0.01, * < 0.05.

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