Sending out an SMS:

The impact of automatically enrolling consumers into overdraft alerts

Andrea Caflisch, Michael D. Grubb, Darragh Kelly, Jeroen Nieboer and Matthew Osborne

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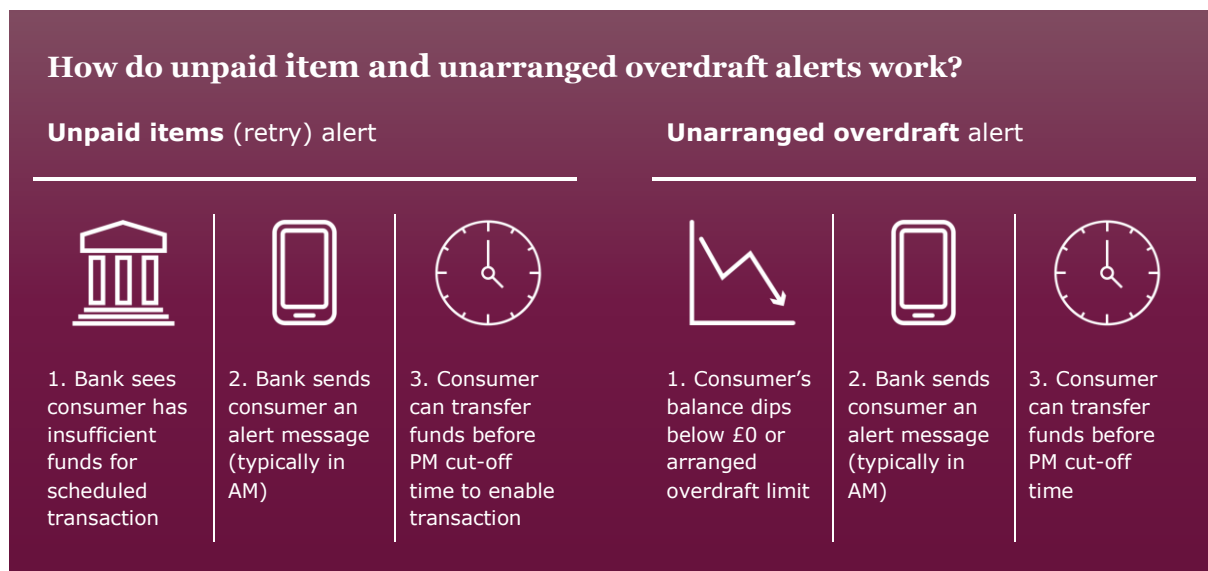
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1   Executive summary

Incidental charges incurred by consumers on their Personal Current Account (PCA) can be substantial, especially for small amounts of unarranged borrowing and unpaid items. An estimate by the Competition and Markets Authority (CMA) for 2014 puts these charges at £24 annually per PCA – an estimated £1.2 billion across the market.

Although part of this figure reflects a genuine demand for credit, evidence from several recent market investigations suggests that some of these incidental charges could have been avoided if consumers had been aware of their balance.[1] In addition, previous FCA research shows that consumers who register for mobile banking and text alert notifications manage to significantly reduce their charges.[2]

Much like the warning light that flashes red on the dashboard when you're about to run out of petrol, it seems that many consumers would benefit from 'just in time' alerts for their bank account. Although such alerts have actually been available to customers of the majority of UK PCA providers for several years now, we found that very few customers, only 3-8%, had registered for them.

A recent policy initiative by the CMA required firms to enrol consumers automatically into two types of alerts: unarranged overdraft and unpaid item alerts.[3] But little is currently known about the impact of automatic enrolment and whether there are specific groups who benefit more than others. Using a unique, large and detailed dataset covering the transactions of 1.5 million consumers across 6 banks, and by looking at large-scale automatic enrolment exercises carried out by two major retail banks, we are able for the first time to estimate the effect of automatically enrolling consumers into these alerts. The samples for the two banks are similar to the wider market, based on a comparison with representative customer samples from the UK's 6 biggest PCA providers.

How do unpaid item and unarranged overdraft alerts work?

Unpaid items (retry) alert

1. Bank sees consumer has insufficient funds for scheduled transaction
2. Bank sends consumer an alert message (typically in AM)
3. Consumer can transfer funds before PM cut-off time to enable transaction

Unarranged overdraft alert

1. Consumer's balance dips below £0 or arranged overdraft limit
2. Bank sends consumer an alert message (typically in AM)
3. Consumer can transfer funds before PM cut-off time

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[1] Office of Fair Trading (2008), CMA (2016).
[2] Hunt, Kelly and Garavito (2015).
[3] While not required by the CMA, unpaid item alerts can be implemented as retry alerts. These retry alerts are the subject of this OP and are referred to throughout as unpaid item alerts.

Key findings

We find that automatic enrolment into both types of alerts has large effects on charges:

- Automatic enrolment into **unpaid item alerts** reduces charges by **21-24%**;
- Automatic enrolment into **unarranged overdraft alerts** reduces charges by **25%**.

We also estimate average treatment effects for different types of consumers, grouped by their pre-alerts level of incidental charges (rare, occasional or heavy). The vast majority of consumers fall into the first category, with occasional and heavy users accounting for less than 10% of consumers.

Figure 1 shows results by consumer types: the left bar in each pair represents the level of monthly charges without automatic enrolment into alerts ('Control'); the right bar with automatic enrolment ('Auto-enrolled'). We find that the benefits of automatic enrolment – the difference between the bars – differ markedly between types of consumers. Those who rarely incur charges can avoid as much as half of charges thanks to alerts, whereas heavy users still incur the majority of their charges after automatic enrolment. As the figure shows, we find strikingly similar patterns across the two banks, for both unpaid item and unarranged overdraft charges, providing reassurance that these findings are not specific to a particular customer base or firm implementation.

Figure 1: Effect of automatic enrolment on charges, by usage type
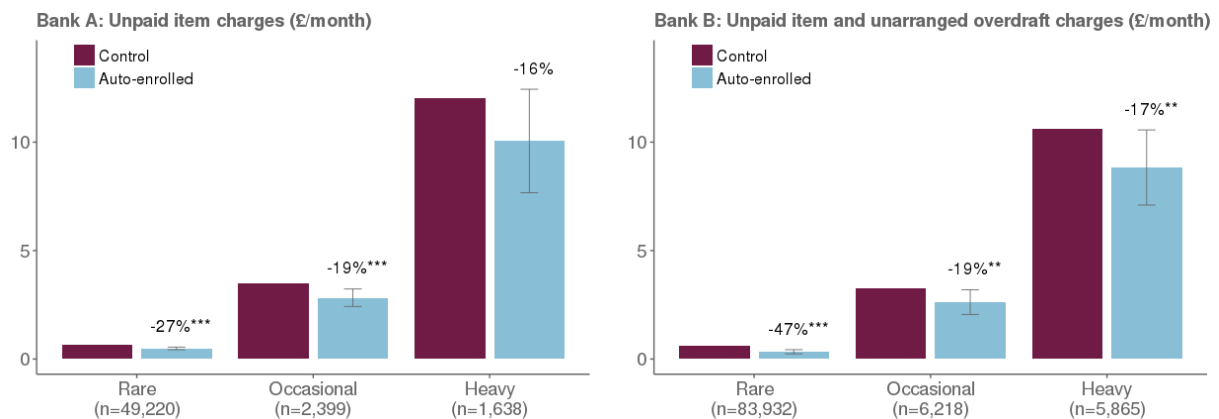
Notes: Charges shown are monthly totals, effect sizes are in percentages, sample sizes (n) represent number of consumers. Stars indicate the significance level of the treatment effect: *** = p<.01, ** = p<.05, * = p<.1. Bank A rolled out unpaid item alerts; Bank B rolled out unpaid item and unarranged overdraft alerts.

Policy implications

Our findings provide support for automatic enrolment. The vast majority of people do not enrol themselves despite alerts being available for many years. Yet we find a statistically and economically significant reduction in charges for consumers when they are automatically enrolled. Merely making an alerts service available to consumers does not mean that it will be taken up by all those who would benefit.

We also find that the benefits from automatic enrolment are not shared evenly between consumers. Although those who incur greater charges appear to save greater absolute amounts of money, relative reductions are much lower (and sometimes statistically indistinguishable from zero). A large number of heavy users of unarranged overdrafts and unpaid items are not helped by automatic enrolment into alerts.

2   Introduction

Background

The amount of incidental charges incurred on Personal Current Accounts (PCAs) by UK consumers is a source of public concern. A particular cause for this concern is consumers paying substantial charges for small amounts of unarranged borrowing and unpaid items. Consumers incurred £1.2 billion such charges in 2014, an average of £24 per account.[4] The majority of these charges are paid by a minority of consumers.

Recent reviews of the UK PCA market suggest that consumers incur incidental charges due to inattention, or more generally a lack of timely information. The Office of Fair Trading's market study in 2008 found that the two main reasons reported by consumers for incurring unarranged overdraft charges were not monitoring accounts and forgetting about payments. The 2016 retail banking market investigation by the Competition and Markets Authority, the OFT's successor, reported that half of unarranged overdraft users were unaware they had recently used their overdrafts.[5]

One of the CMA's policy initiatives following its investigation was an order compelling major UK banks to automatically enrol customers into unarranged overdraft and unpaid item alerts (text messages or mobile app notifications) by February 2018. This alerting service was already widely available to consumers but typically only on an opt-in basis. The alerts are sent to a consumer's mobile phone to warn them of (impending) unarranged overdraft usage or unpaid items.[6] Some banks had taken the initiative to automatically enrol their customers into one or more of these alerts prior to the CMA's intervention, so the order ensures that all eligible consumers (who hold a PCA with the banks covered by the order) are enrolled unless they opt out.[7]

In this paper, we measure the impact of automatically enrolling consumers into unpaid item and unarranged overdraft alerts. Using data from recent automatic enrolment exercises by two major retail banks, which together represent over a quarter of the UK PCA market, we directly address the lack of robust evidence on this important policy question. Given that our sample is broadly representative of the PCA market, our estimates provide an early insight into how consumers across the market will use their overdrafts under the new opt-out alerts regime.

Crucially, we also investigate the distributional impact: do consumers who frequently incur incidental charges benefit from these alerts, or do they continue to pay the bulk of

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[4] CMA retail banking market investigation final report (p. 104).

[5] Ibid, p. 173 and appendix 6.4.

[6] For unpaid item alerts, the Order does not require firms to offer customers an opportunity to avoid unpaid item charges. In practice, however, most firms have operated a 'retry' system since 2014 – giving consumers time until the afternoon to deposit funds so a previously unpaid transaction can be re-attempted. The unpaid item alerts required by the CMA can be implemented as retry alerts. This OP looks at the impact of automatic enrolment into these retry alerts which are referred to throughout as unpaid item alerts.

[7] At the start of our sample period (2015-2016), we estimate that 59% of consumers were eligible for automatic enrolment into unpaid item alerts and 63% was eligible for automatic enrolment into unarranged overdraft alerts. In Section 4, we discuss eligibility for automatic enrolment in more detail.

incidental charges? These questions are pertinent for the FCA's ongoing review of high-cost credit products, including overdrafts.[8]

The PCA market

PCAs are a crucial part of consumers' participation in the UK's financial system and society. PCAs offer access to payment systems, a protected deposit facility and borrowing arrangements in the form of overdrafts. 90% of UK employees get their salary paid directly into their bank account.[9] Moreover, following ongoing reforms of the UK welfare system, an account with a financial institution will effectively become a requirement for receipt of government benefits. The penetration of PCAs reflects this importance: 97% of adults have a PCA and 22% hold a PCA with more than one bank.[10]

The predominant charging model for PCAs in the UK is 'free banking' (or 'free-if-in-credit'): most consumers do not pay an account fee for their PCA. Revenue comes from various sources, including incidental charges (the CMA estimated for 2014 that incidental charges for unarranged overdrafts and unpaid items made up 14% of PCA revenues).[11] Some consumers will effectively pay for their PCA through overdraft fees and other incidental charges, whereas others will not incur any charges.[12] Although it is known that incidental charges are only paid by a part of the population, it is unclear exactly how these charges are concentrated and how they correlate with different types of charges.

Overdraft credit

An overdraft is a way for consumers to use their PCA to borrow money from their bank. The most common form is an arranged overdraft: a line of credit with a pre-agreed borrowing limit, which consumers automatically access when their account balance drops below zero.[13] But if the consumer has not agreed an arranged overdraft with their bank, or attempts to spend beyond their arranged overdraft limit, the extension of credit is at the bank's discretion. The customer will either be granted an unarranged overdraft, which is typically more costly than using an arranged overdraft facility, or the transaction will be rejected with the customer incurring fees for these unpaid items.[14]

Unarranged overdrafts (also known as unauthorised overdrafts), as the name suggests, are usually not agreed beforehand with the consumer. Many PCAs in the UK have an unarranged facility by default, but the facility is not typically discussed or negotiated when an account is opened. Even if consumers are aware of the facility, they typically do not know how much credit the bank is willing to provide. Unarranged overdraft episodes are mostly paid for on a cost-per-day basis: for example, £5 per day

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[8] FCA FS17/2 High cost credit feedback statement, states that "fundamental changes" to overdrafts may be necessary (p. 63).

[9] BACS 2016 annual report and financial statements, p. 3.

[10] CMA retail banking market investigation final report, p. 160.

[11] CMA retail banking market investigation final report, p. 104. The other main sources of revenue are net value of funds (50%), arranged overdrafts (20%) monthly account fees (12%) and interchange fees (10%).

[12] Of course, these consumers may still be profitable due to the revenue generated by their deposits and their purchase of other financial products from the PCA provider.

[13] The CMA estimates that approximately 45% of PCA holders have an arranged overdraft facility.

[14] Some unpaid items, such as attempted cash withdrawals from an ATM, do not incur a fee. Unpaid item fees are typically charged for scheduled transactions, such as standard orders and direct debits.

while overdrawn. In recent years, the majority of PCA providers have been charging daily fees in the £5-10 range, with most providers also applying a monthly cap.[15]

Unpaid items occur when a consumer reaches the limit of unarranged credit their bank is willing to provide, or if the bank account does not have an unarranged overdraft facility. Unpaid items fees are charged per transaction, but daily or monthly caps may apply. In recent years, PCA providers have charged unpaid item fees in the £5-15 range.

Consumers may occasionally want to make use of unarranged overdrafts as a (short term) credit facility, or take the risk of incurring unpaid item charges due to unarranged credit not being extended. Prior research suggests that this is not the full story, however. A survey conducted for the OFT market study found that only 7% of UK PCA holders exceeded arranged overdraft limits because they "knew it would happen but had to make a payment".[16] In a survey of overdraft users in the United States, Stango and Zinman (2014) found that over 50% of overdraft charges were avoidable by using alternative accounts with available liquidity and that 60% of overdraft users reported overdrawing because they "thought there was enough money in my account".[17]

Recent policy interventions in the PCA market

The findings quoted above point to important alternative explanations for consumers incurring incidental charges, such as inattention and the cost of constantly monitoring one's account. Policy initiatives to rectify such 'behavioural market failures' have focussed on increasing consumer engagement through better disclosure and use of technology. Results have been mixed. Previous research by the FCA evaluates two such initiatives: (i) sending annual account summaries to PCA customers and (ii) requiring banks to offer overdraft text alerts for consumers to sign up to.[18] The study found that annual summaries had no effect on charges or external switching rates, but that text alerts reduced overdraft charges for those consumers who signed up to them (Hunt, Kelly, and Garavito, 2015).[19] The text alerts were especially effective for mobile banking users.

Automatic enrolment into alerts

Of course, the availability of effective overdraft alerts does not mean that they will be adopted by those consumers that would benefit from them. Several years after the introduction of overdraft alerts, we find that sign-up rates are low: only 3-8% of consumers registered for these alerts. Importantly, the vast majority of those incurring unarranged overdraft and unpaid items charges did not sign up to alerts.

There are a number of reasons why consumers who would benefit from alerts do not sign up to them. Clearly, if consumers are not aware of the existence of alerts then they will

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[15] Our dataset predates the introduction of the Monthly Maximum Charge, a firm-specific monthly cap on combined unarranged and unpaid items charges (for more information, see CMA retail banking market investigation final report, p. 557). Note that most banks in our dataset already implemented a cap on both or either of these charges.

[16] OFT personal current accounts market study, p. 69 and Annexe D.

[17] Stango and Zinman, p. 996.

[18] Annual summaries were an initiative to come out of the OFT (2008) market study; text alerts were a joint initiative of the Department of Business, Innovation & Skills and HM Treasury (Consumer credit and personal insolvency review, 2011).

[19] Interestingly, international evidence suggests that increasing consumers' awareness of the costs of overdraft by surveying them on their overdraft usage (US: Stango and Zinman, 2014), or even marketing overdraft products (Turkey: Alan et al., forthcoming) can also reduce overdraft usage.

not adopt them. If consumers overestimate their ability to be financially organised in the future, then they may not see the need for alerts. Grubb and Osborne (2015) find overconfidence of this type in mobile phone usage. Even if consumers value alerts, they may still not sign up to them due to the perceived hassle of doing so or self-control problems. If we consider that self-control problems typically involve trade-offs between now and later, we see that even a small cost of signing up can lead to perpetual procrastination until another day that never comes (O'Donoghue and Rabin, 1999).

If there are substantial barriers to signing up to overdraft alerts, then evidence from other studies suggest that automatic enrolment is an effective way of raising enrolment rates (Madrian and Shea, 2001; Johnson and Goldstein, 2003). The argument for automatically enrolling consumers is that it delivers substantial benefits to consumers that would not have taken action to self-enrol, whereas those that do not want to receive the alerts can opt out with little effort. Grubb (2015) predicts that increasing enrolment into overdraft alerts could have substantial benefits to the market - not only helping consumers incur fewer incidental charges, but potentially benefiting all account holders by increasing competition among banks.

CMA order on unarranged overdraft and unpaid item alerts

The CMA's order ensured that, by February 2018, all eligible UK consumers were enrolled into alerts that notify them when they have "exceeded a Pre-agreed limit" or "attempted to exceed a Pre-agree credit limit and will incur a charge".[20] The former scenario refers to the use of an unarranged overdraft facility (which will typically lead to a charge), the latter to unpaid item charges. For unarranged overdraft alerts, the order requires that a fee-free "grace period" should be communicated. This period should provide customers with as good an opportunity as possible to take action to avoid or reduce charges. For unpaid item alerts, the order does not require a grace period. In practice, however, most firms have operated a 'retry' system since 2014 – giving consumers time until the afternoon to deposit funds so a previously unpaid transaction can be re-attempted. Unpaid item alerts can be implemented as retry alerts.

Since several banks had already automatically enrolled their customers into alerts similar to those mandated by the CMA prior to February 2018, the implementation of the order has brought customers of more banks in line with the rest of the market.

Using automatic enrolment exercises to measure impact

As noted above, several banks had enrolled their customers into unarranged overdraft alerts and unpaid item alerts before the CMA order. In a detailed dataset of PCAs requested by the FCA from the UK's six biggest retail banks, based on a random sample of consumers and thus representative of UK market, we observe two automatic enrolment exercises by different banks during our sample time period. The richness of our data allows us to estimate the effect on incidental charges and various other aspects of consumer behaviour. Crucially, we compare those enrolled with those not yet enrolled – yielding a more robust estimate of enrolment impact than a before-after analysis.

The two banks in question independently enrolled the majority of their customers into alerts over a number of months. Since these automatic enrolment exercises correspond

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[20] CMA Retail Banking Investigation Order 2017. The order applies to banks with more than 150,000 PCAs; this translates to over 90% of the PCA market.

closely to the CMA's policy intervention (i.e. enrolling all customers that had not taken action and registered themselves), we believe our findings are a faithful representation of the policy's impact on consumers. We are especially interested in how alerts affect the share of incidental charges paid by different types of consumers and whether certain consumer segments are unlikely to be helped by alerts.

3   Data

The PCA dataset

The research in this paper is based on a detailed dataset (henceforth the *PCA dataset*) that covers consumers representative of 90% of the market from January 2015 to December 2016.[21] Specifically, the dataset contains detailed data on a random sample of 250,000 adult customers per bank for the six largest UK banks by market share of PCAs.[22] The data includes details of all customers' accounts, customer demographics, overdraft arrangements, account transactions, self-service banking (phone, internet and mobile) log-ins, text alerts and other relevant bank communications for the 24-month period. The full dataset comprises over one billion account transactions.

Table 1: Descriptive statistics of the PCA dataset

	Mean	Q5	Q25	Median	Q75	Q95
Age (years)	47.11	21	32	46	61	80
Tenure (years)	15.10	1	5	11	21	50
Gender (=1 if Female)	0.50					
Arranged OD facility	0.56					
Mobile banking registration	0.41					
Online banking registration	0.67					

Notes: Statistics for primary account holders as of 1st of January 2015, after dormancy correction but before other exclusions (See Annex 1), yielding 1,366,355 customers across six banks. Metrics are weighted by PCA provider account market shares (market shares for 2015 provided by the CMA based on their market investigation data). Tenure is based on the opening date of a customer's first account with the bank.

Table 1 shows some descriptive statistics on primary account holders in the PCA dataset. We find that the median age in our dataset is slightly higher than the UK population median (40) which can be explained by our sampling of UK adults.[23] Another notable feature is the high percentage of mobile banking registrations: 41% of primary account holders in our dataset were registered for mobile banking at the start of 2015.

Our focus is on consumers that use their PCA as their primary payment account and that pay the charges incurred on their account; we therefore exclude dormant accounts, secondary accounts, accounts belonging to defaulted consumers and accounts with uncharacteristically high levels of activity. A detailed description of how these exclusions were applied can be found in Annex 1.[24] Unless stated otherwise, all figures reported in

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[21] CMA retail banking market investigation final report finds the six largest UK PCA providers hold 90% of UK PCAs

[22] The dataset also includes customers that are in joint accounts with the 250,000 customers from the random sample, including all their accounts.

[23] Office of National Statistics, 2014 Census.

[24] Annex 1 also contains further information on excluded observations. Dormant and secondary accounts typically do not incur charges and capture, at best, only part of the consumer's portfolio. Defaulted consumers are unlikely to pay the charges on

the remainder of this section are based on 2016 data and all market-level figures are weighted by providers' market shares. Our unit of observation - which we refer to as *consumer* – is the primary account holder, to whom we attribute charges on all accounts (jointly) held with the bank.

Distribution of charges

Average monthly unpaid item charges are £0.56 and average monthly unarranged overdraft charges are £1.44. However, most PCA account holders incur zero charges, with only a minority incurring unpaid item or unarranged overdraft fees. To provide an intuitive breakdown of the entire distribution of charges, we divide customers into five groups based on average monthly charges. The lowest group consists of customers who did not incur any charges during 2016; the other four groups are made up of consumers incurring, on average, less than £5, between £5 and £10, between £10 and £15, and over £15 a month.

Tables 2 and 3 show that the vast majority of consumers neither incur unpaid items nor unarranged overdraft charges in a given year. Only 10% of consumers incurred any unpaid item charges and 14% incurred unarranged overdraft charges in 2016. This is much less than, for example, the proportion of consumers that use arranged overdraft (28% in 2016).

Looking at the distribution of unpaid item charges in Table 2, we note charges are highly concentrated on a small proportion of consumers. Consumers charged between £5 and £15 a month, approximately 2% of all PCA holders, are together responsible for 36% of unpaid item charges. At the extreme, consumers incurring over £15 a month make up only 1% of the PCA market but account for 35% of unpaid item charges.

Table 2: Distribution of unpaid item charges in 2016

Monthly average (£)	Share of consumers	Share of charges
15+	1%	35%
10-15	1%	14%
5-10	1%	22%
0-5	7%	29%
Zero	90%	0%

Notes: Based on 925,027 customers across six banks.

For unarranged overdraft usage (shown in Table 3), we also find that charges are highly concentrated. Those consumers that incur less than £5 per month make up more than half of unarranged overdraft users, yet they account for only 12% of fees charged. At the other end of the distribution, the 2% of PCA customers incurring over £15 a month constitutes nearly two thirds (64%) of unarranged overdraft charges.

their account (although this provides a conservative estimate of the costs of default – both financial and non-financial). Accounts with high levels of activity are most likely small businesses using a consumer account.

Table 3: Distribution of unarranged overdraft charges in 2016

Monthly average (£)	Share of consumers	Share of charges
15+	2%	64%
10-15	1%	12%
5-10	2%	12%
0-5	8%	12%
Zero	86%	0%

Notes: Based on 925,027 customers across six banks.

Unarranged overdraft episodes

We define an unarranged overdraft episode as a period of time starting with a consumer's end-of-day account balance dipping below zero (or their arranged overdraft limit) and ending as their balance returns into positive (or arranged overdraft) territory. If a consumer stays within certain zero-charge buffers defined by their bank (usually £10 or £15) then we do not consider this as an unarranged overdraft episode, as the consumer will not be charged for unarranged overdraft usage within the buffer.

Overdraft episode length and amount borrowed

The bar chart in Figure 2A shows the distribution of charged periods by duration. Note that intra-day episodes are typically not charged and therefore not included in the chart.[25] We see that 78% of charged episodes last less than a week, 57% less than three days, and nearly a third of overdraft use periods (31%) are resolved in one day.

Figure 2: Distribution of charged unarranged overdraft usage periods by duration [A] and maximum amount borrowed [B]
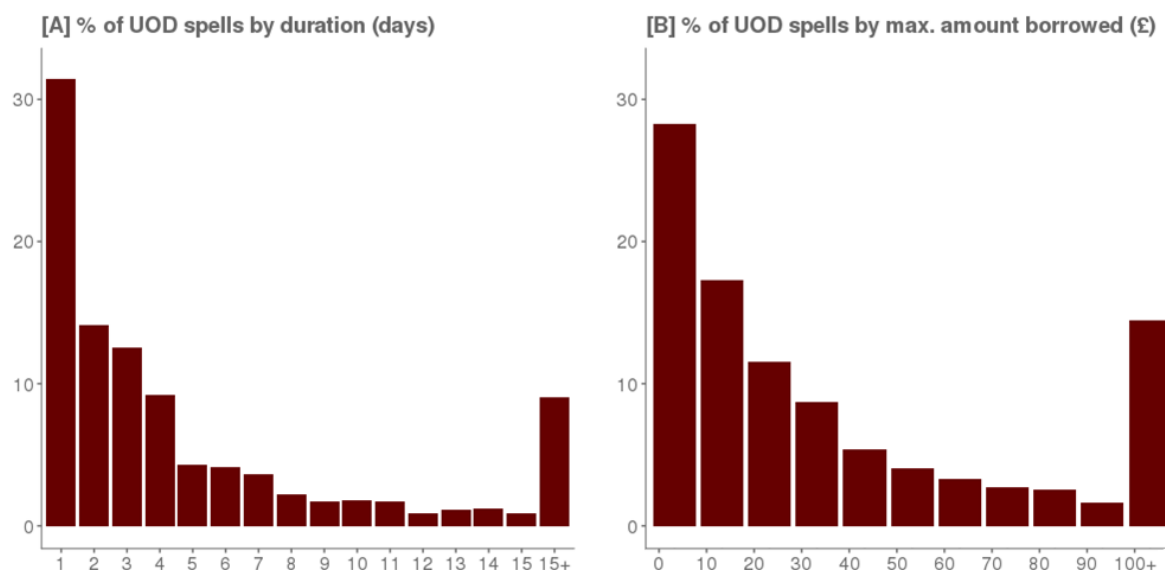
Notes: Based on 925,027 customers across 6 banks.

[25] 77% of unarranged overdraft usage periods in our data are intra-day episodes. Relative to charged overdrafts, intra-day episodes are more likely to be initiated by a scheduled payment and less likely to be resolved by BACS direct credit.

Figure 2B shows unarranged overdraft episodes by the maximum amount borrowed past their account fee-free buffer. Nearly two thirds (63%) of overdraft episodes involve borrowing less than £50. With charges generally above £5 per day during our sample period, these would incur a daily interest rate of over 10%. At the extreme, 28% of overdraft use periods involve borrowing below £10 past the fee-free buffer, equivalent to a daily interest rate of at least 20%. Given the small amount of borrowing, it seems unlikely that such overdraft use periods reflect a need for credit that cannot be fulfilled by other sources of liquidity. It seems more likely that some of these consumers are incurring charges as a result of inattention and/or lack of understanding of charges.

Overdraft alerts

While UK banks offer different types of overdraft alerts, we focus on the two alerts which are by far the most commonly adopted:[26]

- **Unpaid item alerts**, informing the customer that a payment will be rejected and a fee may be applied.

  These alerts are triggered by payments scheduled to occur on a given day (direct debit, standing order or cheque) that cannot be covered by cleared funds in the account or pre-agreed lines of credit. The bank, which typically has discretion over payment under these circumstances, can decide not to honour the payment. The bank will usually also charge the customer a flat unpaid item fee.

  Many banks, including the two banks whose data we analyse in the remaining sections of this paper, have implemented unpaid item alerts as 'retry alerts' – the consumer has not yet been charged for the unpaid item and is given until a specified cut-off time to transfer funds into the account. The alerts are sent in the morning of the scheduled payment date and the cut-off time for depositing funds is usually mid-afternoon. The alert may also inform the consumer of the £ charge amount.

- **Unarranged overdraft alerts**, informing the customer that they will be charged for using their unarranged overdraft unless they transfer funds before a cut-off time.

  These alerts are triggered by any payment that brings the balance of an account below zero or the agreed arranged overdraft limit. At this point, the bank has already used its discretion in deciding to extend an unarranged overdraft to the consumer - it is notifying the consumer in time to avoid being charged unarranged overdraft fees. The first alert is typically sent in the morning (based on the previous day's end-of-day balance) and informs the consumer of an afternoon or evening cut-off time for transferring funds. At some banks, should the consumer remain in unarranged overdraft, a further alert is sent several days later.

Most of the banks in the PCA dataset offered unpaid item and unarranged overdraft alerts to their customers on an opt-in basis. Previous FCA research shows that these alerts significantly reduce overdraft charges for those that sign up, although the research was not able to assess alert effectiveness for those that didn't actively sign up (and who are now automatically enrolled). Qualitative evidence suggests that most consumers have a

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[26] Other types of alerts are fee incurred alerts, weekly balance updates and low balance alerts. The CMA's Retail Banking Order requires most firms to automatically enrol customers into unarranged overdraft alerts with fee-free "grace periods". It also requires firms to automatically enrol customers into alerts for unpaid item charges. In practice, most firms have operated a 'retry' system since 2014 – giving consumers time until the afternoon to deposit funds so a previously unpaid transaction can be re-attempted - and have therefore implemented unpaid items alerts as retry alerts.

positive attitude towards these alerts.[27] Positive attitudes notwithstanding, voluntary take up of all overdraft alerts was surprisingly low, with registration rates in our in sample between 3% and 8%.

Response to alerts

Unarranged overdraft episodes are resolved when account balances return to positive or within the arranged overdraft limit. Pooling data from two banks in our dataset, we are able to plot the timing of unarranged overdraft resolutions in relation to the timing of alerts sent during 2016.[28] We look at consumers who entered their unarranged overdraft, received an unarranged overdraft alert at the point of entering unarranged overdraft (in real time) and/or an unpaid item alert the following morning. These consumers had been automatically enrolled into the unpaid item alerts, whereas they may either have self-registered or have been automatically enrolled for the unarranged overdraft alerts. Note that unpaid item alerts typically offer a grace period with cut-offs in the mid-afternoon (between 3pm and 4pm), while the real-time unarranged overdraft alerts have cut-offs later in the evening. If consumers do not transfer money before the specified cut-off time, they will be charged a fee (and, in the case of unpaid items, transactions will be rejected).

Figure 3 shows the timing of unarranged overdraft resolutions that occur on the first day of unarranged overdraft usage. In the left panel, we see a clear spike in the share of unarranged overdrafts resolved in the mid-afternoon, corresponding to the cut-off time for avoiding unpaid item fees. We also see increased activity between 7-9AM, when most unpaid item alerts are received.

Figure 3: Response to alerts on the first day in unarranged overdraft
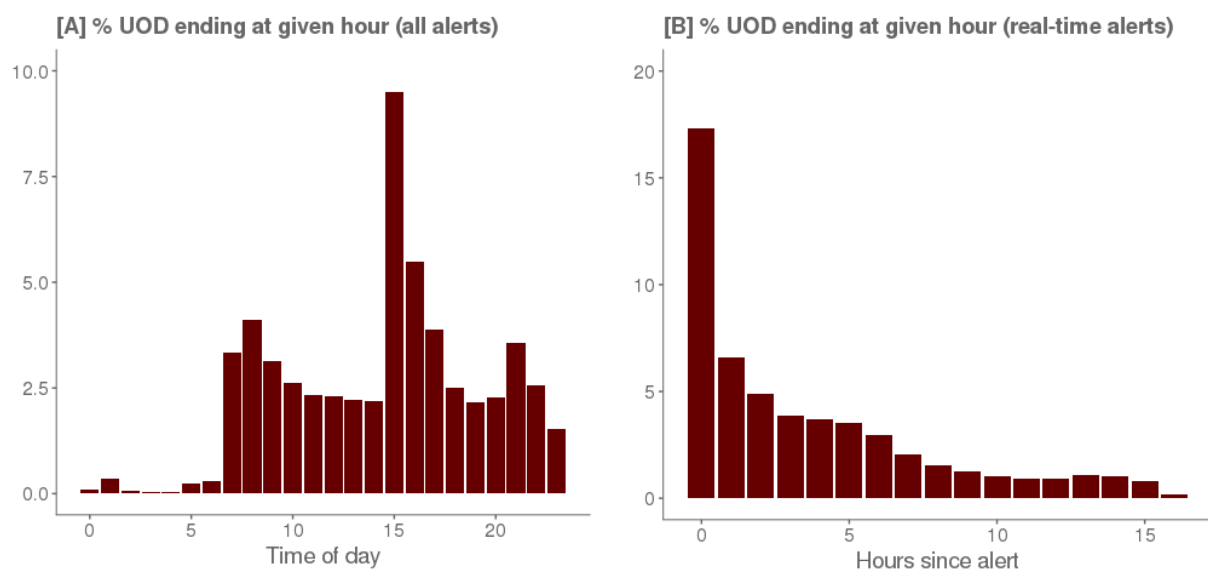
Notes: Based on data for all of 2016 from two banks.

The right panel of Figure 3 shows time of unarranged overdraft resolution relative to the time the alert was sent. Note that this is only for unarranged overdraft alerts which were

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[27] FCA occasional paper 10 and FCA-commissioned qualitative research (Colllaborate, 2016).

[28] These two banks are not the same two banks used for estimating the effect of automatic enrolment.

sent in real time. The fact that 17% of customers resolve unarranged overdrafts within an hour receiving an unarranged overdraft alert is highly suggestive that the resolution is in response to the alert, rather than due to the next pre-scheduled paycheck direct deposit. Many consumers act immediately after receiving an alert, with 17% doing so within an hour and the response rate dropping off over time. In total, 54% of customers respond to the alert on the day. The fact that 17% of customers resolve unarranged overdrafts within an hour of receiving an unarranged overdraft alert is highly suggestive that the resolution is in response to the alert, rather than due to the next pre-scheduled payment.

4   Automatic enrolment into alerts

In our PCA dataset, we observe two banks automatically enrolling their customers into unarranged overdraft alerts or unpaid item alerts. In both cases, the banks gradually roll out the alerts over a number of months until the entire population of eligible consumers has been enrolled.[29] This *staggered roll-out* approach, often preferred by firms for technical or administrative reasons, allows us to get a good estimate of the impact of enrolment on charges.[30] Because we observe outcomes for both enrolled and soon-to-be enrolled consumers at the same point in time, we can estimate the impact of automatic enrolment controlling for any time trends.

We can only measure the impact of automatic enrolment for existing consumers that are *eligible* for automatic enrolment.[31] Consumers are eligible if they did not already register themselves for the alerts and if the bank holds a valid mobile phone number for them.

Moreover, our estimation approach requires that (absent alerts) all consumers in our estimation sample share the same underlying trend in charges across time and account tenure. We can only provide evidence to support this assumption for consumers who we observe in the data prior to automatic enrolment into alerts. Hence we construct our estimation sample from those consumers who are eligible for automatic enrolment and who have at least two months of pre-treatment data in our observation window - we refer to those auto-enrolled earlier as *previously* auto-enrolled. While consumers in our estimation sample are therefore not necessarily a random sample of the bank's customer base, we find that their demographic characteristics are in line with the market.

Next, we discuss the details of the two automatic enrolment exercises. We refer to the banks involved as Bank A and Bank B. For reasons of commercial confidentiality, we cannot mention specific timings (dates of enrolment) or provide sample materials. We also redact our findings where appropriate.

Bank A: unpaid item alerts

The beginning of our sample period captures the last twelve months of a staggered roll-out of unpaid item alerts by Bank A. As we exclude customers with less than two months of pre-treatment data from our estimation sample, this leaves us with a ten month period of automatic enrolment that we can use to estimate the effect on consumer behaviour. Bank A enrolled approximately 26% of its customers over this time – as shown in red in Figure 4. We observe the exact date that each consumer is enrolled into the alert (although consumers may not have noticed themselves since the bank did not notify

[29] Note that this does not mean that the entire population will be enrolled at the end of the roll-out: if consumers do not wish to receive the alerts, they can opt out at any point after being enrolled.

[30] For most banks (including the two banks whose automatic enrolment we analyse), unpaid item and unarranged overdraft charges accrue during a monthly billing cycle and are charged the following month. For our main results, we measure the effect of alerts on charges incurred on a monthly basis – with charges recorded against the calendar month that the relevant billing cycle ended in.

[31] We exclude consumers who joined the bank during the observation window. We also do not measure the effect of automatic enrolment upon account opening. Although the PCA dataset does contain instances of consumers who joined banks with an opt-out alerts policy for new accounts, we do not have sufficient data to construct a reliable counterfactual for these individuals.

them of enrolment). Consumers were able to opt out of receiving the alert at any point by changing their registration settings in their online banking; it was not possible for them to adjust these settings in their mobile banking app during our observation window.

Figure 4: Bank A's proportion of consumers enrolled into alerts
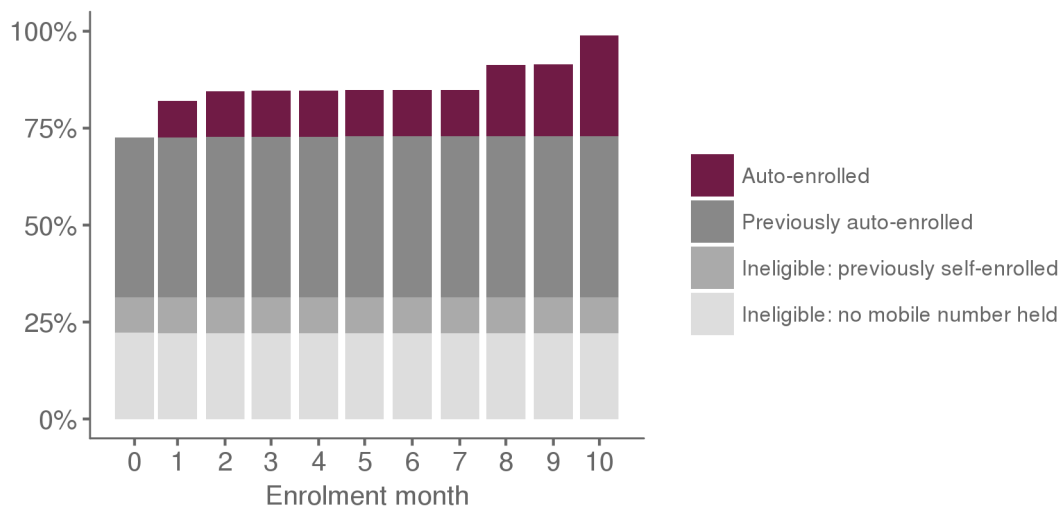
Notes: Based on sample of existing Bank A customers as of January 1st, 2015 (n=201,078) after exclusions.

Population and sample pre-treatment statistics

Table 4 shows some summary statistics on our estimation sample (those eligible but not previously automatically enrolled), alongside statistics for the full PCA dataset. We find our estimation sample for Bank A is broadly similar to the PCA dataset, with slightly longer tenures and lower mobile and online banking registration rates.

Table 4: Comparison of estimation sample and full PCA dataset

	Estimation sample (n=53,257)				PCA dataset (n=1,366,355)			
	Mean	Q25	Median	Q75	Mean	Q25	Median	Q75
Age (years)	46.97	35	47	59	47.11	32	46	61
Tenure (years)	18.48	5	13	24	15.10	5	11	21
Gender (=1 if Female)	0.54				0.50			
Arranged OD facility	0.51				0.56			
Mobile banking registration	0.19				0.41			
Online banking registration	0.50				0.67			

Notes: All statistics calculated at the consumer level for the 1st of January 2015. PCA dataset figures are taken from Table 1. Tenure is based on the opening date of a customer's first account with the bank.

Table A1 (Annex 2) shows a more detailed pre-treatment distribution of key variables for the consumer sample used for our estimation (left panel), alongside the sample of consumer eligible for automatic enrolment that were previously enrolled (right panel). The latter sample includes both eligible consumers that were enrolled previously and those whose automatic enrolment date is missing from our data.[32] As Table A1 shows, our estimation sample is slightly older than previously enrolled consumers, has longer average tenures, higher balances and is less likely to be registered for mobile banking. Next, Table A2 shows the two samples of Bank A customers ineligible for automatic enrolment. The sample of self-enrolled consumers is quite similar to eligible consumers, whereas the sample of consumers for whom the bank holds no mobile phone number is older, holds significantly higher balances and is much less likely to use mobile banking.

Table A5 and Table A6 in Annex 2 describe key characteristics of consumers that were enrolled at different times, averaged over the two months before the enrolment programme started.[33] There are some differences between waves of enrolment over time, although the waves with the largest sample sizes (enrolment month 1, 2, 8 and 10) are quite similar. Enrolment month 1 and 2 contains individuals that are slightly older, have shorter tenure, lower balances and have lower average charges than those in enrolment months 8 and 10. We use individual fixed effects and tenure fixed effects to control for these differences.

Bank B: unarranged overdraft and unpaid item alerts

Figure 5: Bank B's automatic enrolment over time
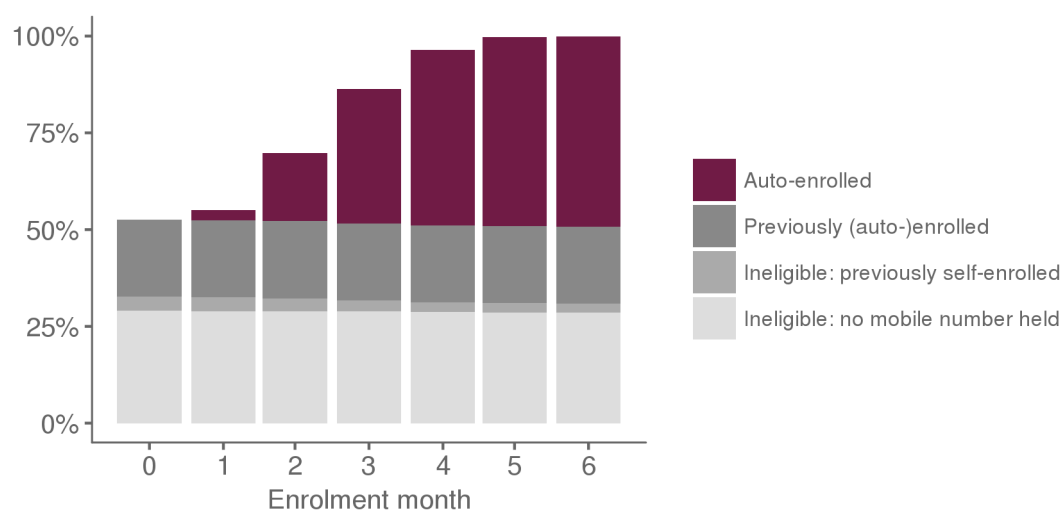
Notes: Based on sample of existing Bank B customers as of January 1st, 2015 (n=208,971) after exclusions.

Bank B automatically enrolled approximately 49% of its customers simultaneously into unpaid item and unarranged overdraft alerts over a six month period entirely within in our observation window, with sufficient pre-treatment data for all these consumers.

[32] In our sample, auto-enrolment dates are missing for 5.2% of those automatically enrolled.

[33] With the exception of indicator variables (overdraft facility, mobile and internet banking registration) - these were computed at the start of automatic enrolment. Note that we only had two months of pre-enrolment data available for Bank A.

Figure 5 shows enrolment over time. We observe the exact enrolment date for each customer. The bank itself notified each customer of enrolment with a text message on the date of enrolment. Customers were able to opt out of receiving the alert at any point by changing their registration settings in their online banking; it was not possible for customers to adjust these settings in their mobile banking app during our observation window.

Population and sample pre-treatment statistics

Table 5 shows some summary statistics on our estimation sample (those automatically enrolled within our observation window), alongside statistics for the full PCA dataset (broadly representative of the market). We find our estimation sample for Bank B is broadly similar to the PCA dataset, with a slightly lower age and a higher online banking registration rate.

Table 5: Comparison of estimation sample and full PCA dataset

|	Estimation sample (n=96,015)				PCA dataset (n=1,366,355)			
	Mean	Q25	Median	Q75	Mean	Q25	Median	Q75
Age (years)	43.35	30	42	55	47.11	32	46	61
Tenure (years since customer opened their account)	15.93	7	14	23	15.10	5	11	21
Gender (=1 if Female)	0.51				0.50			
Arranged OD facility	0.70				0.56			
Mobile banking registration	0.41				0.41			
Online banking registration	0.81				0.67			

Notes: All statistics calculated at the consumer level for the 1st of January 2015. PCA dataset figures are taken from Table 1.

Table A3 (Annex 2) shows a more detailed pre-treatment distribution of key variables for the consumer sample used for our estimation (left panel), alongside the sample of consumers eligible for automatic enrolment that were previously enrolled (right panel).[34] As Table A3 shows, our estimation sample is very similar to those previously enrolled, although it has longer average tenures, higher balances and is more likely to have an arranged overdraft facility. Next, Table A4 shows the two samples of Bank B customers ineligible for automatic enrolment. The sample of self-enrolled consumers is slightly younger than eligible consumers, with shorter tenures and a greater likelihood of using mobile banking, whereas the sample of consumers for whom the bank holds no mobile

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[34] Automatic enrolment date is not observed for these individuals, however we infer that they were previously auto-enrolled because our data shows consumers in this group receiving alerts from the beginning of our sample period,

phone number is older, holds significantly higher balances and is much less likely to use mobile banking.

Table A7 in Annex 2 describes key characteristics of consumers that were enrolled at different times, averaged over the five months before the enrolment programme started.[35] We note some differences between waves of enrolment that suggest enrolment was not random. Specifically, the earlier waves have higher account tenures, are on average older, are less likely to use mobile banking, are more likely to have an arranged overdraft facility, have higher balances and lower average charges. As discussed in Annex 7, we believe these differences arise because automatic enrolment timing depended on an account identifier correlated with tenure. Hence our specification controls for tenure using fixed effects (see additional detail in Annexes 3 and 7). We also use individual fixed effects to control for time-invariant differences between consumers.

Methodology

In order to correctly estimate the impact of automatic enrolment into alerts on charges, it needs to be the case that the enrolment process used by banks was not conditioned on variables unobserved to us that would have been correlated with an individual's trend in charges. Our understanding of the enrolment process from discussion with both banks and preliminary data analysis is that individuals were enrolled in waves based on an individual identifier that, notably at Bank B, was highly correlated with account tenure. In Annex 7, we describe the enrolment process for both banks in more detail and we perform supplementary econometric analysis which supports the presence of parallel trends across the treatment and control groups. The results of this exercise suggest that it is reasonable to assume that, conditional on account tenure, any additional variation in enrolment identifiers was essentially random and uncorrelated with trends in charges.

Eligible customers were enrolled without prior notice. Although time of enrolment was not independent of customer characteristics, customers would not have been aware of the criteria used to select them for enrolment at a particular time. Therefore, customers would not have taken any purposeful action (to influence their eligibility) that may have affected their likelihood of being enrolled at all, or at a particular time.

Specification

Our estimation of the impact of automatic enrolment uses a fixed effects (FE) model to control for consumer characteristics that remain constant over time, as well as general time trends (at the month-year level), and tenure (months since first account opening). We also show our main results without controls for tenure for comparison in the annex. Under the assumption of common (time and tenure) effects for individuals across the population, we obtain an unbiased estimate of the average effect of automatic enrolment by comparing outcomes of those consumers already enrolled to those not (yet) enrolled. The latter thus constitutes the counterfactual – representing the outcomes they would have obtained had they not been enrolled – for the former group.

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[35] With the exception of overdraft facility, mobile and internet banking registration indicators – these were computed at the start of automatic enrolment.

Our empirical approach relies on the assumption of parallel trends conditional on observables – Annex 7 explains this in more detail and shows that it is unlikely that differential time trends across consumer groups are driving our key results.

Figure 6 illustrates this point. The left panel shows the average difference in unpaid item charges incurred per week relative to 8 weeks before automatic enrolment (conditional on observables) at Bank A. The right panel shows the average difference in unpaid item charges per month relative to 5 months before automatic enrolment (conditional on tenure fixed effects) at Bank B. Prior to automatic enrolment, the estimated effect of automatic enrolment is not statistically different from zero, providing evidence to support our assumption of parallel trends conditional on observables. For Bank A we ran this analysis on the weekly level to provide more observations before enrolment to assess trends given our shorter pre-treatment observation window (we can observe 8 weeks rather than 2 months). All of our main results are on the monthly level.

Figure 6 - Pre- and post-treatment unpaid item charges
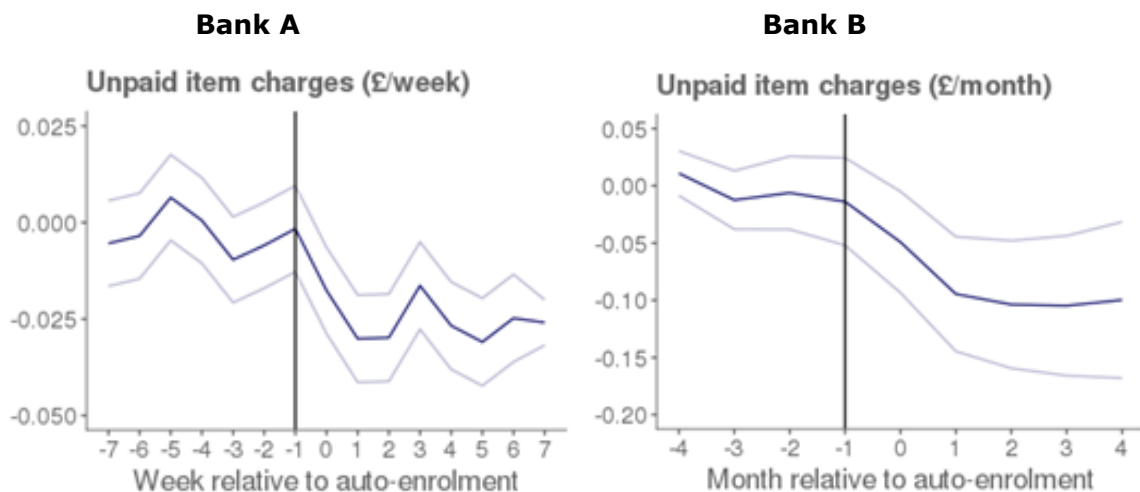
Note: light blue lines indicate 95% confidence intervals.

At Bank A, we observe an immediate and sustained drop in unpaid item charges from the week of automatic enrolment, which is the effect of the unpaid item alerts. Because we inferred real-time unpaid item charges (from unpaid item transactions) at Bank A for this analysis, these charges do not take into account billing cycles (charges are actually billed to customers with a delay from the end of their monthly billing cycle). At Bank B, we observe a drop in charges over a 2-month period before levelling off. The slower drop in charges for Bank B is due to the delay between incurring charges and charges being billed to customer accounts following billing cycles. We control for this lag in our main results using two dummy variables: one for the month of enrolment and one for the month after enrolment. The underlying data used in the graphs can be found in Annex 7.

The calendar observation windows that we use for our analysis across both banks starts from the start of our sample time period – January 2015 – up to four months following the end of the automatic enrolment exercise.

Treatment estimates

We note that our estimates are not standard Intent-to-Treat (ITT) effects, but likely a conservative underestimate due to a data limitation. In the standard Intent-to-Treat (ITT) exercise, the researcher observes which individuals are exogenously assigned treatment, even though actual treatment may differ because some individuals may opt-in or opt-out of the treatment. The ITT effect, or the effect of being assigned treatment, can be recovered by comparing the average outcomes among those assigned treatment and those not. In our situation, automatic enrolment is staggered over time and all eligible individuals are either automatically enrolled or actively opt-in by the end of the sample period. Thus the intended-treatment and control groups must be constructed on a period-by-period basis. A limitation of our data arises from the fact that in a given period, some individuals actively opt-in to alerts, and although we know that these individuals would have been automatically enrolled had they not opted-in, we do not know when they would have been automatically enrolled. As a result, while we know they should be included in the control group prior to actively opting in, we cannot tell in which future period they should be moved into the intended-treatment group, so cannot estimate a standard ITT effect.[36]

Our approach is to treat individuals who actively opt-in during the treatment window as though they would not have been automatically enrolled in the future, and so we always include them in the control group. Thus, in place of an indicator for the (partially unobserved) intended treatment, we use an indicator for actual automatic enrolment in our regressions. This is potentially problematic, because individuals who actively-opt in to alerts are placed into the control group in later periods not by exogenous assignment to non-treatment, but due to their own endogenous choices to opt-in. However, we believe this approach will lead to a conservative underestimate of the true ITT for two reasons.

First, some opt-in behaviour is likely driven by factors that are uncorrelated with underlying overdraft risk. Hence, some of the difference between the automatic enrolment indicator and the unobserved intended treatment is likely standard measurement error that will lead to attenuation bias in the ITT. (Intuitively we would underestimate the ITT effect because some of the treated individuals are misplaced into the control group, making the two groups more similar.)

Second, there will be some opt-ins which are not random. In prior work, it has been found that individuals will often opt-in to alerts following past instances in overdrafts, and overdraft charges will subsequently drop due to mean reversion.[37] Since we include such opt-ins in our control group, the drop in overdraft charges will be attributed to the overall time trend in charges, rather than the effect of being treated. Such non-random opt-ins will also cause the estimated ITT to be further biased towards zero. We expect the bias to be small, however, because few consumers tend to opt in; the monthly rate at which customers actively opt in is very low (0.08% for Bank A, 0.35% for Bank B; measured prior to auto-enrolment).

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[36] Individuals who opt-out are kept in the treatment group, following standard practice for estimating the ITT. We exclude individuals who opt-in prior to the first auto-enrolment window from the analysis.

[37] FCA Occasional Paper 10.

5   Results

This section contains our estimates of the effect of automatic enrolment into unpaid item and unarranged overdraft alerts. We present our results for the entire enrolled consumer sample and for sub-groups of different consumer types. Finally, we also estimate the effect of automatic enrolment on other outcome variables that measure how consumers use their accounts (balances, transactions and digital banking).

We present treatment estimates from a three-way (calendar month, individual and tenure) fixed effects (FE) regression model. Calendar month FE control for seasonal trends in overdraft usage. Individual FE control for account and consumer characteristics that do not change over time. Tenure FE (in months) control for the correlation between tenure and overdraft usage. Our regression specification is set out in Annex 3 and the tables with our regression results are in Annexes 4, 5 and 6.[38]

Unpaid item alerts

We find that automatically enrolling consumers into unpaid item alerts reduces unpaid item charges by 21% (Bank A) to 24% (Bank B) relative to not having alerts. The left panel in Figure 7 (Figure 8) shows the decrease in charges for Bank A (Bank B) customers, relative to the baseline of the charges that would have applied had alerts not been rolled out. The average absolute reductions in unpaid item charges correspond to £0.23 (Bank A) and £0.08 (Bank B) per customer per month.

Figure 7: Bank A impact of automatic enrolment on unpaid item charges
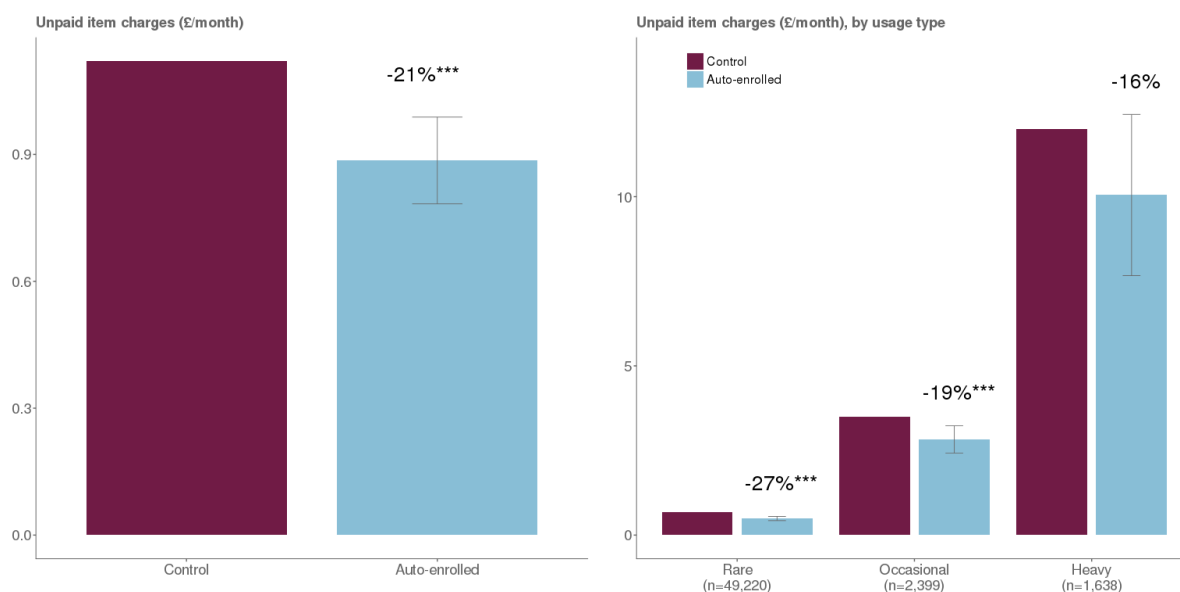
Notes: Control level is *Baseline* and treatment effect shown is the *AutoEnrolled* coefficient in Tables A8 (left panel) and A9 (right panel) in Annex 4. Error bars show 95% confidence interval. Stars indicate significance: *** = p<.01, ** = p<.05, * = p<.1

[38] Annex 4 also includes the results of a simple fixed effects model without tenure fixed effects.

Figure 8: Bank B impact of automatic enrolment on unpaid item charges
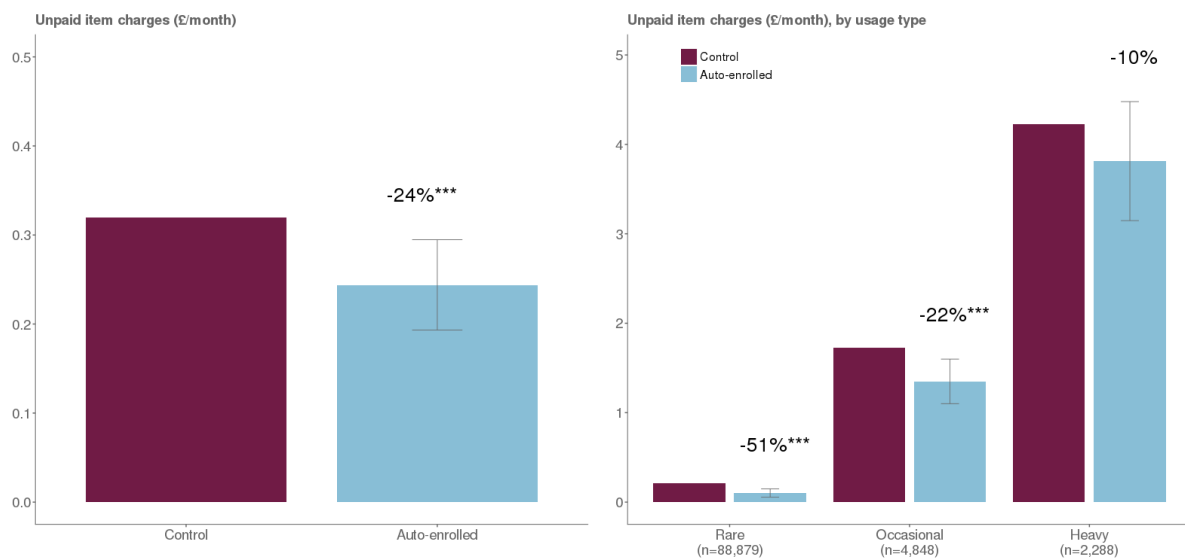
Notes: Control level is *Baseline* and treatment effect shown is the *AutoEnrolled* coefficient in Tables A12 (left panel) and A13 (right panel) in Annex 4. Error bars show 95% confidence interval. Stars indicate significance: *** = p<.01, ** = p<.05, * = p<.1

We note that the baselines and pound amount effects per customer per month may seem small, however, we know from our distributional analysis in Section 3 that unpaid item charges are highly skewed with 90% of consumers not paying charges over a year. As these pound amount savings represent an average over all customers in our sample, we would expect consumers who do incur charges to save much more than these pounds amounts per month. Given that the majority of incidental charges are incurred by small numbers of consumers, we next investigate whether the effect of automatic enrolment into alerts varies with the level of charges incurred.

Effects across usage types

We divide consumers into three groups based on their average monthly charges in the months before automatic enrolment, based on the notion that past charges are reliable predictors of future charges. We define the following groups for both banks separately:

- **Rare:** consumers that incurred no charges in the pre-treatment period
- **Occasional:** consumers that incurred less or at the median of charges in the pre-treatment period, conditional on being charged
- **Heavy:** consumers that incurred more charges than the median of charges in the pre-treatment period, conditional on being charged[39]

As shown in the right panel of Figures 7 (Bank A) and 8 (Bank B), we find similar patterns across the 2 banks. The higher the level of incurred charges, the greater the absolute (pound terms) reduction thanks to alerts but the lower the relative reduction. Whilst consumers in the *Rare* charge category see their charges reduced by 27-51% due to automatic enrolment, consumers in the *Heavy* category see average reductions of 10-16%. In fact, we are not able to conclusively say whether the effect of automatic enrolment for this latter category is statistically different from zero – that is, whether

[39] Customers incurring the median charge conditional on being charged are allocated to the Occasional group, which explains why there are more customers in this group compared to the heavy group.

alerts had an effect for these consumers at all. This may be due to the small sample of consumers in this category.

These figures also confirm the persistent nature of unpaid item charges over time. While we categorised consumers into three groups by the amount of charges they incurred in a pre-enrolment period, each group persistently incurred a similar amount of charges during and after the period of enrolment.

Unarranged overdraft alerts

As shown in the left panel of Figure 9, we find that automatically enrolling consumers in to unarranged overdraft alerts reduces unarranged overdrafts by 25% (Bank B) relative to not having alerts. In the sample of automatically enrolled consumers for Bank B, this reduces average monthly unarranged overdraft charges by £0.25 per customer.

Figure 9: Bank B impact of automatic enrolment on unarranged overdraft charges
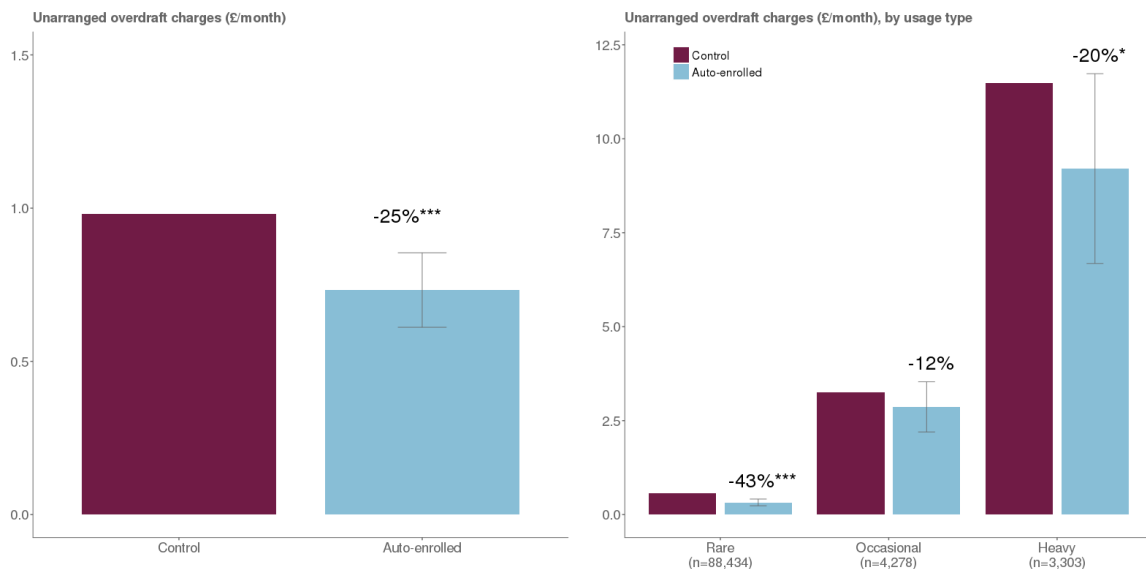
Notes: Control level is Baseline and treatment effect shown is the AutoEnrolled coefficient in Tables A14 (left panel) and A15 (right panel) in Annex 4. Error bars show 95% confidence interval. Stars indicate significance: *** = p<.01, ** = p<.05, * = p<.1

Effects across usage types

As with unpaid item charges, we also investigate the effect of automatic enrolment across different usage categories. We define the following groups in the same way as for unpaid item charges but only for unarranged overdraft charges (regardless of unpaid item charges incurred):

- **Rare:** consumers that incurred no charges in the pre-treatment period
- **Occasional:** consumers incurred less than or at the median charges in the pre-treatment period, conditional on being charged
- **Heavy:** consumers incurred more than the median charges in the pre-treatment period, conditional on being charged

The right panel of Figure 9 shows results across categories, the pattern of which seems to match our findings for unpaid item charges. A notable difference is that we do not find that the effect for the *Occasional* consumer category is significantly different from zero as with unpaid items. The largest group of consumers, those in the *Rare* category, reduce their monthly charges on average by close to half (43%).

At Bank B, we were also able to estimate the effect of the automatic enrolment on the combined amount of unpaid items and unarranged overdraft charges incurred to get the total impact on incidental charges. We present these results in Figure 10. Note that the estimated treatment effect for all three consumer types is statistically significant; suggesting that automatic enrolment into both types of alerts by Bank B did have an effect on those incurring higher charges.

Figure 10: Bank B impact of automatic enrolment on unpaid item and unarranged overdraft charges
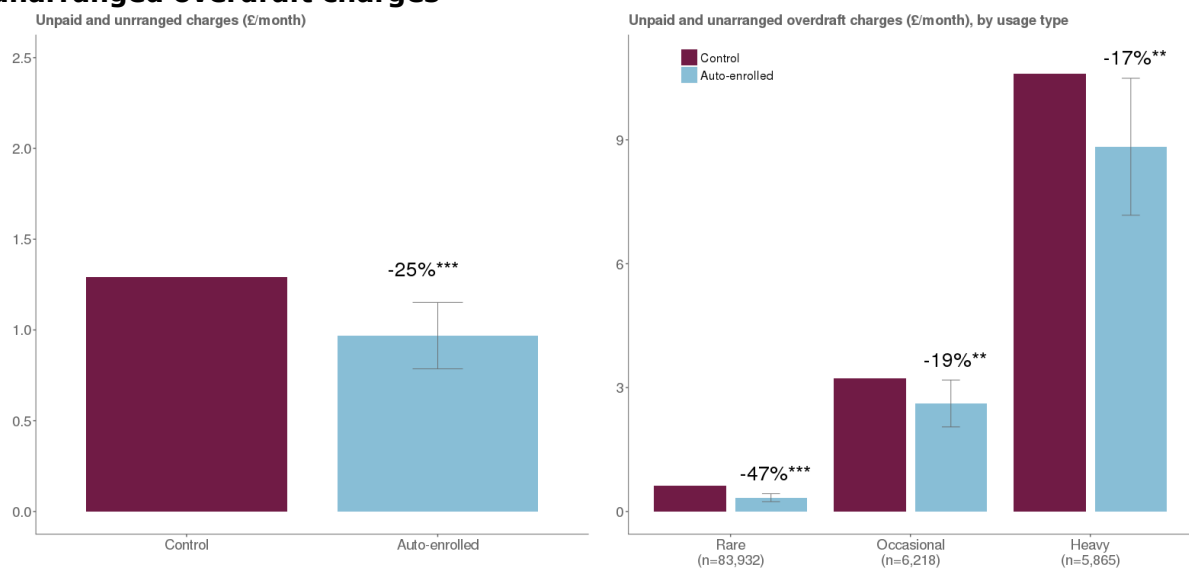
Notes: Control level is Baseline and treatment effect shown is the *AutoEnrolled* coefficient in Tables A16 (left panel) and A17 (right panel) in Annex 4. Error bars show 95% confidence interval. Stars indicate significance: *** = p<.01, ** = p<.05, * = p<.1.

Effects by other consumer types

To understand how the impact of automatic enrolment into unpaid item alerts varies with individual characteristics, we repeat our analyses on a number of different subgroups of the data: In particular, we divide the data by age groups, estimated income[40] groups, whether a consumer has an arranged overdraft facility, whether a consumer is registered for mobile banking, and whether a consumer has at least £100 of available savings in an easy access savings account with the same bank in the period before enrolment. The full set of results can be found in Annex 5.

Secondary outcomes

We estimated the effects of the alerts on a number of alternative outcomes, including changes to average and minimum account balance levels, arranged overdraft use, mobile

[40] Our proxy for income is a three-month rolling average of credit turnover (all credit transactions) on the consumer's accounts.

banking use, transaction behaviour and the number of overdraft episodes that consumers have per month. Studying these further effects sheds light on any potential side effects that come with overdraft alerts. For example, we would be interested to know whether overdraft alerts are only effective because they prompt consumers to increase their account balance levels or their mobile banking usage, which in turns lowers overdraft charges. The outcomes that we studied and their results (focussing on relative effects only) are summarised in Table 7. The table also includes our main results for comparison. The statistical tables can be found in Annex 6.

In summary, we find no large and statistically significant effects other than the key expected outcomes: unpaid item charges for Bank A (who only rolled out unpaid item alerts) and unpaid item and unarranged overdraft charges for Bank B (who rolled out both unpaid item and unarranged overdraft alerts). We do not find statistically significant effects on customer balance levels or arranged overdraft charges.

Our results show a marked difference in the number of overdraft episodes that consumers have per month. We find a 19.7% reduction in the number of overdraft episodes equal to or greater than 2 days per month and a 14.9% reduction in the total number of overdraft episodes per month, which suggests that consumers are better able to make use of their grace periods because of overdraft alerts.

These results lead us to conclude that the main mechanism by which consumers are managing to reduce their incidental charges is not by making permanent changes to the way they use their account or the level of funds that are held as a buffer. We know that alerts must have prompted customers to transact differently (as this is necessary to avoid charges) – but there are no clear effects detected by our models. It is more likely that consumers are transacting in a more timely manner, bringing forward transactions that would have otherwise happened later in order to avoid charges.

The only other statistically significant effect that we find is for Bank B, which shows a slight increase in the number of scheduled transactions a customer has – though the effect is very small.

Table 6 – Summary of impact of automatic enrolment on all outcomes

Outcome variable (monthly basis)	Relative Effect (Bank A)	Relative Effect (Bank B)
Unpaid item charges	-21% (baseline £1.12 per month)	-24% (baseline £0.32 per month)
Unarranged charges	-	-25% (baseline £0.98 per month)
Number of unarranged overdraft episodes	n/a	-14.9% (baseline 0.03 episodes per month)
Number of unarranged overdraft episodes longer than 1 day	n/a	-19.7% (baseline 0.02 episodes per month)
Arranged overdraft charges	-	-
Average balance	-	-
Minimum balance	-	-
Mobile banking log ins	-	-
Number of scheduled transactions	-	+3% (baseline 8.37 transactions per month)
Number of transactions	-	-

Notes: Estimates are only reported for statistically significant effects at the 5% level.

6   Conclusion

Our findings show that automatically enrolling consumers into unpaid item and unarranged overdraft alerts brings significant benefits to many consumers. We estimate that having been automatically enrolled into alerts saved consumers 21-25% in unpaid item and unarranged overdraft charges. These findings provide an important estimate of the impact of the CMA's order on retail banks, which mandated that banks roll out these alerts to every eligible consumer in the UK. We focus on the impact of automatic enrolment on different consumer segments, revealing that the effectiveness of alerts varies. Those who incur the least charges are those who receive the greatest percentage reduction in charges with alerts. We find less convincing evidence that the alerts are helpful in reducing charges for those most likely to incur charges; though it is possible they are helpful in other ways such as increasing consumer awareness of charges.

The overdraft alerts we document had been available to consumers on an opt-in basis for many years prior to automatic enrolment. Remarkably, few consumers took notice: 3-8% were typical sign up rates. In fact, the vast majority of those incurring incidental charges were not registered for alerts at the time of automatic enrolment. These findings illustrate why a rule that merely mandates the availability of a facility for consumers may often not have the intended impact and how automatic enrolment can drastically improve enrolment rates.

With reference to earlier FCA research, we note that automatic enrolment into alerts is more effective than the disclosure of charges after-the-fact through annual statements. Although we cannot attribute the relative effectiveness of alerts to a particular feature of their implementation, it seems that their timely and relevant nature is important. Making consumers more acutely aware of incidental charges, at the point when they can still take action to avoid charges, seems a useful principle for the disclosure of contingent charges.

What might be good principles for regulators or other policy bodies to mandate automatic enrolment of consumers into timely communications? There appear to be very few downsides to automatically enrolling consumers into overdraft alerts. We already noted the big difference in enrolment rates between opt-in and opt-out regimes. Of the consumers that received overdraft alerts because of automatic enrolment, few opted out, which indicates that most consumers find alerts useful. Furthermore, the cost incurred in opting out (or ignoring alerts) seems low.

Alerts and consumer types

Naturally, overdraft alerts are most useful for those who are able to act on them (though we note that they may also be useful to drive behaviour change more generally). Consumers who do not have phone numbers registered with their bank, who do not have a facility for quick account access (mobile or online banking), or those in financial distress are a lot less likely to reap the benefits of overdraft alerts.

Crucially, our analysis shows that the proportion of charges avoided differs sharply with frequency of usage. Whereas those rarely incurring charges manage to cut their charges effectively in half thanks to alerts, frequent users are only able to reduce their charges by about a fifth, or even less. These findings may not be overly surprising, for two reasons. First, those incurring the highest amounts of charges will have their charges capped at a monthly maximum level; reducing the number of unpaid items or days spent in unarranged overdraft may therefore not reduce costs by very much (or at all) for these consumers. Second we would expect that consumers incurring many incidental charges are less likely to have liquid funds available elsewhere to transfer to their account after receiving an alert. They are also less likely to have access to cheaper sources of credit (or may be less aware of these alternatives), which may also explain why alerts are not as effective for these consumers.

Because the relative reduction in charges caused by alerts is smaller for consumers who incur higher charges, the concentration of incidental charges necessarily increases. Although the total amount of charges might decrease for consumers of all usage types, the proportion of charges paid by the most frequent users (say, the top 5% of consumers) therefore increases after automatically enrolling consumers into alerts. We could say that automatic enrolment is regressive, as it widens the distribution of outcomes. Although it is important not to lose sight of the fact that the absolute amount of charges saved is highest for those who incurred the highest level of charges, the differential impact of alerts is important in the context of concerns about the UK's 'free if in credit' charging model.

It is worth noting that the CMA also implemented a number of other interventions as a result of their market investigation, designed to help consumers who incur incidental charges. These include an Order on major PCA providers to i) implement a Monthly Maximum Charge – a price cap (of the bank's choosing) on the amount of incidental charges incurred per month, ii) register a customer's phone number at account opening so that overdraft alerts can be sent, and iii) make customers data available through APIs – a development known as 'Open Banking' - so that third parties may provide new services to consumers. Open Banking is envisaged to spur innovation to help consumers in multiple ways - for example, by facilitating the development of smart lines of credit provided by third parties that could act as a shield from unpaid item charges and that are cheaper than overdrafts, introducing new competitive forces in the interests of consumers.

Improving alert effectiveness

There is a range of other potential overdraft alerts – beyond the alerts studied in this paper - that may bring substantial benefits to consumers. It is worthwhile noting that the current set of overdraft alerts are only sent once consumers have already started using their unarranged overdraft (or are attempting a transaction without sufficient funds). They then usually have less than a day to correct their position before an incidental charge is incurred.

It is possible that consumers would benefit more if alerts were sent *before* usage of unarranged overdraft. Given the relative increase of fees for arranged overdraft usage in recent years, it may also be beneficial to notify consumers of their usage of arranged overdraft alerts. Following recommendations from the CMA to evaluate the need for

further alerts, the FCA is working with PCA providers on Randomised Controlled Trials (RCTs) to estimate the impact of overdraft alerts that provide an earlier warning to consumers. We will be publishing the detailed results of these RCTs in the coming months.

Our estimate of the impact of alerts is limited to the enrolment window used by the 2 banks in our analysis. It is therefore possible that, due to improvements in alert and mobile banking technology, consumers have become more responsive to alerts since. With the advent of further improvements and Open Banking functionality, consumers should be able to avoid incidental charges without having to separately load their mobile banking app or even automatically, by linking an account. Some of this functionality has existed for several years, but we expect that the development of technology will make it more flexible and easier to control.

It is also possible that the effectiveness of alerts increases over time due to consumer learning and other changes in behaviour encouraged by alerts. Consumers may be less likely to incur charges in the first place, or they may take actions that increase the likelihood that they can respond to alerts (such as installing a mobile banking app or keeping a buffer in instant-access savings accounts). Insofar as these changes occur over a longer time period than our enrolment window, we cannot measure them in this paper.

Further lessons for policy

Our estimates only provide a partial-equilibrium forecast of the impact of alert automatic enrolment. Whenever consumer behaviour changes, especially where these changes have an impact on revenue, firms will typically react. This may take the form of adjusting incidental charges, other charges or the terms of the overdraft facilities. We cannot forecast such reactions and therefore make no specific predictions on the effect of the automatic enrolment policy, when fully 'worked out'. We do believe that our results are a good forecast of automatic enrolment into alerts in the current market. The fact that we observe very similar treatment effects and patterns for both banks gives us further confidence in the robustness of our results. They can also be used for Cost Benefit Analysis (CBA) on the policy.

Research using detailed data on consumer behaviour is an important part of pinning down the precise effect of policies. This form of research is also in line with the FCA's framework for measuring the impact of its interventions using ex post evaluations.[41] As this paper shows, the analysis of aggregate results often does not tell the full story, or leaves the policy researcher unable to control for time trends that affect estimates. Where this data is available due to staggered roll-outs or other natural experiments, regulators can benefit from these sources of data.

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[41] FCA DP18/3: Ex post Impact Evaluation Framework

Annex 1: Sample adjustments

We exclude consumers deemed to be:

1. **Dormant**. Dormant consumers are removed on a rolling basis if they do not carry out any transactions over twelve months. To ensure consistency over time, we asked the submitting banks to exclude consumers with a (pre-2015) history of at least 12 months of inactivity.

   Across the banks in our sample, we exclude 7-8% of consumers on this criterion during the sample period.

2. **Not holding a primary account with the bank**. Consumers are removed if their three-month rolling average of their monthly credit turnover falls lower than £500 and their three-month rolling average of their monthly number of transactions drops below 2.

   Across the banks in our sample, we exclude 10-16% of consumers on this criterion during the sample period (of those not yet excluded due to dormancy).

3. **Defaulted**. Consumers are removed if they incur unarranged overdraft charges in at least one of their accounts for three consecutive months and they also do not credit their account for three months.

   Across the banks in our sample, we exclude 0.1-0.8% of consumers on this criterion during the sample period (of those not already excluded due to one of the 2 criteria above).

4. **Using an account for business purposes**. Consumers are defined as business users if one or more of the following apply to at least one of their accounts:
   - three-month rolling average monthly credit turnover higher than £30,000;
   - three-month rolling average monthly credit transactions is higher than 50.
   - arranged overdraft limit is higher than £10,000.

   Across the banks in our sample, we exclude 1.1-1.6% of consumers on this criterion during the sample period (of those not already excluded due to one of the three criteria above).

If consumers are excluded from our sample they do not re-enter in later months.

As a result of using three-month rolling means, we can only classify customers into the above categories from March 2015. For the customers who do not fall into the above categories from March 2015 we can use their data from January and February 2015.

Annex 2: Enrolment breakdown

This annex contains the following tables:

- *Table A1: Bank A estimation and previously enrolled consumer sample characteristics in month before the start of automatic enrolment*
- *Table A2: Bank A ineligible consumer sample characteristics in month before the start of automatic enrolment*
- *Table A3: Bank B estimation and previously enrolled consumer sample characteristics in month before the start of automatic enrolment*
- *Table A4: Bank B ineligible consumer sample characteristics in month before the start of automatic enrolment*
- *Table A5: Bank A account characteristics and charges in month before start of automatic enrolment, per automatic enrolment month (months 1-5)*
- *Table A6: Bank A account characteristics and charges in month before start of automatic enrolment, per automatic enrolment month (months 6-10)*
- *Table A7: Bank B account characteristics and charges in month before start of automatic enrolment, per automatic enrolment month*

Table A1: Bank A estimation and previously enrolled consumer sample characteristics in month before the start of automatic enrolment

	Estimation sample (n=53,257)					Previously enrolled (n=96,423)				
	Mean	**SD**	**Q25**	**Q50**	**Q75**	Mean	SD	Q25	Q50	Q75
Age (years)	**46.97**	**16.35**	**35**	**47**	**59**	39.89	15.24	28	37	50
Gender (1=Female)	**0.54**					0.52				
Tenure (years)	**18.48**	**18.70**	**5**	**13**	**24**	13.89	15.35	3.7	8.1	18.7
Average balance	**2,451**	**9,705**	**96**	**524**	**2,025**	1,581	6,987	89	371	1,176
Arranged OD facility	**0.51**					0.45				
Arranged OD ch.	**3.59**	**13.65**	**0**	**0**	**0**	3.18	11.67	0	0	0
Unarranged OD ch.	**1.22**	**8.57**	**0**	**0**	**0**	0.82	6.77	0	0	0
Unpaid items ch.	**1.09**	**6.11**	**0**	**0**	**0**	1.23	5.58	0	0	0
Mobile banking reg.	**0.19**					0.52				
Mobile banking logins	**2.93**	**10.67**	**0**	**0**	**0**	11.41	19.3	0	1	16.5
Online banking reg.	**0.50**					0.41				
Online banking logins	**0.15**	**1.16**	**0**	**0**	**0**	0.55	2.62	0	0	0.5

Notes: Balance and arranged, unarranged and unpaid item charge amounts in pounds sterling (£) per month. Mobile and internet banking log-ins are also monthly averages.

Table A2: Bank A ineligible consumer sample characteristics in month before the start of automatic enrolment

	Self-enrolled (n=18,730)					No mobile held (n=32,668)				
	Mean	SD	Q25	Q50	Q75	Mean	SD	Q25	Q50	Q75
Age (years)	41.79	14.80	30	39	52	66.67	16.76	56	70	79
Gender (1=Female)	0.50					0.46				
Tenure (years)	14.58	15.80	3	9	20	34.60	23.69	15	26	65
Average balance	1,645	6,411	106	439	1,322	4,992	14,440	470	1735	5212
Arranged OD facility	0.49					0.71				
Arranged OD ch.	3.25	11.9	0	0	0	1.705	8.62	0	0	0
Unarranged OD ch.	0.78	6.6	0	0	0	0.632	5.89	0	0	0
Unpaid items ch.	1.18	5.6	0	0	0	0.397	3.83	0	0	0
Mobile banking reg.	0.43					0.02				
Mobile banking logins	8.16	16.8	0	0	10	0.08	1.78	0	0	0
Online banking reg.	0.51					0.31				
Online banking logins	0.43	2.1	0	0	0	0.12	1.12	0	0	0

Notes: Balance and arranged, unarranged and unpaid item charge amounts in pounds sterling (£) per month. Mobile and internet banking log-ins are also monthly averages.

Table A3: Bank B estimation and previously enrolled consumer sample characteristics in month before the start of automatic enrolment

	Estimation sample (n=96,015)					Previously enrolled sample (n=52,512)*				
	Mean	**SD**	**Q25**	**Q50**	**Q75**	Mean	SD	Q25	Q50	Q75
Age (years)	**43.35**	**15.86**	**30**	**42**	**55**	43.96	18.07	28	41	57
Gender (1=Female)	**0.51**					0.52				
Tenure (years)	**15.93**	**10.43**	**7**	**14**	**23**	12.88	11.46	4	9	20
Average balance	**2,920**	**13,434**	**117**	**656**	**2,283**	2,214	10,302	49.7	357	1,575
Arranged OD facility	**0.70**					0.54				
Arranged OD	**4.21**	**11.42**	**0**	**0**	**2.9**	3.59	10.61	0	0	1.2
Unarranged OD	**0.74**	**4.48**	**0**	**0**	**0**	1.15	5.73	0	0	0
Unpaid items	**0.30**	**1.53**	**0**	**0**	**0**	0.49	1.93	0	0	0
Mobile banking reg.	**0.41**					0.38				
Mobile banking logins	**10.76**	**21.68**	**0**	**0**	**13**	10.98	23.84	0	0	11.4
Online banking reg.	**0.81**					0.71				
Online banking logins	**4.19**	**9.87**	**0**	**0.75**	**4.5**	3.87	11.04	0	0.2	3.2

Notes: Balance and arranged, unarranged and unpaid item charge amounts in pounds sterling (£) per month. Mobile and internet banking log-ins are also monthly averages. *= Due to data limitations we cannot distinguish between the following 2 scenarios: these consumers (i) self-enrolled or (ii) had been automatically enrolled by the bank prior to the automatic enrolment exercise we observe.

Table A4: Bank B ineligible consumer sample characteristics in month before the start of automatic enrolment

	Self-enrolled (n=8,810)					No mobile held (n=51,634)				
	Mean	SD	Q25	Q50	Q75	Mean	SD	Q25	Q50	Q75
Age (years)	39.4	14.84	27	37	50	63.34	17.52	52	65	76
Gender (1=Female)	0.52					0.55				
Tenure (years)	10.73	10.14	3	8	16	24.83	11.73	16	25	33
Average balance	2,048	12,474	48	324	1,231	5,218	14,790	443	1,764	5,251
Arranged OD facility	0.52					0.735				
Arranged OD	4.23	14.26	0	0	2.4	2.77	9.63	0	0	0
Unarranged OD	1.75	6.93	0	0	0	0.313	2.85	0	0	0
Unpaid items	0.6	2.14	0	0	0	0.119	0.98	0	0	0
Mobile banking reg.	0.45					0.05				
Mobile banking logins	14.3	26.27	0	0	19.6	0.94	6.65	0	0	0
Online banking reg.	0.79					0.35				
Online banking logins	4.47	11.29	0	0.8	4.2	1.421	5.12	0	0	0

Notes: Balance and arranged, unarranged and unpaid item charge amounts in pounds sterling (£) per month. Mobile and internet banking log-ins are also monthly averages.

Table A5: Bank A account characteristics and charges in month before start of automatic enrolment, per automatic enrolment month (months 1-5)

Enrolment month	1 (n=18,887)	2 (n=5,269)	3 (n=125)	4 (n=148)	5 (n=153)
Age (years)	46.00 (16.55)	46.41 (16.23)	39.53 (14.89)	39.91 (15.67)	43.19 (16.21)
Gender (1=Female)	0.53	0.51	0.46	0.43	0.49
Tenure (years)	17.42 (18.32)	16.60 (17.94)	11.93 (13.19)	10.53 (12.57)	15.718 (18.53)
Average balance	2312.60 (8426.58)	2142.97 (6427.74)	808.52 (2306.42)	1432.69 (5348.11)	1865.87 (4450.54)
Arranged OD facility	0.48	0.46	0.41	0.35	0.39
Arranged OD charges	2.42 (9.89)	2.88 (10.83)	3.95 (14.14)	3.45 (12.18)	1.85 (8.93)
Unarranged OD charges	0.88 (6.70)	1.03 (7.24)	2.06 (12.16)	1.49 (10.68)	0.00 (0.00)
Unpaid items charges	0.81 (4.60)	1.08 (5.26)	1.45 (4.91)	1.84 (8.19)	1.65 (6.01)
Mobile banking reg.	0.18	0.16	0.29	0.37	0.34
Mobile banking logins	3.25 (11.11)	2.45 (9.33)	6.14 (14.75)	6.16 (12.92)	7.92 (16.49)
Online banking reg.	0.51	0.51	0.51	0.52	0.53
Online banking logins	0.16 (1.23)	0.15 (1.35)	0.41 (1.38)	0.19 (1.20)	0.78 (4.39)

Notes: Balance and arranged, unarranged and unpaid item charge amounts in pounds sterling (£) per month.
Mobile and internet banking log-ins are also monthly averages.
Standard errors are in parentheses.

Table A6: Bank A account characteristics and charges in month before start of automatic enrolment, per automatic enrolment month (months 6-10)

Enrolment month	6 (n=97)	7 (n=85)	8 (n=13,065)	9 (n=126)	10 (n=15,302)
Age (years)	41.88 (17.05)	40.40 (17.73)	47.77 (16.08)	44.30 (18.08)	47.93 (16.22)
Gender (1=Female)	0.38	0.40	0.56	0.53	0.56
Tenure (years)	12.65 (15.16)	14.33 (16.41)	19.54 (19.04)	17.22 (19.47)	19.75 (19.04)
Average balance	1164.90 (2690.34)	853.27 (1408.73)	2572.21 (12481.42)	1558.43 (5338.78)	2677.56 (9579.61)
Arranged OD facility	0.36	0.43	0.54	0.49	0.54
Arranged OD	2.16 (7.26)	2.61 (8.75)	4.55 (16.06)	4.28 (14.09)	4.48 (16.02)
Unarranged OD	0.15 (1.523)	0.63 (5.84)	1.57 (10.09)	0.38 (4.35)	1.42 (9.58)
Unpaid items	1.59 (4.05)	1.30 (7.00)	1.30 (7.16)	0.93 (3.71)	1.22 (6.95)
Mobile banking reg.	0.30	0.31	0.18	0.29	0.18
Mobile banking logins	5.92 (11.46)	7.74 (17.39)	2.67 (10.19)	5.38 (10.88)	2.72 (10.71)
Online banking reg.	0.57	0.52	0.49	0.50	0.49
Online banking logins	0.35 (1.34)	0.32 (1.01)	0.12 (0.85)	0.11 (0.37)	0.13 (1.16)

Notes: Balance and arranged, unarranged and unpaid item charge amounts in pounds sterling (£) per month.
Mobile and internet banking log-ins are also monthly averages.
Standard errors are in parentheses.

Table A7: Bank B account characteristics and charges in month before start of automatic enrolment, per automatic enrolment month

Enrolment month	1 (n=5,404)	2 (n=30,444)	3 (n=34,099)	4 (n=19,211)	5 (n=6,457)	6 (n=400)
Age (years)	48.79 (12.96)	50.88 (14.37)	39.60 (14.85)	39.46 (16.21)	34.86 (13.55)	35.58 (13.19)
Gender (1=Female)	0.53	0.50	0.52	0.50	0.51	0.49
Tenure (years)	22.15 (8.40)	23.35 (9.27)	12.84 (8.42)	10.37 (9.49)	8.71 (4.30)	11.35 (7.92)
Average balance	4,317 (13,512)	4,119 (15,037)	2,191 (11,369)	2,338 (14,205)	1,612 (7,481)	3,464 (42,422)
Arranged OD facility	0.91	0.89	0.65	0.49	0.47	0.58
Arranged OD	6.64 (15.51)	5.72 (13.62)	4.03 (10.36)	2.01 (6.99)	2.51 (10.61)	4.40 (8.63)
Unarranged OD	0.42 (3.57)	0.48 (3.71)	0.94 (5.09)	0.82 (4.61)	0.93 (4.66)	0.96 (3.54)
Unpaid items	0.13 (0.94)	0.14 (1.05)	0.35 (1.63)	0.43 (1.90)	0.47 (1.86)	0.76 (2.31)
Mobile banking reg.	0.33	0.29	0.47	0.47	0.53	0.52
Mobile banking logins	6.29 (15.34)	6.09 (15.55)	13.10 (23.55)	13.67 (24.56)	15.30 (26.11)	15.60 (30.22)
Online banking reg.	0.82	0.77	0.84	0.82	0.85	0.84
Online banking logins	4.32 (7.93)	3.97 (8.46)	4.33 (10.03)	4.17 (11.24)	4.38 (11.76)	5.87 (14.36)

Notes: Balance and arranged, unarranged and unpaid item charge amounts in pounds sterling (£) per month.
Mobile and internet banking log-ins are also monthly averages.
Standard errors are in parentheses.

Annex 3: Econometric specification

We estimate treatment effects using 2 models: a linear two-way (customer and month) fixed effects model and a linear three-way (customer, month and tenure) fixed effects model. The latter is our preferred model for both banks (see Annex 7). Each observation corresponds to a customer-month. Standard errors are clustered by customer and month in all of our results.

In our tables of results we report the '*baseline*' for each regression. The baseline is calculated by predicting (from the model) the non-treatment outcome for all treated customer-months. This can be interpreted as the average charges absent the treatment. We also report the '*% effect*', which is the treatment effect divided by the baseline.

Two way Fixed Effects Model

$$X_{i,t} = AutoEnrolled_{i,t}\beta_1 + EnrolmentMonth_{i,t}\beta_2 + EnrolmentMonthLag_{i,t}\beta_3 + \theta_i + \mu_t + \varepsilon_{it}$$

Where $X_{i,t}$ is the outcome variable (for example unpaid item charges) for individual i in month t, $AutoEnrolled_{i,t}$ is a dummy variable for if consumers have been automatically enrolled into alerts, $EnrolmentMonth_{i,t}$ is a dummy variable capturing only the month that consumers are automatically enrolled, $EnrolmentMonthLag_{i,t}$ is a dummy variable capturing only the month after the month that consumers are automatically enrolled, μ_t are calendar month fixed effects, θ_i are individual fixed effects. The two enrolment month variables are intended to capture the lag between enrolment into overdraft alerts and observing the effect on account bills up to two months later.

Three way Fixed Effects Model

$$X_{i,t} = AutoEnrolled_{i,t}\beta_1 + EnrolmentMonth_{i,t}\beta_2 + EnrolmentMonthLag_{i,t}\beta_3 + \delta_{t-s\_i} + \theta_i + \mu_t + \varepsilon_{it}$$

Where $X_{i,t}$ is the outcome variable (for example unpaid item charges) for individual i in month t, $AutoEnrolled_{i,t}$ is a dummy variable for if consumers have been automatically enrolled into alerts, $EnrolmentMonth_{i,t}$ is a dummy variable capturing only the month that consumers are automatically enrolled, $EnrolmentMonthLag_{i,t}$ is a dummy variable capturing only the month after the month that consumers are automatically enrolled, δ_{t-s_i} (where s_i indicates the account opening month for individual i) are fixed effects for the time customers have been with their bank (in months), μ_t are calendar month fixed effects, θ_i are individual fixed effects. The two enrolment month variables are intended to capture the lag between enrolment into overdraft alerts and observing the effect on account bills up to two months later.

Annex 4: Treatment effect regressions

This annex presents regression tables for the main results discussed in the paper. The emphasis is on the average treatment effect across the automatically enrolled consumer sample, plus average treatment effect by three pre-treatment charge usage categories

- **Rare** are consumers that incurred no charges in the pre-treatment period
- **Occasional** are consumers that incurred less or at the median of charges in the pre-treatment period conditional on being charged
- **Heavy** are consumers that incurred more charges than the median of charges in the pre-treatment period conditional on being charged

This annex contains the following tables.

- Table A8: Bank A automatic enrolment impact on unpaid item charges
- Table A9: Bank A automatic enrolment impact on unpaid item charges, by usage.
- Table A10: Bank A automatic enrolment impact on unpaid item charges and unarranged overdraft charges.
- Table A11: Bank A automatic enrolment impact on unpaid item charges and unarranged overdraft charges, by usage
- Table A12: Bank B automatic enrolment impact on unpaid item charges.
- Table A13: Bank B automatic enrolment impact on unpaid item charges, by usage.
- Table A14: Bank B automatic enrolment impact on unarranged overdraft charges.
- Table A15: Bank B automatic enrolment impact on unarranged overdraft charges, by usage.
- Table A16: Bank B automatic enrolment impact on unpaid item and unarranged overdraft charges.
- Table A17: Bank B automatic enrolment impact on unpaid item and unarranged overdraft charges, by usage.

Table A8: Bank A automatic enrolment impact on unpaid item charges

	2-way fixed effects	3-way fixed effects
	(1)	(2)
AutoEnrolled	-0.233***	-0.234***
	(0.053)	(0.052)
Enrolment month	0.191***	0.194***
	(0.040)	(0.040)
Enrolment month (lag)	0.046	0.049
	(0.053)	(0.054)
Baseline UPT charges	1.11	1.12
% effect	-21	-20.9
Customer and month fixed effects	Yes	Yes
Tenure fixed effects	No	Yes
No. customers	53257	53257
Observations	746,293	746,293
R^2	0.400	0.401

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A9: Bank A automatic enrolment impact on unpaid item charges, by usage

	2-way fixed effects			3-way fixed effects		
	Rare	Occasional	Heavy	Rare	Occasional	Heavy
	(1)	(2)	(3)	(4)	(5)	(6)
AutoEnrolled	-0.181***	-0.688***	-2.013	-0.182***	-0.662***	-1.960
	(0.030)	(0.202)	(1.322)	(0.034)	(0.206)	(1.217)
Enrolment month	0.158***	0.568**	1.528	0.164***	0.544**	1.575*
	(0.025)	(0.224)	(1.000)	(0.026)	(0.211)	(0.930)
Enrolment month (lag)	0.038	0.177	0.761	0.044*	0.186	0.841
	(0.024)	(0.181)	(0.931)	(0.026)	(0.189)	(0.902)
Baseline UPT charges	0.67	3.52	12.06	0.67	3.49	12.01
% effect	-27	-19.6	-16.7	-27.2	-19	-16.3
Customer and month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Tenure fixed effects	No	No	No	Yes	Yes	Yes
No. customers	49220	2399	1638	49220	2399	1638
Observations	688,707	34,135	23,451	688,707	34,135	23,451
R^2	0.288	0.246	0.400	0.288	0.252	0.406

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A10: Bank A automatic enrolment impact on unpaid item charges and unarranged overdraft charges

	2-way fixed effects	3-way fixed effects
	(1)	(2)
AutoEnrolled	-0.227***	-0.234***
	(0.077)	(0.076)
Enrolment month	0.194***	0.201***
	(0.058)	(0.058)
Enrolment month (lag)	0.082	0.089
	(0.069)	(0.069)
Baseline UPT charges	2.22	2.23
% effect	-10.2	-10.5
Customer and month fixed effects	Yes	Yes
Tenure fixed effects	No	Yes
No. customers	53257	53257
Observations	746,293	746,293
R^2	0.598	0.598

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A11: Bank A automatic enrolment impact on unpaid item and unarranged overdraft charges, by usage

	2-way fixed effects			3-way fixed effects		
	Rare	Occasional	Heavy	Rare	Occasional	Heavy
	(1)	(2)	(3)	(4)	(5)	(6)
AutoEnrolled	-0.138**	-0.543*	-2.239*	-0.139**	-0.542*	-2.356*
	(0.063)	(0.290)	(1.341)	(0.063)	(0.280)	(1.278)
Enrolment month	0.179***	0.548*	1.177	0.179***	0.501*	1.365*
	(0.045)	(0.304)	(0.804)	(0.045)	(0.302)	(0.788)
Enrolment month (lag)	0.088**	0.242	0.606	0.088**	0.236	0.789
	(0.036)	(0.215)	(1.021)	(0.035)	(0.211)	(1.034)
Baseline UPT charges	0.89	3.99	26.59	0.89	3.99	26.71
% effect	-15.5	-13.6	-8.4	-15.6	-13.6	-8.8
Customer and month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Tenure fixed effects	No	No	No	Yes	Yes	Yes
No. customers	48093	2588	2576	48093	2588	2576
Observations	672,294	36,893	37,106	672,294	36,893	37,106
R^2	0.355	0.371	0.551	0.355	0.377	0.554

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A12: Bank B automatic enrolment impact on unpaid item charges

	2-way fixed effects	3-way fixed effects
	(1)	(2)
AutoEnrolled	-0.077***	-0.075***
	(0.026)	(0.026)
Enrolment month	0.044**	0.044**
	(0.019)	(0.019)
Enrolment month (lag)	0.002	0.003
	(0.010)	(0.010)
Baseline UPT charges	0.32	0.32
% effect	-24	-23.5
Customer and month fixed effects	Yes	Yes
Tenure fixed effects	No	Yes
No. customers	96015	96015
Observations	1,308,924	1,308,924
R^2	0.328	0.328

Clustered standard errors shown between brackets   *p<0.1, **p<0.05, ***p<0.01

Table A13: Bank B automatic enrolment impact on unpaid item charges, by usage

	2-way fixed effects			3-way fixed effects		
	Rare	Occasional	Heavy	Rare	Occasional	Heavy
	(1)	(2)	(3)	(4)	(5)	(6)
AutoEnrolled	-0.109***	-0.390**	-0.579*	-0.108***	-0.380***	-0.417
	(0.036)	(0.162)	(0.328)	(0.023)	(0.127)	(0.339)
Enrolment month	0.076***	0.303**	0.452	0.067***	0.272***	0.350
	(0.023)	(0.120)	(0.300)	(0.015)	(0.098)	(0.319)
Enrolment month (lag)	0.033**	0.036	0.153	0.025**	0.010	0.074
	(0.016)	(0.107)	(0.239)	(0.012)	(0.099)	(0.239)
Baseline UPT charges	0.21	1.74	4.39	0.21	1.73	4.23
% effect	-51.9	-22.4	-13.2	-51.3	-22	-9.9
Customer and month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Tenure fixed effects	No	No	No	Yes	Yes	Yes
No. customers	88879	4848	2288	88879	4848	2288
Observations	1,211,644	66,489	30,791	1,211,644	66,489	30,791
R^2	0.194	0.180	0.254	0.195	0.184	0.263

Clustered standard errors shown between brackets   *p<0.1, **p<0.05, ***p<0.01

Table A14: Bank B automatic enrolment impact on unarranged overdraft charges

	2-way fixed effects	3-way fixed effects
	(1)	(2)
AutoEnrolled	-0.258***	-0.247***
	(0.087)	(0.064)
Enrolment month	0.180***	0.155***
	(0.053)	(0.037)
Enrolment month (lag)	0.081**	0.059**
	(0.035)	(0.024)
Baseline UOD charges	0.99	0.98
% effect	-26	-25.2
Customer and month fixed effects	Yes	Yes
Tenure fixed effects	No	Yes
No. customers	96015	96015
Observations	1,308,924	1,308,924
R^2	0.358	0.358

Clustered standard errors shown between brackets   **p<0.1, **p<0.05, ***p<0.01*

Table A15: Bank B automatic enrolment impact on unarranged charges, by usage

	2-way fixed			3-way fixed effects		
	Rare	Occasional	Heavy	Rare	Occasional	Heavy
	(1)	(2)	(3)	(4)	(5)	(6)
AutoEnrolled	-0.255***	-0.373	-2.290	-0.246***	-0.384	-2.283*
	(0.085)	(0.389)	(1.427)	(0.045)	(0.340)	(1.289)
Enrolment month	0.195***	0.170	1.708*	0.163***	0.134	1.520*
	(0.057)	(0.422)	(0.935)	(0.038)	(0.382)	(0.876)
Enrolment month (lag)	0.099***	-0.002	1.034	0.070***	-0.046	0.798
	(0.037)	(0.169)	(0.720)	(0.018)	(0.153)	(0.743)
Baseline UOD charges	0.58	3.24	11.5	0.57	3.25	11.49
% effect	-44	-11.5	-19.9	-43.1	-11.8	-19.9
Customer and month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Tenure fixed effects	No	No	No	Yes	Yes	Yes
No. customers	88434	4278	3303	88434	4278	3303
Observations	1,205,157	59,014	44,753	1,205,157	59,014	44,753
R^2	0.205	0.218	0.318	0.206	0.222	0.323

Clustered standard errors shown between brackets   **p<0.1, **p<0.05, ***p<0.01*

Table A16: Bank B automatic enrolment impact on unpaid item and unarranged overdraft charges

	2-way fixed effects	3-way fixed effects
	(1)	(2)
AutoEnrolled	-0.335***	-0.322***
	(0.094)	(0.070)
Enrolment month	0.223***	0.199***
	(0.062)	(0.049)
Enrolment month (lag)	0.083**	0.061**
	(0.040)	(0.031)
Baseline UOD charges	1.3	1.29
% effect	-25.7	-25
Customer and month fixed effects	Yes	Yes
Tenure fixed effects	No	Yes
No. customers	96015	96015
Observations	1,308,924	1,308,924
R^2	0.382	0.382

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A17: Bank B automatic enrolment impact on unpaid item and unarranged charges, by usage

	2-way fixed			3-way fixed effects		
	Rare	Occasional	Heavy	Rare	Occasional	Heavy
	(1)	(2)	(3)	(4)	(5)	(6)
AutoEnrolled	-0.302***	-0.650**	-1.836*	-0.296***	-0.614**	-1.768**
	(0.092)	(0.325)	(1.100)	(0.049)	(0.290)	(0.846)
Enrolment month	0.225***	0.302	1.639**	0.196***	0.236	1.429**
	(0.061)	(0.265)	(0.776)	(0.040)	(0.234)	(0.643)
Enrolment month (lag)	0.107***	0.088	0.836	0.079***	0.032	0.624
	(0.036)	(0.209)	(0.529)	(0.017)	(0.191)	(0.494)
Baseline UOD charges	0.64	3.27	10.66	0.63	3.23	10.6
% effect	-47.2	-19.9	-17.2	-47	-19	-16.7
Customer and month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Tenure fixed effects	No	No	No	Yes	Yes	Yes
No. customers	83932	6218	5865	83932	6218	5865
Observations	1,143,771	85,499	79,654	1,143,771	85,499	79,654
R^2	.212	0.216	0.327	0.213	0.220	0.331

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Annex 5: Treatment effect regressions for relevant subgroups

This annex presents regression tables of treatment effects on the main outcome variables (unpaid item charges, unarranged overdraft charges) for various subgroups of interest in the auto-enrolled consumer sample.

The results are summarised in the following table.

Consumer group	Key insight on impact of alerts
Age	- largest effects found for 40-50 year olds, we find a consistent 30% decrease in charges across banks and types of charges - fewer effects for 18-30 year olds, the only effect we find is a 22.5% decrease in unpaid item charges at Bank B - We find no effects for 60+ year olds
Estimated Income	- effects are broadly similar in size across estimated income groups, though high income customers experience larger effects - these results could be driven by age or other factors
With arranged overdraft	- largest effects tend to be for those with an arranged overdraft but differences are not statistically significant - results are mixed and could be driven by age (i.e. older people are more likely to have an arranged overdraft)
Registered for mobile banking	results are mixed: at Bank B we only find an effect on unpaid items for those who are registered for mobile banking. Other differences, for unpaid items at Bank A and unarranged overdrafts at Bank B, are not statistically significant.
Having available savings in easy access savings account at bank	- results are mixed: having available savings with the same bank does not appear to be a key condition for usefulness of alerts - for Bank A we only find an effect for customers with no savings - for Bank B we find higher relative effects for those with savings

This annex contains the following tables.

Arranged overdraft facility

- Table A18: Bank A automatic enrolment impact on unpaid item charges, by arranged overdraft facility.
- Table A19: Bank B automatic enrolment impact on unpaid item charges, by arranged overdraft facility.
- Table A20: Bank B automatic enrolment impact on unarranged overdraft charges, by arranged overdraft facility.

Age

- Table A21: Bank A automatic enrolment impact on unpaid item charges, by age.
- Table A22: Bank B automatic enrolment impact on unpaid item charges, by age.
- Table A23: Bank B automatic enrolment impact on unarranged overdraft charges, by age.

Estimated income

- Table A24: Bank A automatic enrolment impact on unpaid item charges, by estimated income.
- Table A25: Bank B automatic enrolment impact on unpaid item charges, by estimated income.
- Table A26: Bank B automatic enrolment impact on unarranged overdraft charges, by estimated income.

Digital activity (internet or mobile banking)

- Table A27: Bank A automatic enrolment impact on unpaid item charges, by digital activity.
- Table A28: Bank B automatic enrolment impact on unpaid item charges, by digital activity.
- Table A29: Bank B automatic enrolment impact on unarranged overdraft charges, by digital activity.

Mobile banking registration

- Table A30: Bank A automatic enrolment impact on unpaid item charges, by mobile banking.
- Table A31: Bank B automatic enrolment impact on unpaid item charges, by mobile banking.
- Table A32: Bank B automatic enrolment impact on unarranged overdraft charges, by mobile banking.

Table A18: Bank A automatic enrolment impact on unpaid item charges, by arranged overdraft facility

	No Arranged OD	Arranged OD
	(1)	(2)
AutoEnrolled	-0.195***	-0.277***
	(0.044)	(0.078)
Enrolment month	0.186***	0.202***
	(0.031)	(0.062)
Enrolment month (lag)	0.048	0.047
	(0.033)	(0.086)
Baseline UPT charges	1.17	1.07
% effect	-16.7	-25.9
Customer, month and tenure fixed effects	Yes	Yes
# customers	26060	27197
Observations	353,117	393,176
R^2	0.396	0.403

Clustered standard errors shown between brackets   *$p<0.1$, **$p<0.05$, ***$p<0.01$

Table A19: Bank B automatic enrolment impact on unpaid item charges, by arranged overdraft facility

	No Arranged OD	Arranged OD
	(1)	(2)
AutoEnrolled	-0.058	-0.065***
	(0.041)	(0.022)
EnrolmentMonth	0.024	0.048***
	(0.029)	(0.017)
EnrolmentMonthLag	-0.028	0.010
	(0.018)	(0.012)
Baseline UPT charges	0.53	0.22
% effect	-11	-29.4
Customer, month and tenure fixed effects	Yes	Yes
# customers	29304	66711
Observations	392,053	916,871
R^2	0.340	0.307

Clustered standard errors shown between brackets   *$p<0.1$, **$p<0.05$, ***$p<0.01$

Table A20: Bank B automatic enrolment impact on unarranged overdraft charges, by arranged overdraft facility

	No Arranged OD	Arranged OD
	(1)	(2)
AutoEnrolled	-0.270***	-0.250***
	(0.093)	(0.077)
EnrolmentMonth	0.167***	0.152***
	(0.063)	(0.047)
EnrolmentMonthLag	0.064	0.062**
	(0.047)	(0.031)
Baseline UOD charges	1.17	0.91
% effect	-23.1	-27.5
Customer, month and tenure fixed effects	Yes	Yes
# customers	29304	66711
Observations	392,053	916,871
R^2	0.337	0.369

Clustered standard errors shown between brackets   *p<0.1, **p<0.05, ***p<0.01

Table A21: Bank A automatic enrolment impact on unpaid item charges, by age

	18-30	30-40	40-50	50-60	60+
	(1)	(2)	(3)	(4)	(5)
AutoEnrolled	-0.010	-0.232**	-0.522***	-0.241***	-0.108
	(0.064)	(0.092)	(0.132)	(0.090)	(0.083)
EnrolmentMonth	0.071	0.225**	0.391***	0.156**	0.113**
	(0.046)	(0.096)	(0.111)	(0.064)	(0.050)
EnrolmentMonthLag	0.047	-0.002	0.227**	-0.031	0.004
	(0.042)	(0.088)	(0.103)	(0.082)	(0.070)
Baseline UPT charges	1.01	1.38	1.7	1.14	0.46
% effect	-1	-16.8	-30.7	-21.1	-23.5
Customer, month and tenure fixed effects	Yes	Yes	Yes	Yes	Yes
# customers	8377	9385	11550	10735	12615
Observations	112,671	129,465	162,868	152,079	181,599
R^2	0.381	0.398	0.433	0.372	0.372

Clustered standard errors shown between brackets   *p<0.1, **p<0.05, ***p<0.01

Table A22: Bank B automatic enrolment impact on unpaid item charges, by age

	18-30	30-40	40-50	50-60	60+
	(1)	(2)	(3)	(4)	(5)
AutoEnrolled	-0.088**	-0.060	-0.124***	-0.012	0.006
	(0.043)	(0.065)	(0.043)	(0.048)	(0.026)
EnrolmentMonth	0.064*	0.025	0.074***	0.026	-0.015
	(0.036)	(0.045)	(0.027)	(0.049)	(0.014)
EnrolmentMonthLag	0.016	-0.039	0.034	-0.007	-0.012**
	(0.038)	(0.034)	(0.040)	(0.031)	(0.006)
Baseline UPT charges	0.39	0.4	0.41	0.19	0.05
% effect	-22.5	-15	-30.2	-6.3	11
Customer, month and tenure fixed effects	Yes	Yes	Yes	Yes	Yes
# customers	23467	20473	18561	16103	17395
Observations	317,503	278,853	253,536	220,492	238,337
R^2	0.295	0.341	0.338	0.328	0.338

Clustered standard errors shown between brackets   *p<0.1, **p<0.05, ***p<0.01

Table A23: Bank B automatic enrolment impact on unarranged overdraft charges, by age

	18-30	30-40	40-50	50-60	60+
	(1)	(2)	(3)	(4)	(5)
AutoEnrolled	-0.184	-0.361***	-0.295***	0.095	-0.089*
	(0.171)	(0.132)	(0.108)	(0.104)	(0.051)
EnrolmentMonth	0.126	0.234**	0.161*	0.008	0.045
	(0.119)	(0.096)	(0.083)	(0.083)	(0.034)
EnrolmentMonthLag	0.105	0.061	0.056	-0.040	0.003
	(0.102)	(0.065)	(0.102)	(0.036)	(0.032)
Baseline UOD charges	1.46	1.37	0.96	0.31	0.22
% effect	-12.6	-26.4	-30.7	30.6	-40.6
Customer, month and tenure fixed effects	Yes	Yes	Yes	Yes	Yes
# customers	23467	20473	18561	16103	17395
Observations	317,503	278,853	253,536	220,492	238,337
R^2	0.353	0.376	0.357	0.319	0.320

Clustered standard errors shown between brackets   *p<0.1, **p<0.05, ***p<0.01

Table A24: Bank A automatic enrolment impact on unpaid item charges, by estimated income

	0-750	750-1500	1500-2250	2250-3000	3000+
	(1)	(2)	(3)	(4)	(5)
AutoEnrolled	-0.166***	-0.179***	-0.324***	-0.426***	-0.251**
	(0.047)	(0.059)	(0.112)	(0.159)	(0.099)
EnrolmentMonth	0.113*	0.208***	0.257**	0.465***	0.128
	(0.066)	(0.046)	(0.118)	(0.157)	(0.082)
EnrolmentMonthLag	0.044	0.063	0.118*	0.124	-0.038
	(0.039)	(0.054)	(0.070)	(0.238)	(0.092)
Baseline UPT charges	0.77	1.06	1.43	1.52	1.23
% effect	-21.6	-16.9	-22.6	-28.1	-20.4
Customer, month and tenure fixed effects	Yes	Yes	Yes	Yes	Yes
# customers	14667	12244	7932	4439	12143
Observations	196,960	178,237	116,237	65,011	175,605
R^2	0.313	0.364	0.417	0.414	0.426

Clustered standard errors shown between brackets   *$p<0.1$, **$p<0.05$, ***$p<0.01$

Table A25: Bank B automatic enrolment impact on unpaid item charges, by estimated income

	0-750	750-1500	1500-2250	2250-3000	3000+
	(1)	(2)	(3)	(4)	(5)
AutoEnrolled	-0.062	0.001	-0.141**	-0.124**	-0.070*
	(0.046)	(0.038)	(0.062)	(0.056)	(0.036)
EnrolmentMonth	0.023	0.004	0.087*	0.103**	0.033
	(0.034)	(0.029)	(0.046)	(0.051)	(0.027)
EnrolmentMonthLag	-0.002	-0.028	0.001	0.027	0.015
	(0.030)	(0.017)	(0.015)	(0.036)	(0.019)
Baseline UPT charges	0.24	0.27	0.43	0.43	0.27
% effect	-25.8	0.4	-32.8	-28.9	-25.9
Customer, month and tenure fixed effects	Yes	Yes	Yes	Yes	Yes
# customers	13940	18306	17095	12047	34116
Observations	176,896	253,154	237,397	167,424	470,630
R^2	0.262	0.304	0.326	0.359	0.345

Clustered standard errors shown between brackets   *$p<0.1$, **$p<0.05$, ***$p<0.01$

Table A26: Bank B automatic enrolment impact on unarranged overdraft charges, by estimated income

	0-750	750-1500	1500-2250	2250-3000	3000+
	(1)	(2)	(3)	(4)	(5)
AutoEnrolled	-0.218	-0.166	-0.284**	-0.322**	-0.283***
	(0.168)	(0.106)	(0.137)	(0.140)	(0.082)
EnrolmentMonth	0.149	0.069	0.241***	0.238**	0.171***
	(0.108)	(0.080)	(0.094)	(0.101)	(0.045)
EnrolmentMonthLag	0.056	0.019	0.063	0.054	0.094**
	(0.074)	(0.061)	(0.065)	(0.060)	(0.040)
Baseline UOD charges	1.05	1.1	1.12	1.11	0.8
% effect	-20.7	-15.1	-25.3	-29	-35.4
Customer, month and tenure fixed effects	Yes	Yes	Yes	Yes	Yes
# customers	13940	18306	17095	12047	34116
Observations	176,896	253,154	237,397	167,424	470,630
R^2	0.339	0.373	0.350	0.389	0.347

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A27: Bank A automatic enrolment impact on unpaid item charges, by mobile banking

	No Mobile Banking	Mobile Banking
	(1)	(2)
AutoEnrolled	-0.239***	-0.201**
	(0.054)	(0.103)
EnrolmentMonth	0.174***	0.275***
	(0.044)	(0.090)
EnrolmentMonthLag	0.060	-0.006
	(0.053)	(0.102)
Baseline UPT charges	1.06	1.37
% effect	-22.6	-14.7
Customer, month and tenure fixed effects	Yes	Yes
# customers	43322	9935
Observations	607,171	139,122
R^2	0.388	0.434

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A28: Bank B automatic enrolment impact on unpaid item charges, by mobile banking

	No Mobile Banking	Mobile Banking
	(1)	(2)
AutoEnrolled	-0.032	-0.123***
	(0.027)	(0.036)
EnrolmentMonth	0.018	0.078***
	(0.021)	(0.027)
EnrolmentMonthLag	-0.004	0.013
	(0.011)	(0.021)
Baseline UPT charges	0.2	0.46
% effect	-16	-26.7
Customer, month and tenure fixed effects	Yes	Yes
# customers	56544	39471
Observations	768,203	540,721
R^2	0.324	0.329

Clustered standard errors shown between brackets   *$p<0.1$, **$p<0.05$, ***$p<0.01$

Table A29: Bank B automatic enrolment impact on unarranged overdraft charges, by mobile banking

	No Mobile Banking	Mobile Banking
	(1)	(2)
AutoEnrolled	-0.244***	-0.260***
	(0.066)	(0.097)
EnrolmentMonth	0.157***	0.175***
	(0.046)	(0.057)
EnrolmentMonthLag	0.067**	0.060
	(0.028)	(0.055)
Baseline UOD charges	0.76	1.3
% effect	-32.2	-20
# customers	56544	39471
Customer, month and tenure fixed effects	Yes	Yes
Observations	768,203	540,721
R^2	0.345	0.366

Clustered standard errors shown between brackets   *$p<0.1$, **$p<0.05$, ***$p<0.01$

Table A30: Bank A impact of automatic enrolment on unpaid items, by available savings (having savings of more than £100 with the bank before enrolment)

	No savings	Savings
	(1)	(2)
AutoEnrolled	-0.278***	-0.028
	(0.051)	(0.026)
EnrolmentMonth	0.213***	0.087***
	(0.032)	(0.030)
EnrolmentMonthLag	0.054*	0.031
	(0.032)	(0.027)
Baseline UPT charges	0.92	0.23
% effect	-30.2	-12.4
Customer, month and tenure fixed effects	Yes	Yes
# customers	32371	16849
Observations	446,331	242,376
R^2	0.291	0.269

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A31: Bank B impact of automatic enrolment on unpaid items, by available savings (having savings of more than £100 with the bank before enrolment)

	No savings	Savings
	(1)	(2)
AutoEnrolled	-0.088**	-0.049***
	(0.036)	(0.009)
EnrolmentMonth	0.048*	0.043***
	(0.027)	(0.007)
EnrolmentMonthLag	-0.00002	0.011*
	(0.015)	(0.006)
Baseline UPT charges	0.41	0.13
% effect	-21.4	-37.8
Customer, month and tenure fixed effects	Yes	Yes
# customers	63777	32238
Observations	865,433	443,491
R^2	0.328	0.301

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A32: Bank B impact of automatic enrolment on unarranged overdrafts, by available savings (having savings of more than £100 with the bank before enrolment)

	No savings (1)	Savings (2)
AutoEnrolled	-0.293***	-0.088**
	(0.083)	(0.042)
EnrolmentMonth	0.173***	0.093***
	(0.049)	(0.026)
EnrolmentMonthLag	0.056*	0.063*
	(0.034)	(0.037)
Baseline UOD charges	1.27	0.25
% effect	-23.1	-35.2
Customer, month and tenure fixed effects	Yes	Yes
# customers	67380	28635
Observations	914,927	393,997
R^2	0.359	0.288

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Annex 6: Treatment effect regressions for further outcome variables

This annex presents regression tables of average treatment effects (across the entire auto-enrolled consumer sample) on other outcome variables of interest. These outcome variables are:

Secondary outcomes 1: average monthly balance, minimum monthly balance, # mobile banking log-ins per month, # scheduled transactions per month

Secondary outcomes 2: arranged overdraft charges, unarranged overdraft charges (only for Bank A), and # total transactions per month

This annex contains the following tables.

- Table A33: Bank A automatic enrolment impact on secondary outcomes 1
- Table A34: Bank A automatic enrolment impact on secondary outcomes 2
- Table A35: Bank B automatic enrolment impact on secondary outcomes 1
- Table A36: Bank B automatic enrolment impact on secondary outcome 2

Table A33 – Bank A secondary outcomes 1

	Average Balance	Min Balance	Mobile Logins	# Scheduled Transactions
	(1)	(2)	(3)	(4)
AutoEnrolled	-55.680	-63.275	-0.017	-0.050
	(90.959)	(76.070)	(0.139)	(0.040)
EnrolmentMonth	142.915**	143.655**	0.073	0.042
	(70.704)	(65.100)	(0.123)	(0.039)
EnrolmentMonthLag	95.728	93.145	0.281***	0.030
	(60.755)	(58.079)	(0.083)	(0.026)
Pre-treat mean	2800.77	1738.84	4.72	7.03
% effect	-2	-3.6	-0.4	-0.7
Customer, month and tenure fixed effects	Yes	Yes	Yes	Yes
Customers	53257	53257	53257	53257
Observations	746,293	746,293	746,293	746,293
R^2	0.740	0.749	0.715	0.936

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A34 - Bank A secondary outcomes 2

	Arranged Charges	Unarranged Charges	# Transactions
	(1)	(2)	(3)
AutoEnrolled	0.095*	0.001	0.051
	(0.050)	(0.040)	(0.280)
EnrolmentMonth	-0.047	0.007	0.366**
	(0.053)	(0.028)	(0.154)
EnrolmentMonthLag	-0.040	0.040	0.293**
	(0.032)	(0.030)	(0.147)
Pre-treat mean	3	1.11	34.53
% effect	3.2	0.1	0.1
Customer, month and tenure fixed effects	Yes	Yes	Yes
Customers	53257	53257	53257
Observations	746,293	746,293	746,293
R^2	0.786	0.645	0.876

Clustered standard errors shown between brackets *p<0.1, **p<0.05, ***p<0.01

Table A35 - Bank B secondary outcomes 1

	Average Balance	Min Balance	Mobile Logins	# Scheduled Transactions
	(1)	(2)	(3)	(4)
AutoEnrolled	106.336	81.060	0.317	0.274**
	(93.440)	(80.017)	(0.205)	(0.114)
EnrolmentMonth	-72.399	-89.654	-0.164	-0.150**
	(75.317)	(55.617)	(0.145)	(0.071)
EnrolmentMonthLag	2.347	16.959	-0.121	-0.145***
	(36.723)	(41.653)	(0.165)	(0.041)
Pre-treat mean	3180.77	2120.34	12.14	8.37
% effect	3.3	3.8	2.6	3.3
Customer, month and tenure fixed effects	Yes	Yes	Yes	Yes
Customers	96015	96015	96015	96015
Observations	1,308,924	1,308,924	1,308,924	1,308,924
R^2	0.616	0.674	0.824	0.928

Clustered standard errors shown between brackets $^*p<0.1, ^{**}p<0.05, ^{***}p<0.01$

Table A36 – Bank B secondary outcomes 2

	Arranged Charges	# Transactions	UnarrOD episodes >= 1	UnarrOD episodes >= 2
	(1)	(2)	(3)	(4)
AutoEnrolled	-0.078	0.744	-0.004**	-0.004**
	(0.218)	(0.487)	(0.002)	(0.002)
EnrolmentMonth	0.077	-0.077	0.002*	0.002*
	(0.112)	(0.336)	(0.001)	(0.001)
EnrolmentMonthLag	-0.010	0.266	0.0001	0.001
	(0.073)	(0.176)	(0.001)	(0.001)
Pre-treat mean	4.65	47.81	0.03	0.02
% effect	-1.7	1.6	-14.9	-19.7
3-way fixed effects	Yes	Yes	Yes	Yes
Customers	96015	96015	96015	96015
Observations	1,308,924	1,308,924	1,308,924	1,308,924
R^2	0.680	0.862	0.350	0.308

Clustered standard errors shown between $^*p<0.1, ^{**}p<0.05, ^{***}p<0.01$

Annex 7: Parallel trends assumption

This annex provides evidence in support of the conditional parallel trends assumption required by our empirical approach to estimating the effects of unpaid and unarranged overdraft alerts on consumer behaviour.

Our two-way fixed-effects model (Annex 3) allows for groups of customers enrolled in alerts at different times to have systematically different levels of charges. However, the model requires that different enrolment groups would have had parallel trends in charges absent auto-enrolment. As discussed in Section 4, neither bank enrolled customers in a randomized order, so parallel trends are not guaranteed. In fact, Tables A1-A3 document systematic differences in customer tenure across enrolment groups for both banks. We suspect that this is due to enrolling customers in batches by account identifiers which are correlated with tenure. This could be problematic for the two-way fixed-effects model, because unpaid item and unarranged overdraft charges both fall with tenure, especially for new accounts. This is likely because new accounts typically open with low balances that increase over time.

Our preferred three-way fixed-effects model (Annex 3) solves the problem created by systematic differences in tenure across enrolment groups by controlling for a tenure time trend. To identify the intent-to-treat effect, this specification requires the weaker assumption that different enrolment groups have parallel calendar-time trends conditional on a common tenure trend. We follow the standard approach of providing evidence to support this conditional parallel trends assumption using pre-treatment data (below). To do so, we exclude from our sample all customers automatically enrolled prior to the third month of our sample, for whom we cannot credibly check the conditional parallel trends assumption.

Bank A

Through our conversations with Bank A we learned about the approach they took to automatically enrolling customers into unpaid item alerts. They first started enrolling customers with high levels of digital activity (defined by frequently using mobile and online banking) – though this stage of enrolment occurred before our observation time window. They then proceeded to enrol the rest of their customers in batches until all eligible customers were enrolled.

For our analysis here and all our results in the paper, we only include customers who are enrolled from the third month of our observation time window to allow for at least 2 months of pre-treatment data, which leaves 26% of total sample of customers. We are fortunate to have received transaction-level data on unpaid items incurred at Bank A, which allows us to conduct a pre-treatment conditional parallel trend analysis on the weekly level during the eight weeks prior to auto enrolment. We infer weekly unpaid item charges incurred using the unpaid item transactions in our data. Note that our main results in the paper are conducted on the monthly level using billed unpaid item charges. We run the following specification on the weekly level:
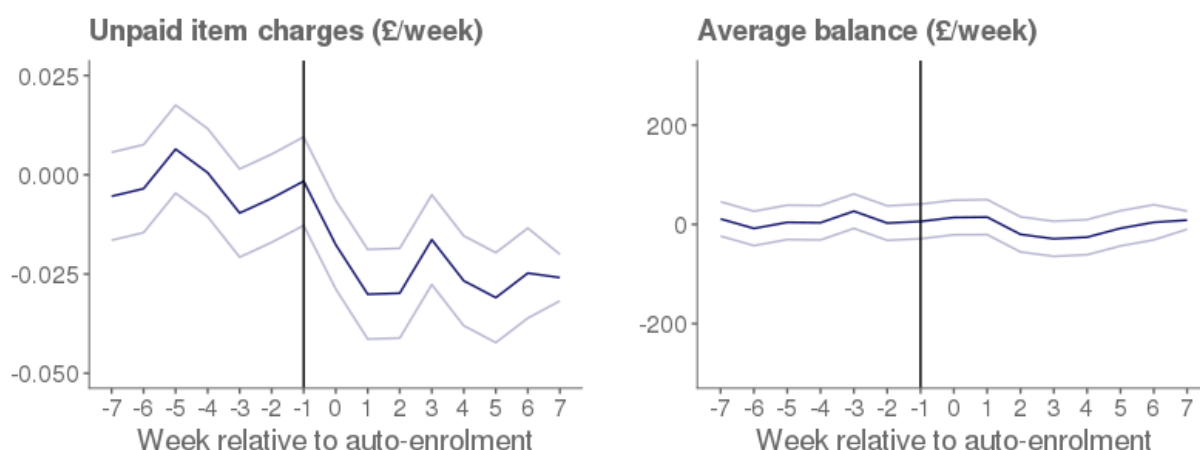
$$X_{i,t} = \sum_{l=-7}^{6} WeekstoAutoEnrol_{i,t,l}\,\beta_l + 7WeeksSinceAutoEnrol_{i,t}\,\beta_7 + \theta_i + \mu_t + \delta_{t-s\_i} + \varepsilon_{it}$$

Where $X_{i,t}$ is the outcome variable for individual i in week t, $WeekstoAutoEnrol_{i,t,l}$ are dummy variables for being in week l relative to enrolment into text alerts, $7WeeksSinceAutoEnrol_{i,t}$ is a dummy variable for being enrolled for 7 or more weeks, μ_t and θ_i are week and customer fixed effects, δ_{t-s_i} are fixed effects for the time customers have been with their bank (in weeks).

The results are presented in Table A37 for four variables at the weekly level: unpaid item charges, average weekly balance, days spent in unarranged and arranged overdraft. For unpaid item charges, we find no 'effects' of the treatment before enrolment. This is consistent with the parallel trends assumption. We also observe a clear sustained drop in unpaid item charges from the week of automatic enrolment, which suggests an immediate and stable impact of alerts on consumers. The mean weekly inferred unpaid item charges incurred in our estimation sample is £0.14 per week. We observe a sustained reduction of about £0.025 per week, which corresponds to a 18% relative effect (this is close to our main result of a 21% relative reduction in unpaid item charges).[42]

For average weekly balances, we run the same specification on the same sample and then once again on the sample excluding customers with very high balances (defined here as having an average balance of over £100,000 during the entire period), which drops 1.3% of our sample. Customers with very high balances distort the results, which is clear from comparing both sets of results in Table A37. On the sample without customers with very high balances, we find no differences over time. We also find no clear impact on days spent in unarranged and arranged overdraft. The $WeekstoAutoEnrol_{i,t,l}$ and $7WeeksSinceAutoEnrol_{i,t}$ coefficients are plotted in Figures 11 and 12.

Figure 11 – Bank A pre-treatment trends for unpaid items and average balance

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Figure 12 - Bank A pre-treatment trends for unarranged and arranged days

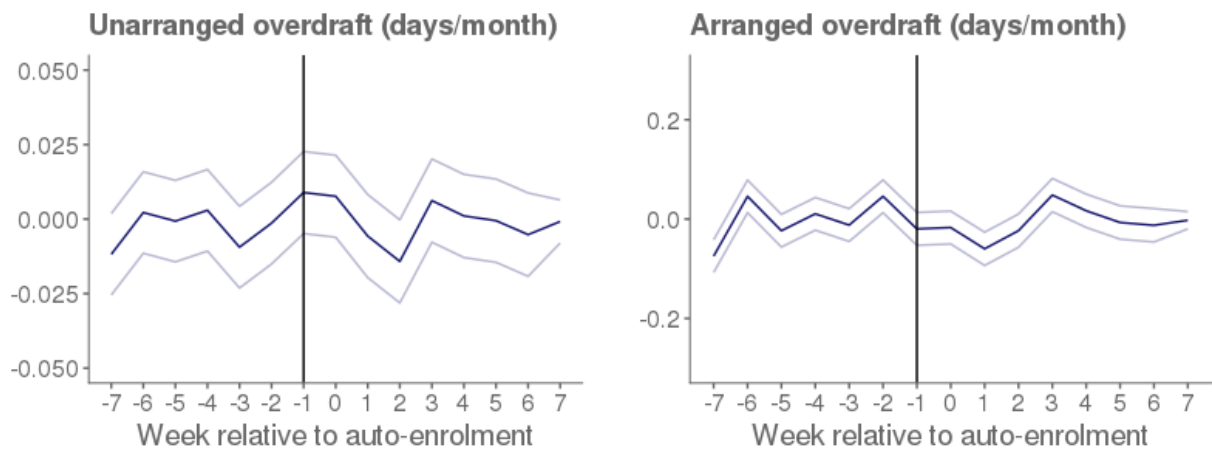## Table A37 – Bank A pre-treatment trends

|	Unpaid item charges	Average balance	Average balance	Days in unarranged	Days in arranged
	(1)	(2)	(3)	(4)	(5)
l =-7 WeekstoAutoEnrol	-0.005	11.051	110.108	-0.012*	-0.074***
	(0.005)	(22.278)	(69.880)	(0.007)	(0.017)
l =-6 WeekstoAutoEnrol	-0.003	-8.148	133.539**	0.002	0.046**
	(0.007)	(19.875)	(65.743)	(0.005)	(0.021)
l =-5 WeekstoAutoEnrol	0.006	4.116	69.375	-0.001	-0.023
	(0.006)	(20.416)	(94.836)	(0.007)	(0.050)
l =-4 WeekstoAutoEnrol	0.001	3.395	108.389	0.003	0.011
	(0.006)	(31.077)	(95.900)	(0.007)	(0.037)
l =-3 WeekstoAutoEnrol	-0.010	26.605	212.519***	-0.009	-0.012
	(0.008)	(30.121)	(53.867)	(0.006)	(0.056)
l =-2 WeekstoAutoEnrol	-0.006	2.671	201.089***	-0.001	0.046
	(0.010)	(23.141)	(56.857)	(0.006)	(0.045)
l =-1 WeekstoAutoEnrol	-0.002	5.967	151.871**	0.009	-0.020
	(0.004)	(26.982)	(62.278)	(0.007)	(0.054)
l =0 WeekstoAutoEnrol	-0.018**	13.909	150.974**	0.008	-0.017
	(0.008)	(25.023)	(76.317)	(0.007)	(0.026)
l =1 WeekstoAutoEnrol	-0.030***	14.651	181.962**	-0.006	-0.060
	(0.006)	(24.229)	(76.735)	(0.008)	(0.038)
l =2 WeekstoAutoEnrol	-0.030***	-20.101	154.705**	-0.014	-0.023
	(0.007)	(25.640)	(63.962)	(0.010)	(0.082)
l =3 WeekstoAutoEnrol	-0.016***	-29.012	136.007**	0.006	0.048
	(0.004)	(27.086)	(63.911)	(0.008)	(0.035)
l =4 WeekstoAutoEnrol	-0.027***	-25.758	122.060*	0.001	0.017
	(0.007)	(29.518)	(68.995)	(0.008)	(0.026)
l =5 WeekstoAutoEnrol	-0.031***	-7.886	130.206	-0.001	-0.007
	(0.006)	(33.018)	(85.084)	(0.007)	(0.042)
l =6 WeekstoAutoEnrol	-0.025***	4.199	138.745*	-0.005	-0.012
	(0.008)	(26.609)	(76.785)	(0.009)	(0.027)
7WeeksSinceAutoEnrol	-0.026***	8.525	91.685	-0.001	-0.002
	(0.004)	(27.246)	(78.818)	(0.007)	(0.031)
Customer, month and tenure FE	Yes	Yes	Yes	Yes	Yes
Customers with >£100,000 balances	Yes	No	Yes	Yes	Yes
Customers	53255	52550	53255	53255	53255
Observations	3,421,732	3,376,388	3,421,732	3,421,732	3,421,732
R^2	0.163	0.680	0.497	0.410	0.598

Clustered standard errors shown between brackets

*p<0.1, **p<0.05, ***p<0.01

Bank B

Through our conversations with Bank B we learned that their customers were automatically enrolled into overdraft alerts in a non-random but predictable way. First, customers who had been with the bank for a long time were enrolled in random batches over several months. Then, remaining customers were enrolled in order of an identifier correlated with their account tenure. To verify this empirically, we split our sample of eligible customers into 10 equally sized groups in order of their enrolment dates. We then plotted the 1st and 9th decile of tenure for each group to illustrate the distribution of tenure over time – the results are shown in the figure below. The first half of customers (in the first five groups) had no systematic differences in their 1st and 9th deciles of tenure and had generally been with the bank for more than 15 years. Customers enrolled later tended to have been with the bank for a much shorter amount of time, and the length of time shortened as enrolment progressed. Customers who were enrolled last (in the last 2 groups) had a larger range of tenure. Table A8 shows further statistics on the groups of consumers who were enrolled by month of enrolment.

Figure 13 – 1st and 9th decile of tenure for 10 enrolment groups
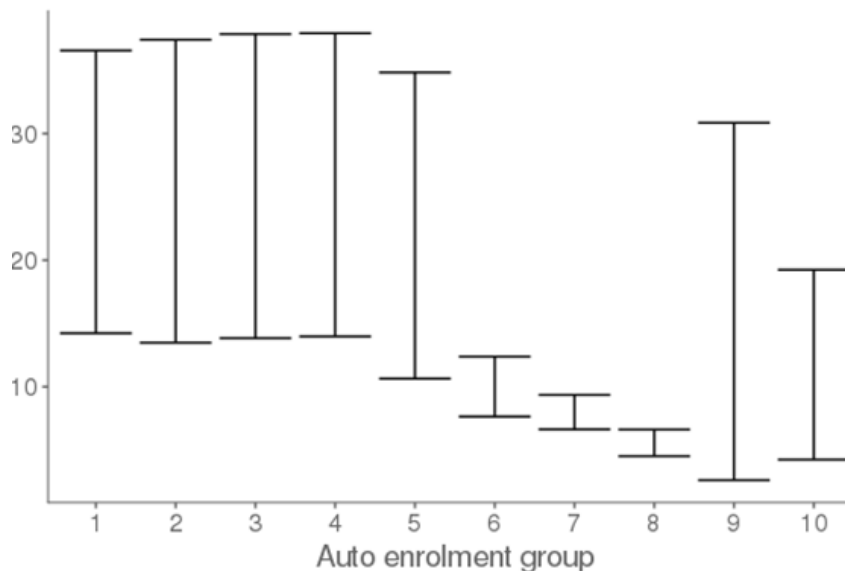
Because the key difference between consumers who were enrolled over time is tenure, we would expect consumers to be enrolled in an as-good-as-random way conditional on tenure. This is a key assumption that is needed to be able to estimate the effect in our data. To check this assumption, we run the following regression specification. Importantly, it includes tenure fixed effects: a dummy variable for being in each month relative to a customer' first account opening.

$$X_{i,t} = \sum_{l=-4}^{4} MonthstoEnrol_{i,t,l}\,\beta_l \;+ 4MonthsSinceEnrol_{i,t}\,\beta_5 + \delta_{t-s\_i} + \theta_i + \mu_t \; + \varepsilon_{it}$$

Where $X_{i,t}$ is the outcome variable for individual i in month t, $MonthstoEnrol_{i,t,l}$ are dummy variables for being in month l relative to enrolment into text alerts, $4MonthsSinceEnrol_{i,t}$ is a dummy variable for being enrolled for 5 or more months, δ_{t-s_i} are tenure fixed effects, μ_t are calendar month fixed effects, θ_i are individual fixed effects.

The results are presented in Table A38 for four different monthly outcomes variables: unpaid item charges, unarranged overdrafts, average balances and arranged overdraft charges. We find that all our pre-treatment outcomes for the four months preceding automatic enrolment are not statistically significant from zero – providing evidence that our key assumption hold true. The post-treatment month effects are negative for unpaid item and unarranged overdraft charges (though only statistically significant for unpaid item charges), which is the temporal effects of automatic enrolment on these outcomes.

It is worth noting that the figure below illustrates the lag between the behaviour that incurs charges and the charges being billed to a customer's account. The effects for both unpaid items and unarranged charges take 2 months to fully appear due to this delay before levelling off. The model estimates that we capture in our main results is the difference between pre-treatment levels and the level at which charges fall to 2 months following automatic enrolment.

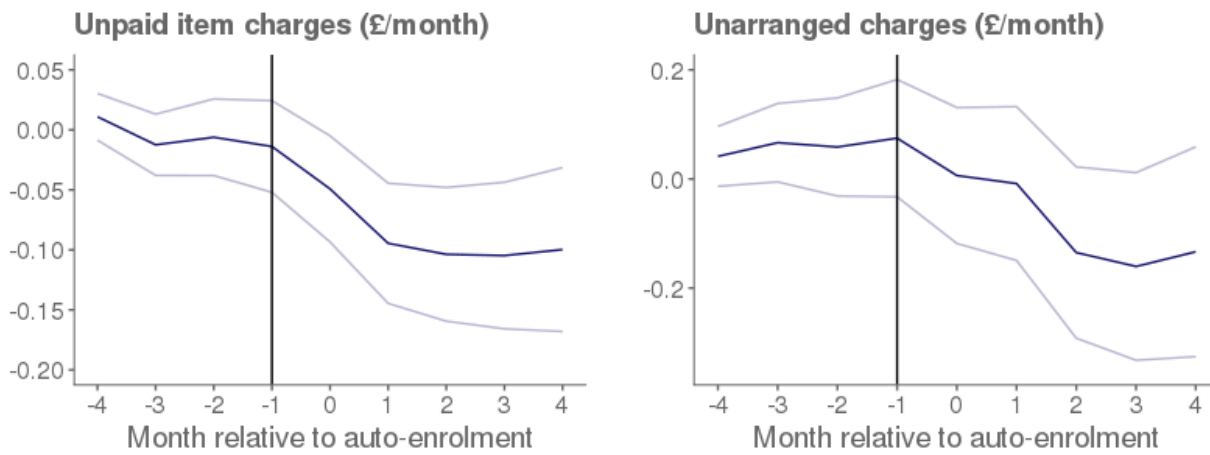**Figure 14 – Bank B pre-treatment trends for unpaid item and unarranged charges**

Figure 15 - Bank B pre-treatment trends for average balances and arranged overdraft charges
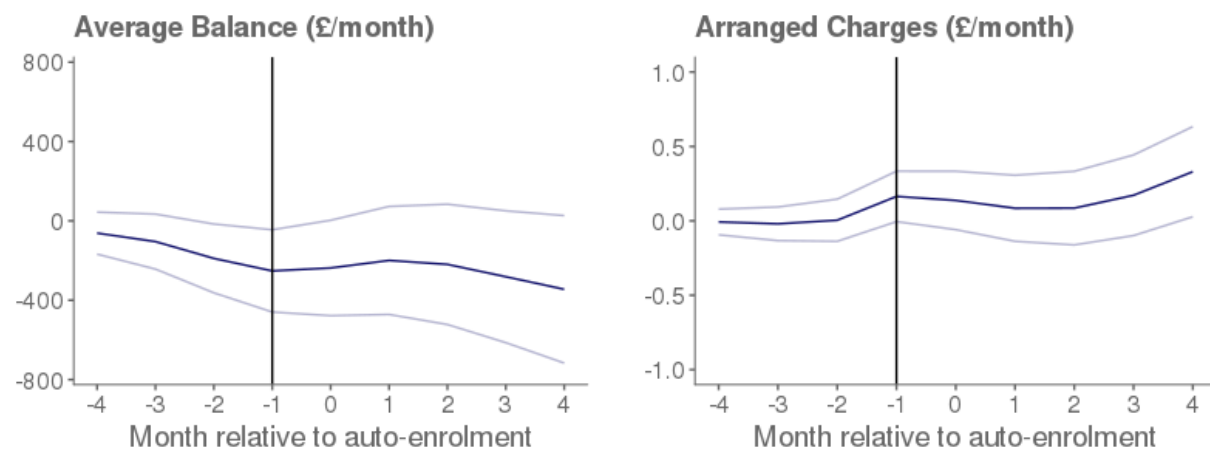
Table A38 - Bank B pre-treatment trends

	Unpaid charges	Unarranged charges	Average Balance	Arranged charges
	(1)	(2)	(3)	(4)
l=-4 MonthstoEnrol	0.011	0.041	-29.606	0.041
	(0.019)	(0.041)	(57.310)	(0.138)
l =-3 MonthstoEnrol	-0.012	0.065	-58.640	0.050
	(0.019)	(0.070)	(109.367)	(0.276)
l =-2 MonthstoEnrol	-0.006	0.057	-130.400	0.094
	(0.029)	(0.084)	(158.286)	(0.333)
l = -1 MonthstoEnrol	-0.013	0.072	-183.164	0.270
	(0.031)	(0.097)	(205.748)	(0.418)
l = 0 MonthstoEnrol	-0.049	0.003	-160.875	0.254
	(0.037)	(0.111)	(246.573)	(0.537)
l =1 MonthstoEnrol	-0.094**	-0.012	-114.858	0.214
	(0.039)	(0.131)	(279.808)	(0.591)
l = 2 MonthstoEnrol	-0.103**	-0.139	-126.944	0.226
	(0.043)	(0.148)	(310.348)	(0.665)
l = 3 MonthstoEnrol	-0.104**	-0.165	-183.005	0.321
	(0.048)	(0.153)	(334.421)	(0.752)
4MonthsSinceEnrol	-0.099**	-0.139	-238.453	0.489
	(0.050)	(0.169)	(353.564)	(0.783)
Customer, month and tenure FE	Yes	Yes	Yes	Yes
Customers	94407	94407	94407	94407
Observations	1,304,103	1,304,103	1,304,047	1,304,103
R^2	0.327	0.355	0.616	0.680

Clustered standard errors shown between brackets

*p<0.1, **p<0.05, ***p<0.01

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