Financial Conduct Authority

Research Note

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An empirical analysis of characteristics associated with cash reliance in the UK

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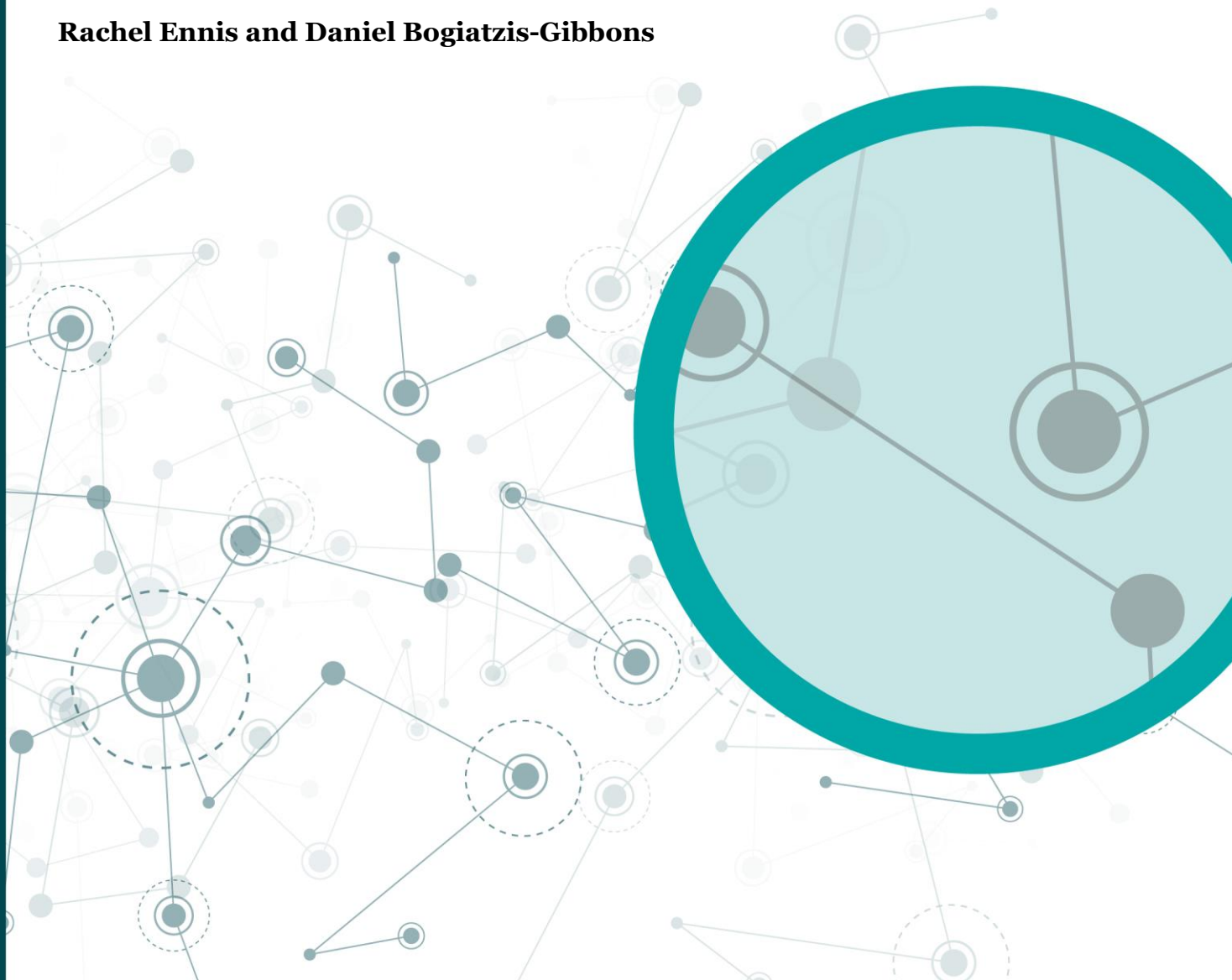

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Equality and diversity considerations

We have considered the equality and diversity issues that may arise from the proposals in this Research Note.

Overall, we do not consider that the proposals in this Research Note adversely impact any of the groups with protected characteristics i.e. age, disability, sex, marriage or civil partnership, pregnancy and maternity, race, religion and belief, sexual orientation and gender reassignment.

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1 Summary

Due to innovation and changes in consumer behaviour, the volume of cash payments made each year in the UK fell by 65% between 2015 and 2021. [1] At the same time, the provision of cash access services including branch and ATM networks is changing. The FCA's cash coverage data suggests that in the 2 years to June 2023, 1,358 bank and building society branches and 4,450 ATMs closed.

While many UK consumers may be able to switch to digital payments or may only use cash services infrequently, those that rely on cash could be adversely impacted by a lack of access to cash services. To protect those that rely on cash, Parliament gave the FCA powers to 'seek to ensure reasonable provision' of cash deposit and withdrawal services for personal and business current accounts across the UK, through Part 8B of the Financial Services and Markets Act 2000. In pursuing the reasonable provision of cash access services in the UK, the FCA must have regard to the Treasury's August 2023 Statement. The FCA published new rules (PS24/8) to maintain reasonable access to cash services provision.

To monitor potential adverse impacts from poor access to cash services, it is essential to identify individuals who are more likely to rely on cash and, consequently, more likely to experience these impacts. There is a large body of existing literature on the characteristics of people that rely on cash. However, there is limited empirical evidence on which characteristics have the strongest association with cash reliance. In this analysis, we use logistic regression analysis to determine the demographic characteristics that have the strongest association with cash reliance for UK adults, using results from the FCA's Financial Lives 2022 Survey (FLS 2022). Specifically, we measure the average effect of having a particular demographic characteristic on the probability that an individual relies on cash.

Based on the FLS 2022, an estimated 6% of UK adults rely on cash, measured through using cash for most or all purchases. On average, we find that being digitally excluded, measured through an individual having low digital capability or poor digital access, makes an individual over 4 times more likely to rely on cash than an individual who is not digitally excluded. This is a shift of 14 percentage points in the probability of cash reliance. This is mainly driven by low digital capability which has a larger effect on cash reliance than poor digital access. We explored other characteristics associated with digital exclusion to provide more insights and found that those in a low-income household, who have poor health or are of older age are more likely to be digitally excluded.

We also find that being in a low-income household, measured through having an annual household income of less than £15,000, makes an individual almost three times as likely to rely on cash, or a shift of 7 percentage points in the probability of cash reliance. We also find a similar effect for individuals with an annual household income of less than £30,000 and find that this effect halves for those with an annual household income of between £30,000 and £50,000 per year. Relatedly, not being in employment, for

[1] However, we note that, for the first time in a decade, the volume of cash payments rose by 7% year on year in 2022, possibly due to post-pandemic rebound, economic uncertainty and the increased cost of living (UK Finance, 2023).

example, being unemployed, makes an individual almost twice as likely to rely on cash, or a shift in 3 percentage points in the probability of cash reliance. Breaking down the underlying reasons for not being in employment, we find that being unemployed, on long-term sickness leave or being retired have the largest effect on the probability of cash reliance, in order of decreasing scale of effect.

Having poor health (+2 percentage points) and living in an urban area (+2 percentage points), Northern Ireland (+6 percentage points) or Scotland (+3 percentage points), are also associated with an increase in the probability that an average individual relies on cash.

We found mixed results when estimating the average effect of being 70 years of age or older on the probability of cash reliance. We found that, on average, being 70 years of age or older has a slight negative effect on the probability of cash reliance but has a slight positive effect on using cash at least as much as other payment methods. This is likely to be explained by cash reliance being more likely to be associated with characteristics such as digital exclusion and being in a low-income household, both of which can be associated with older age.

These findings suggest that in the absence of data to measure cash usage directly, digital exclusion and low income would be the best measures of levels of cash reliance across the UK. These findings build on other work on the characteristics of UK consumers whom cash is important to (Access to Cash Review, 2019; Royal Society of Arts cash census, 2022; Which? Cash-strapped communities, 2019).

2 Context

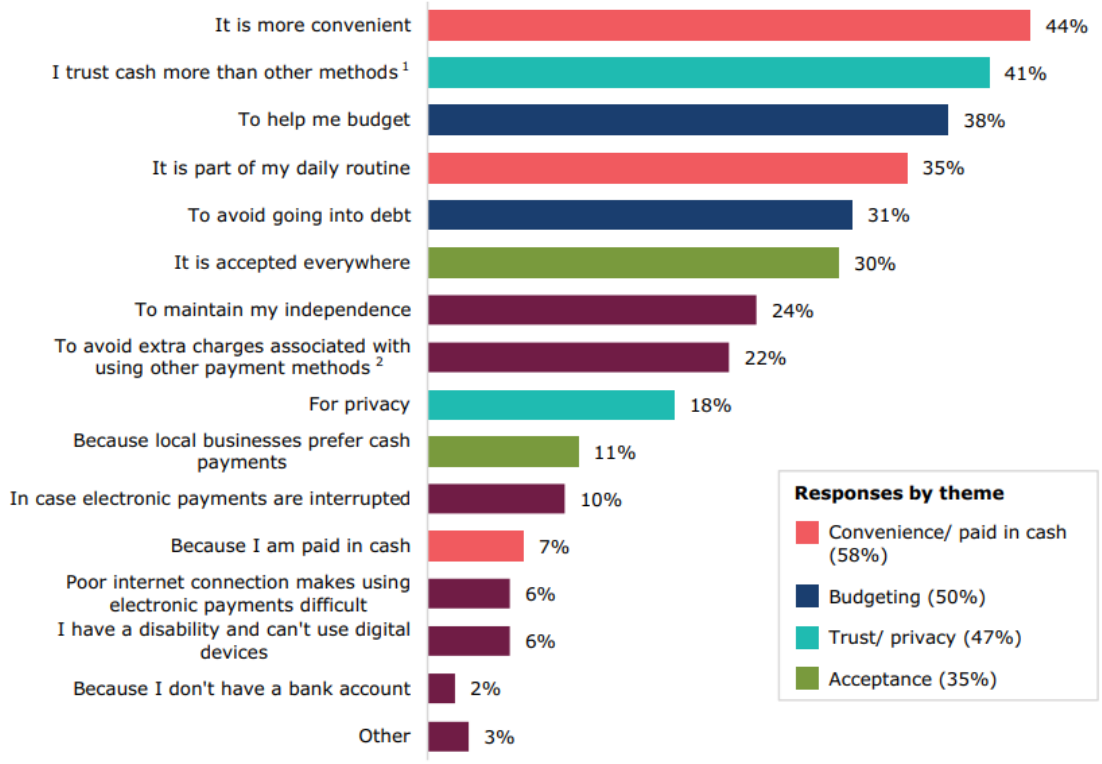
Cash usage in the UK has been in decline. The volume of annual cash payments fell by 11.2 billion between 2015 and 2021, a reduction of 65% (House of Common Library research briefing, 2023). At the same time, the UK has also seen a decline in the number of facilities providing cash access services, mainly withdrawals and deposits, such as bank and building societies and ATMs. The FCA's cash coverage data suggests that in the 2 years to June 2023, 1,358 bank and building society branches and 4,450 ATMs closed.

Despite the decline in cash payments and cash access facilities network shrinking, cash still remains an important method of payment for many consumers and businesses. The FCA's Financial Lives 2022 Survey (FLS 2022) found over 6% of adults (3.1 million) used cash to pay for everything or most things in the 12 months up to May 2022. This rises to 9% for those who had one or more characteristics of vulnerability such as low financial resilience, poor health or low capability including digital capability. [2]

These individuals rely on cash for a variety of reasons as summarised in Figure 1 below. The most commonly cited reasons for relying on cash are convenience (58%), for budgeting (50%), and due to trust and privacy (47%).

[2] The FLS consider vulnerability as a spectrum of risk. All consumers are at risk of becoming vulnerable (and hence at greater risk of harm), particularly if they display characteristics under one or more of our four drivers of vulnerability: poor health, experienced negative life events such as bereavement, low financial or emotional resilience, or low capability such as low knowledge of financial matters. See pages 91 to 92 of the FLS 2022 report.

Figure 1. Reasons for relying on cash



Source: *FLS 2022 Report (Page 209)* ***Base:*** *All UK adults who pay for everything or most things in cash (2022: 743) excluding 'don't know' responses (5%)* ***Question:*** *AT12a (Rebased). Why do you use cash often in your day-to-day life?* ***Notes:*** *[1] Eg a debit or credit card. [2] Eg charges applied by some merchants when using a debit or credit card.*

Frequent cash users will be disproportionately adversely impacted by a continued decline in cash services. To manage a continued decline in cash access services, Parliament gave the FCA powers to 'seek to ensure reasonable provision' of cash deposit and withdrawal services for personal and business current accounts across the UK, through Part 8B of the Financial Services and Markets Act 2000. The FCA published new rules (PS24/8) to maintain reasonable access to cash services provision.

Currently, there is no widely available individual-level data on the use of cash services. The next best alternative could be to estimate cash reliance using available data on demographic population data. Therefore, to monitor potential adverse impacts from poor access to cash services, it is essential to identify individuals who are more likely to rely on cash and, consequently, more likely to experience these impacts.

The FLS 2022 and other external literature (Access to Cash Review, 2019; Royal Society of Arts cash census, 2022; Which? Cash-strapped communities, 2019) identifies several characteristics that can be associated with cash reliance. However, there is limited research on which characteristics have the strongest association with cash reliance and thus may serve as the best predictors.

The aim of this research is to determine the demographic characteristics that have the strongest association with cash reliance. With a total sample size of 19,145 UK adults, the FLS 2022 provides an opportunity to use regression analysis to address this research question. Using FLS 2022 results, we measure the average effect of having a demographic characteristic on the probability that an individual relies on cash.

3 Data and methodology

Data

This research uses data from the FCA's Financial Lives 2022 Survey (FLS 2022) which is the UK's largest tracking survey of UK adults' financial behaviour. The FLS 2022 was conducted between February and June 2022, with the majority of interviews conducted in May 2022. The majority of this fieldwork was conducted online, with a small number of telephone interviews to capture those that do not use the internet.

The survey is nationally representative, using a stratified random probability-based sample design, sampled from the Postcode Address File. The analyses are weighted to be representative of the UK adult population along a number of key demographic characteristics. The total sample size is 19,145 UK adults.

The FLS 2022 Technical Report provides more information about how the 2022 survey was conducted.

Methodology

We use a logistic regression model with population weights to analyse the marginal effect of demographic characteristics on the probability that an average person relies on cash. These marginal effects are used to determine the characteristics that have the strongest association with cash reliance.

Logistic regressions compare how the change in the probability of an outcome shifts in response to covariates. For example, logistic regressions can estimate how the probability of cash reliance shifts based on whether an individual is in a low-income household or not, holding other covariates constant. Our model can be expressed as:

$$\boldsymbol{\pi}(\boldsymbol{X}) = \frac{\exp(\beta_0 + \beta_1 X_1 + \cdots + \beta_k X_k)}{1 + \exp(\beta_0 + \beta_1 X_1 + \cdots + \beta_k X_k)}$$

$$= \frac{\exp(X\beta)}{1 + \exp(X\beta)}$$

$$= \frac{1}{1 + \exp(-X\beta)}$$

Where:

- $\boldsymbol{\pi}$ denotes the probability of a particular outcome with values between 0 and 1. The outcome of interest is equal to 1 if the individual relies on cash, measured through using cash for most or all purchases, and equal to zero if the individual uses cash as much as other payment methods, occasionally, or rarely.
- $\boldsymbol{X}$ is a vector of variables capturing demographic characteristics that could affect the probability of an individual relying on cash. These variables include digital

exclusion, living in a low-income household, being 70 years old or older (70+), having poor health, not in employment, living in an urban area and geographical area of residence. A description of each variable is in Table 1 below.

- β are the regression coefficients (odds ratios) to be estimated.

The results of logistic regressions are often presented using odds ratios, but marginal effects can be superior to odds ratios for interpretation as we can estimate the effect on the probability of an outcome of a variable, netting out the effect of other variables through averaging (Williams, 2012). For a binary variable, the average marginal effect is estimated by calculating the difference between the probability of cash reliance when the value is equal to 1 and when the value is equal to 0. We do this for all respondents in our sample and take the mean to estimate the average marginal effect. With average marginal effects, two hypothetical populations are compared - one consisting entirely of individuals from low-income households and the other consisting entirely of individuals not from low-income households – that both have identical values for the covariates in the model. This allows us to estimate how having a particular characteristic (eg being in a low-income household) affects the probability of relying on cash for an average person in our sample.

The outcome variable and the demographic variables in our model are set out in Table 1 below. These variables were chosen based on existing literature on factors linked to cash reliance and by conducting univariate analyses (examining the relationship between the outcome and each predictor individually). We then included all statistically significant variables in our model.

Table 1: Description of variables and frequency in our weighted sample

Variable	Description	Frequency (=1)	Frequency (=0)
Outcome: Cash reliant	We measure cash reliance through using cash for most or all purchases.	1,112 (6%)	18,033 (94%)
Digitally excluded	As defined by FLS vulnerability measure (see here for a detailed description of the FCA's vulnerability measure), respondents reporting non-existent digital skills (low digital capability) or rating the quality of their internet connectivity as poor (poor digital access).	1,401 (7%)	17,744 (93%)
Low-income household	For the purposes of this analysis, we measure being in a low-income household through having a household income of less than £15,000 per year. A broad definition of a low-income household, as suggested by the UK Government, applies to annual earnings less than 60% of the median UK household income. Using the Annual Survey of Hours	2,343 (12%)	16,821 (88%)

	and Earnings 2021, the 40th percentile is £22,210 (Table 1.7a). We use less than £15,000 per year as this is the closest income band in the FLS. We also evaluate our analysis using an income band ranging from £15,000 to £30,000 per year.		
70+ years old	We use age reported by respondents and grouped respondents based on whether they are 70 years old or older, or less than 70 years old.	3,258 (17%)	15,887 (83%)
Poor health	As defined by the FLS vulnerability measure, we measure poor health through having a physical disability, severe or long-term illness, hearing or visual impairment, poor mental health, addiction or low mental capacity or cognitive difficulties that reduce their ability to carry out day-to-day activities a lot.	1,031 (7%)	18,015 (93%)
Not in employment	For the purposes of this analysis, we use respondents reported working status and group respondents into two groups, employed and not in employment. Employed is defined as: • Working for an employer(s) full-time or part-time • Self-employed full-time or part-time Not in employment is defined as: • Unemployed and looking for work • Unemployed and not looking for work • Retired • Semi-retired (drawing a pension or other income but still working) • Student • Permanently sick/disabled • Temporarily sick (no job to go to) • Looking after the home • Other	7,233 (38%)	11,912 (62%)
Urban	The urban/rural indicator from the 2001 Census matched to FLS survey data using each respondent's postcode.	15,205 (79%)	3,940 (21%)

Geographical area	The geographical area in the United Kingdom (England, Northern Ireland, Scotland, or Wales) the individual lives in, as reported by the respondent.	England: 16,088 (84%) Northern Ireland: 528 (3%) Scotland: 1,618 (8%) Wales: 1,048 (5%)

Table notes: *1. The total sample size is 19,145. 2. There are some missing values for household income, working status and age. The missing indicator method is used account for this. See the appendix for more details. 3. See the appendix for descriptive statistics of the unweighted sample.*

More details on the data and methodology can be found in the Appendix.

Following regression analysis, we analyse how the probability of cash reliance varies within characteristics to provide context to our findings.

4 Results

Which characteristics have the strongest association with cash reliance?

In this subsection, we set out our findings from our evaluation of how having a particular characteristic affects the probability of relying on cash using logistic regression analysis.

Overall findings

An estimated 6% of UK adults rely on cash, which we measure through whether an individual uses cash for most or all purchases. This approximates the probability that a randomly chosen UK adult relies on cash.

On average, we find that the following characteristics are associated with the largest increase in the probability that an individual relies on cash:

- Being digitally excluded, measured through having low digitally capability or poor digital access, makes an individual over 3 times more likely to rely on cash, or a shift of around 14 percentage points in the probability of cash reliance.
- Being in a low-income household, measured through an annual income of less than £15,000, makes an individual almost twice as likely to rely on cash compared to those not in a low-income household, or a shift of around 7 percentage points in the probability of cash reliance.

Table 2 provides a summary of the average change in probability of cash reliance for each characteristic in our model. The full set of results, including the average marginal effects and predicted probabilities for individuals with and without characteristics, and our sensitivity analysis can be found in Tables A4 and A5 in the Appendix.

Table 2: Average change in the probability of cash reliance associated with a demographic characteristic

Characteristic	Average change in probability of cash reliance (percentage point change)	Average change in probability of cash reliance (percentage change)
Digitally excluded	+14pp*** (0.025)	+350%
Low-income household	+7.1pp*** (0.012)	+178%
Not in employment	+3.3pp*** (0.0063)	+83%
70+ years old	-2.1pp** (0.0078)	-53%
Living in an urban area	+2.1pp*** (0.0057)	+53%
Poor health	+2.4pp** (0.011)	+60%

Geographical area	Northern Ireland: +6.1pp*** (0.017) Scotland: +2.8pp*** (0.011) Wales: -0.49pp (0.0096)	Northern Ireland: +153% Scotland: +70% Wales: -12%

*Table notes: 1. The average marginal effect for a characteristic represents the change in the probability of cash reliance between an individual with and without a characteristic, holding other covariates (characteristics in this table) constant. They are reported to two significant figures. 2. P-values reported are for the logistic regression coefficients: *** p<0.01; **p<0.05; *p<0.1. 3. Standard errors relate to estimates of average marginal effects and are in brackets. 4. Estimates for poor health, Northern Ireland, Wales and Scotland are based on small sample sizes (approximately 1,000 respondents) and should be treated with caution.*

We also find that, on average, individuals with a combination of characteristics that are associated with cash reliance are even more likely to rely on cash. For example, on average, an individual in a low-income household that is also digitally excluded is more likely to be a rely on cash than a person in a low-income household who is not digitally excluded.

We set out our findings related to each characteristic in our model in more detail below.

Digital exclusion

We find, on average, being digitally excluded makes an individual over four times more likely to rely on cash than an individual that is not digitally excluded, or results in a shift of around 14 percentage points in the probability of cash reliance.

This result is unsurprising given those that are digitally excluded are less likely to use digital payments and so more likely to use cash. We explored the characteristics associated with digital exclusion to provide more insights. We find that those in a low-income household, with poor health and of older age are more likely to be digitally excluded, with the strength of association decreasing in that order.

To understand more about the aspects of digital exclusion that are associated with cash reliance, we also re-ran our regression analysis with the two underlying components of digital exclusion, low digital skills and poor digital access, instead of digital exclusion. We find, on average, that low digital capability has a larger effect on the probability of cash reliance than poor digital access.

Household income

We find, on average, being in a low-income household, measured through having an annual household income of less than £15,000 for the purposes of this analysis, makes an individual almost three times more likely to rely on cash, or a shift of around 7 percentage points in the probability of cash reliance.

We also find a similar magnitude of effect for individuals in households with an annual income between £15,000 and £30,000. This effect halves for those in a household with an annual income of between 30,000 and £50,000. More generally, we find that cash reliance falls as household income increases, on average. This is consistent with 50% of cash reliant individuals citing that they rely on cash to budget in the FLS 2022.

To test whether broader measures of financial vulnerability may be better predictors of cash reliance, we use low financial resilience, defined as having over-indebtedness, low savings, or low or erratic income, in our model instead of being in a low-income household. We find that, on average, being in a low-income household is associated with a slightly larger change (2 percentage points) in probability of cash reliance than having low financial resilience. This suggests a pure measure of income may be better predictor of cash reliance, if available.

Geographical area

We find, on average, that living in Northern Ireland makes an individual over twice as likely to rely on cash than a similar individual in England, or a shift of around 6 percentage points in the probability of cash reliance. Individuals living in Scotland are also more likely to rely on cash on average – they are around 70% more likely to rely on cash, or a shift of around 3 percentage points in the probability of cash reliance, compared to a similar individual living in England. Finally, we find that living in Wales has no statistically significant effect on the probability of cash reliance on average.

These results are consistent with data published by LINK, the UK's main ATM network, showing that the average annual withdrawal per adult in Northern Ireland is £2,340, compared to an overall UK average of £1,484. The average withdrawal amount per year is also higher than the average in London, Scotland, and regions in the north of England.

As we hold other covariates in our model constant, we account for differences in average household income and other characteristics that could vary between individuals living in different parts of the UK. This means that our findings suggests that an individual with similar characteristics is more likely to rely on cash if they live in Northern Ireland or Scotland, compared to England. This could be explained by differences in preferences for cash, supply of cash services, or other differences within in the UK.

Working status

We find that, on average, not being in employment, for example, being unemployed and looking for work, being permanently sick/disabled or being retired, makes an individual 83% more likely to rely on cash, or a shift of 3 percentage points in the probability of cash reliance. This aligns with our finding that being in a low-income household has a large effect on the probability of cash reliance, on average.

On further investigation, we find that being unemployed (both looking and not looking for work) and being permanently sick/disabled are associated with the largest shift in probability of cash reliance, followed by being retired.

Age

We found mixed results when examining the change in probability of cash reliance associated with older age. This is likely due to associations between age and other characteristics in our model that already capture at least some of the underlying drivers of cash usage in older adults.

On average, we find that being 70+ years old makes an individual 53% less likely to rely on cash than an individual below 70 years old, or a shift of 2 percentage points in the probability of cash reliance, holding other covariates constant. However, the average marginal effect becomes positive (ie being 70+ years of age makes an individual more likely to rely on cash) when we estimate the effect of being 70+ years old on being a

cash user more generally, including individuals that use cash and other payments methods equally. We also tested other age cut-offs (eg 65+ years old) and found similar results.

According to the FLS 2022, a higher proportion (19%) of UK adults aged 85+ rely on cash compared to the average UK adult (6%). This indicates that the slight negative effect on cash reliance might be explained by older individuals tending to rely more on cash while also possessing other characteristics associated with cash reliance in our model. For example, those that are 70+ years old are more likely to be digitally excluded. Consequently, the effect of being 70+ years old on cash reliance is captured by other characteristics rather than being 70+ years old itself.

To assess this further, we can calculate the tetrachoric correlation between age and digital exclusion. The tetrachoric correlation measures the relationship between binary variables that are assumed to represent underlying continuous variables. This metric is appropriate since age is a continuous variable and digital exclusion can be viewed on a continuous scale, the level of digital skills an individual has. The value for tetrachoric correlation ranges from -1 to 1 where -1 indicates a strong negative correlation, 0 indicates no correlation, and 1 indicates a strong positive correlation. We estimate that the correlation between digital exclusion and 70+ years old is 0.51, suggesting there is a positive correlation, which supports our explanation that the effect of being 70+ years old is somewhat captured by other characteristics in our model. We also consider that age may be associated with other characteristics in our model, including poor health and being in a low-income household.

This correlation analysis assumes that the underlying characteristics being measured, though not directly observed, follow a normal (bell-shaped) distribution. This implies that if these characteristics were measured directly, most individual's age or skill levels would cluster around the average, with fewer people being very young or very old, or having extremely high or low skills, resulting in a symmetrical bell-shaped distribution. This assumption of normality seems reasonable given the circumstances. For instance, while differing birth and migration rates across generations means the age distribution is not perfectly normal, it is likely to be well approximated by a normal distribution, unlike highly non-normal distributions such as individual incomes.

Other characteristics

The average change in probability of cash reliance associated with the remaining characteristics in our model is small.

On average, we find that having poor health makes an individual 60% more likely to rely on cash than an individual without poor health, or a shift of 2 percentage points in the probability of cash reliance. However, the sample size is small with approximately 1,000 respondents having poor health and so this estimated effect should be treated with caution.

The average change in probability of cash reliance associated with living in an urban area is of a similar magnitude (+2 percentage points).

Next, we explore how cash reliance varies within characteristics to contextualise these results.

How does the probability of cash reliance vary within characteristics?

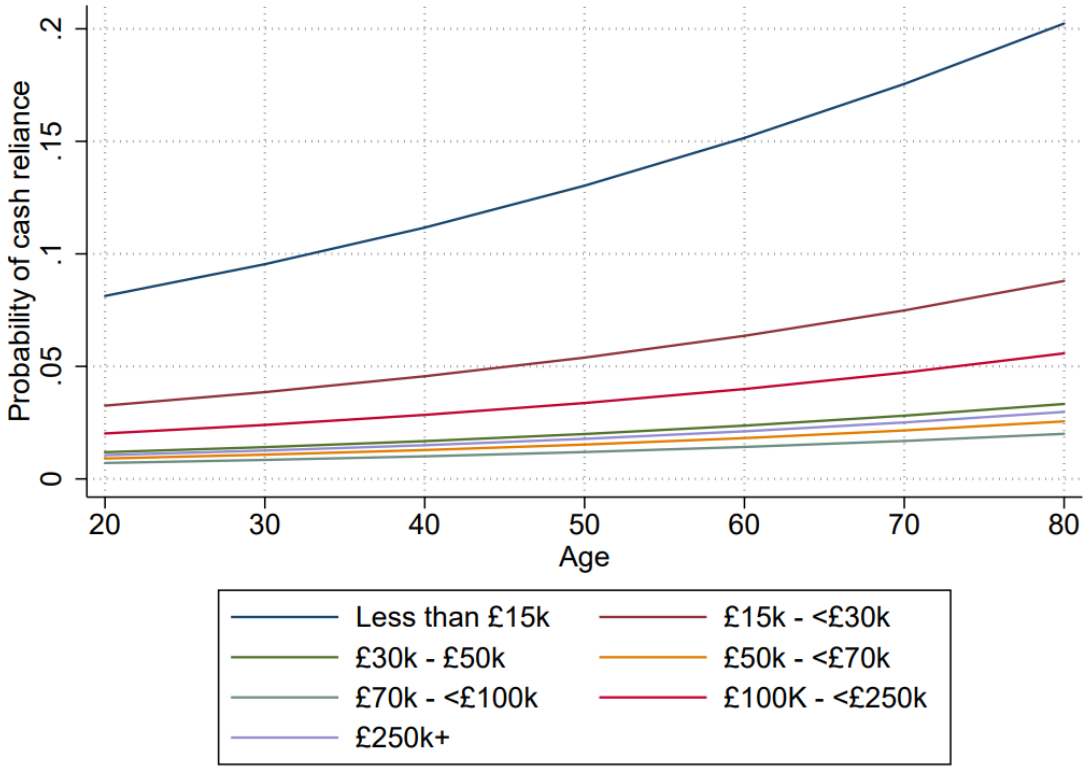
In this subsection, we examine how the probability of cash reliance varies within different characteristics to provide more context to findings from our regression analysis. We focus on age, due to the mixed findings outlined in the previous section, as well as household income and digital exclusion, as these characteristics were estimated to have the largest effect on the probability of cash reliance.

The findings below represent the predicted probability of cash reliance for two characteristics, without controlling for other covariates as in the regression analysis in the previous section. This is done to focus on how the predicted probability of cash reliance varies within characteristics rather than to isolate the effect of having a particular characteristic on cash reliance.

How does the probability of cash reliance vary across age groups with other characteristics?

As illustrated in Figure 2 below, the probability of cash reliance increases with age across all household income bands. The increase in probability with age is more pronounced for individuals in low-income households, measured through having a household income of less than £15,000 per year. The rate of change in probability decreases with household income, except for those with an annual household income between £100,000 and £250,000. Individuals within this income band show a slightly higher probability of cash reliance and a greater change with age compared to individuals in lower and higher income brackets (£30,000 to £100,000 and £250,000+).

Figure 2. The probability of cash reliance, by age and household income

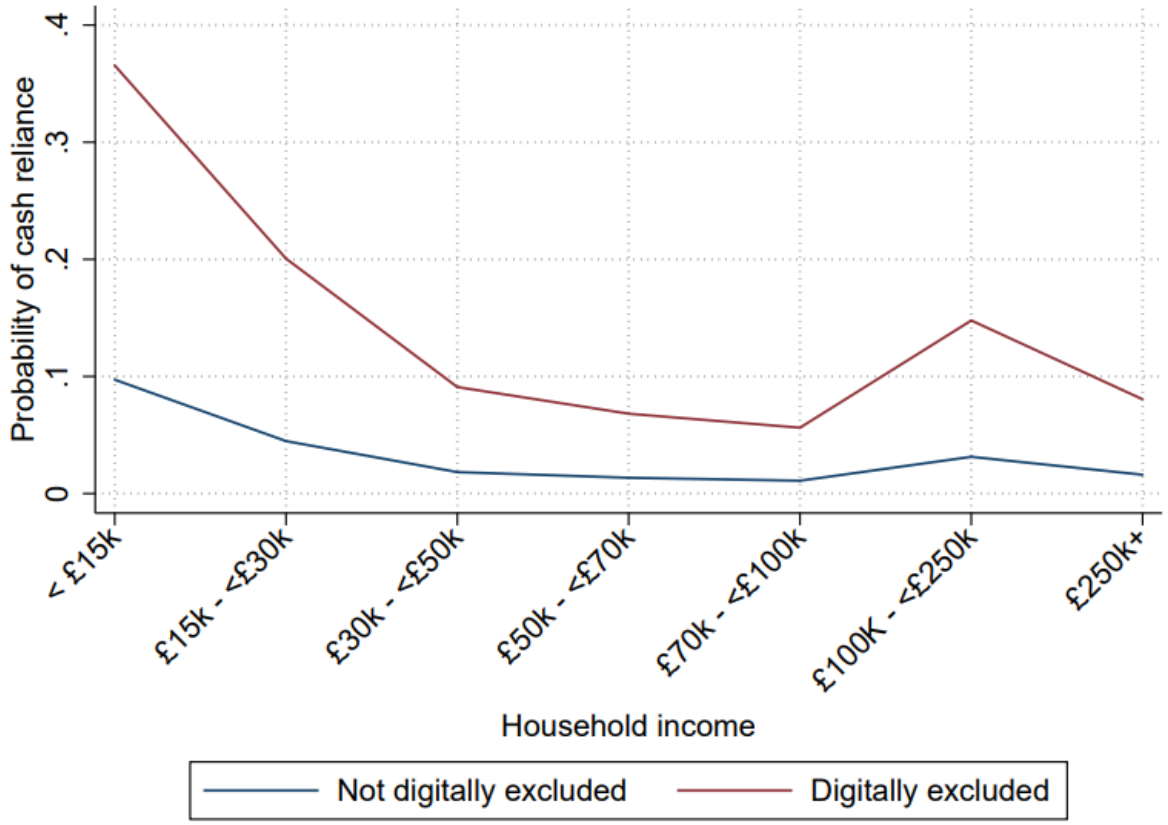


We also find that there is very little change in the probability of cash reliance across age groups for individuals that are not digitally excluded. This means that, on average, a 30-year-old who is not digitally excluded has approximately the same probability of relying on cash as a 70-year-old who is not digitally excluded. This finding, coupled with our finding of an association between digital exclusion and being 70+ years old, suggests that higher digital exclusion in older groups may explain higher cash reliance in older groups found in related literature and in the FLS 2022 results.

How does the probability of cash reliance vary across household income bands with other characteristics?

As illustrated in Figure 3 below, the effect of being digitally excluded on the probability of cash reliance is greater for individuals in low-income households compared to other household income bands. This supports our conclusion that digital exclusion and living in a low-income household are the strongest demographic predictors of cash reliance, with the average individual in a low-income, digitally excluded household having about a one-in-three chance of relying on cash.

Figure 3. The probability of cash reliance, by household income and digital exclusion



5 Discussion

Our findings suggest that being digitally excluded, in particular having low digital capability, and being in a low-income household have the largest effect on the probability of an average UK adult relying on cash. This suggests that in the absence of individual-level data on cash usage, these characteristics would be the most appropriate demographic characteristics to measure cash reliance in the UK, out of the characteristics in our model. Additionally, other factors such as not being in employment and having poor health can also be associated with a higher probability of cash reliance. Older age may be relevant as it can correlate with these characteristics. Preferences for cash also vary between within the UK and should also be considered when measuring cash reliance. These findings align with and expand upon previous research (Access to Cash Review, 2019; Royal Society of Arts cash census, 2022; Which? Cash-strapped communities, 2019) on characteristics of UK consumers whom cash is important to.

There are additional individual and local area factors that influence whether an individual relies on cash, as indicated by the relatively weak predictive power of our model. For example, digital infrastructure and payment methods offered by local retailers may increase the probability that an individual relies on cash. These factors should be considered when assessing the associated risks of declining cash services. To improve the reliability of this analysis, characteristics associated with cash reliance could be explored further using a larger sample size and direct measure of cash reliance, such as volume of cash transactions, rather than self-reported cash reliance.

We acknowledge the limitations of isolating the effect of characteristics on the probability of cash reliance due to correlations between characteristics in our model. For example, digital exclusion and being in a low-income household may be correlated with age, reducing the accuracy in isolating the marginal effect of any single characteristic on cash reliance. However, after testing different model specifications by excluding one variable at a time, the estimated effects do not change significantly in terms of the significance of the effects or the characteristics with the strongest associations with cash reliance. Therefore, while the precise marginal effects should be interpreted with some caution, the overall findings regarding the characteristics most strongly associated with cash reliance remain robust despite this limitation.

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Appendix

Data and variable definitions

Data

This analysis uses data from the Financial Lives 2022 Survey (FLS 2022) which is the UK's largest tracking survey of UK adults' financial behaviour. It is nationally representative, using a stratified random probability-based sample design, sampled from the Postcode Address File. The analyses are weighted to be representative of the UK adult population along a number of key demographic characteristics.

The FLS 2022 was conducted between February and June 2022, with the majority of interviews conducted in May 2022. The majority of fieldwork was conducted online, with a small number of telephone interviews to capture those that do not use the internet. There is an option to complete by telephone so that digitally excluded people can take part.

The FLS has run in three main waves, in 2017, 2020 and 2022, and an additional recontact survey in winter 2022/23. As a tracking survey, it provides evidence of how things are changing from the consumer's perspective.

The survey included a question to collect information on the frequency of cash usage of 19,145 individuals and their demographic and socioeconomic characteristics.

More information about the 2022 survey can be found in its accompanying Technical Report.

Outcome variable

The outcome, frequent cash user, was defined as using cash for most or everything measured through question AT12 in the FLS 2022. We classify those who use cash for most or everything as frequent cash users, and those who do not as infrequent cash users. We use this definition to try isolate those who may need cash from those that have a preference for cash. We refer to frequent cash users in this note as 'cash reliant' as this is the terminology used in FCA publications in relation to access to cash. Table A1 provides the unweighted frequency and proportion of our sample with each response to this question and our classification. The weighted percentage of individuals who rely on cash is 6%, while those who do not rely on cash make up 94%. For robustness, we test a broader definition of cash users in our model too (see sensitivity tests below).

Table A1: Cash reliance in our sample (unweighted)

Response	Frequency	Proportion of sample (%)	Classification
I pay for everything, including bills, in cash	272	1.4%	Cash reliant = 4%
I pay for most things in cash, including larger purchases and bills	471	2.5%	
I use cash and other payments methods equally	3,533	18.5%	Not cash reliant = 96%
I only occasionally use cash	8,499	44.4%	
I almost always use other payment methods.	6,370	33.3%	
Total	19,145	100%	

Table notes: *These estimates are based on Question AT12 in Financial Lives Survey 2022 and classification is based on FCA assumptions.*

Independent variables

In our analysis we use demographic characteristics of frequent cash users from the FLS 2022 results listed in Table A2 below.

For several variables, we make use of the FCA's FLS vulnerability measures. For a detailed description of the FCA's vulnerability measure, see Financial Lives 2020 Survey: the impact of coronavirus, Annex B for a detailed description (FCA, 2021). Further information about these variables and their construction can be found on our web page about the Financial Lives 2022 survey.

Table A2: Demographic variables

Variable	Definition
Household income	Respondents reported total annual household income band. The income bands in the survey are as follows: • Less than £15,000 • More than £15,000 but less than £30,000 • More than £30,000 but less than £50,000 • More than £50,000 but less than £70,000 • More than £70,000 but less than £100,000 • More than £100,000 but less than £250,000

	• More than £250,000 We also create a binary variable for being in a low-income household as the relationship between income and cash use appears to be non-linear, which could dilute the effect of low income on cash use. A broad definition of a low-income household, as suggested by the UK Government, applies to annual earnings less than 60% of the median UK household income. Using the Annual Survey of Hours and Earnings 2021, the 40th percentile is £22,210 (Table 1.7a). We use less than £15,000 per year as this is the closest income band in the FLS. We also evaluate our analysis using an income band ranging from £15,000 to £30,000 per year.
Age	Respondents reported age. We use also create a binary variable for being 70 years old or older, or less than 70 years old.
Poor health	We define poor health using the FCA's FLS vulnerability measure. Poor health is defined as those with a physical disability, severe or long-term illness, hearing or visual impairment, poor mental health, addiction or low mental capacity or cognitive difficulties that reduce their ability to carry out day-to-day activities a lot.
Not in employment	For the purposes of this analysis, we use respondents reported working status and group respondents into two groups, employed and not in employment. Employed is defined as: • Working for an employer(s) full-time or part-time • Self-employed full-time or part-time Not in employment is defined as: • Unemployed and looking for work • Unemployed and not looking for work • Retired • Semi-retired (drawing a pension or other income but still working) • Student • Permanently sick/disabled • Temporarily sick (no job to go to) • Looking after the home • Other
Low resilience	We define low financial resilience using the FCA's Financial Lives Survey vulnerability measure. Low financial resilience

	is defined as having over-indebtedness, low savings, or low or erratic income.
Low capability	We define low capability using the FLS vulnerability measure. Low capability is defined as having low confidence or knowledge in managing financial matters, or poor or non-existent digital skills.
Digitally excluded	We define digital exclusion using the FLS vulnerability measure. Digital exclusion is a subset of low capability measure. It is defined as those reporting having poor or non-existent digital skills (low digital capability) or those rating the quality of their internet connectivity as poor or very poor (poor digital access).
Urban	The urban/rural indicator from the 2001 Census matched to FLS survey data using each respondent's postcode.
Geographical area	The geographical area in the United Kingdom (England, Northern Ireland, Scotland, or Wales) the individual lives in, as reported by the respondent.

We present the descriptive statistics of the unweighted sample in Table A3 below. The descriptive statistic of the weighed sample can be found in Table 1 in the main body of the report.

Table A3: Descriptive statistics of the unweighted sample

Variable	Frequency (=1)	Frequency (=0)
Outcome: Cash reliant	743 (4%)	18,402 (96%)
Digitally excluded	331 (2%)	18,814 (98%)
Low-income household	2,055 (11%)	17,090 (89%)
70+ years of age	3,164 (17%)	15,936 (83%)
Poor health	1,054 (6%)	18,091 (94%)
Not in employment	7,744 (40%)	11,401 (60%)

Urban	14,363 (75%)	4,782 (25%)
Geographical area	England: 15,556 (81%) Northern Ireland: 1,075 (6%) Scotland: 1,456 (8%) Wales: 1,048 (5%)	

Methodology

We use a logistic regression model with population weights to analyse the marginal effect of demographic characteristics on the probability that an average person relies on cash. These marginal effects are used to determine the characteristics that have the strongest association with cash reliance.

Logistic regressions compare how the change in the probability of an outcome shifts in response to covariates. For example, logistic regressions can estimate how the probability of cash reliance shifts based on whether an individual is in a low-income household or not, holding other covariates constant. Our model can be expressed as:

$$\boldsymbol{\pi}(\boldsymbol{X}) = \frac{\exp(\beta_0 + \beta_1 X_1 + \cdots + \beta_k X_k)}{1 + \exp(\beta_0 + \beta_1 X_1 + \cdots + \beta_k X_k)}$$

$$= \frac{\exp(X\beta)}{1 + \exp(X\beta)}$$

$$= \frac{1}{1 + \exp(-X\beta)}$$

Where:

- $\boldsymbol{\pi}$ denotes the probability of a particular outcome with values between 0 and 1. The outcome of interest is equal to 1 if the individual relies on cash, measured through using cash for most or all purchases, and equal to zero if the individual uses cash as much as other payment methods, occasionally, or rarely.
- $\boldsymbol{X}$ is a vector of variables capturing demographic characteristics that could affect the probability of an individual relying on cash. These variables include digital exclusion, living in a low-income household, being 70 years old or older (70+), having poor health, not in employment, living in an urban area and geographical area of residence. A description of each variable is in Table 1 below.
- $\boldsymbol{\beta}$ are the regression coefficients (odds ratios) to be estimated.

The results of logistic regressions are often presented using odds ratios. Odds ratios are defined as the ratio of the probability of success and the probability of failure and are measured in the log odds scale. The odds ratios tell us, "all other things equal", individuals with a particular characteristic are more (or less) likely to rely on cash, providing a direction of the associations and a sense of scale.

The results of logistic regressions are often presented using odds ratios, but marginal effects can be superior to odds ratios for interpretation as we can estimate the effect on the probability of an outcome of a variable, netting out the effect of other variables through averaging (Williams, 2012). For a binary variable, the average marginal effect is estimated by calculating the difference between the probability of cash reliance when the value is equal to 1 and when the value is equal to 0. We do this for all respondents in our sample and take the mean to estimate the average marginal effect. With average marginal effects, two hypothetical populations are compared - one consisting entirely of individuals from low-income households and the other consisting entirely of individuals not from low-income households – that both have identical values for the covariates in the model. This allows us to estimate how having a particular characteristic (eg being in a low-income household) affects the probability of relying on cash for an average person in our sample.

Potential non-response bias has been limited as far as possible by the robust design and weighting process. If possible we have also limited the impact of question nonresponse ("don't know" or "prefer not to say") on the analysis by applying the missing indicator method. To apply this method, we create a binary variable in our regression model to indicate whether the value for that variable is missing (=1) and set the missing values to the mean response (in all cases this is zero). We apply this method for the following variables: low household income, not in employment and 70+ years old. We include these missing indicators in our results table. We find that being in a low-income household and not in employment have a positive statistically significant effect on the probability of cash reliance suggesting that individuals who "prefer not to say" or "don't know" their household income or their working status are more likely to rely on cash. The missing indicator approach increases the representativeness of the results, especially on household income where "prefer not to say" response is relatively high.

We first ran univariate analyses (ie examining the relationship between the outcome and each predictor individually) and then use variables in our model that have a statistically significant effect (P <0.10). We use a P<0.10 instead of P<0.05 as the purpose of this analyses is to identify potential predictor variables. We tested the variables in Table A2, gender and ethnicity as predictor variables. Following these tests, we excluded ethnicity and gender from our multivariate regression analysis as we did not find any statistically significant results.

The predicted margins and average marginal effects for our logistic regression model including all covariates are presented in Table A4.

Table A4: Predicted margins and average marginal effect

Covariate	Predicted margin	Average marginal effect
Digitally excluded		
Yes	0.18*** (0.025)	0.14*** (0.025)
No	0.044*** (0.002)	-
Household income of less than £15,000 per year		

Yes	0.12*** (0.012)	0.071*** (0.013)
No	0.048*** (0.0029)	-
Not in employment		
Yes	0.076*** (0.0035)	0.033*** (0.0063)
No	0.043*** (0.0049)	-
70+		
Yes	0.043** (0.0039)	-0.021** (0.0078)
No	0.064** (0.0057)	-
Living in an urban area		
Yes	0.062*** (0.0033)	0.021*** (0.0057)
No	0.042*** (0.0047)	-
Poor health		
Yes	0.079** (0.0103)	0.024** (0.011)
No	0.055** (0.0030)	-
Country		
England	0.054*** (0.0030)	-
Northern Ireland	0.12*** (0.017)	0.061*** (0.017)
Scotland	0.082*** (0.0103)	0.028*** (0.011)
Wales	0.049 (0.0091)	-0.0049 (0.0096)
Missing indicator: low household income		
Yes	0.085*** (0.0073)	0.038*** (0.0084)
No	0.048*** (0.0031)	-
Missing indicator: not in employment		
Yes	0.15*** (0.042)	0.097*** (0.043)

No	0.056*** (0.0028)	-
Missing indicator: age		
Yes	0.029 (0.023)	-0.030 (0.023)
No	0.058 (0.0028)	-
Observations	19,145	19,145

Table notes: *1. Figures are reported to two significant figures. 2. P-values reported are for the logistic regression coefficients: *** p<0.01; **p<0.05; *p<0.1. 3. Standard errors relate to estimates of predicted margins and average marginal effects and are in brackets. 4. Estimates for poor health, Northern Ireland, Wales and Scotland are based on small sample sizes (approximately 1,000 respondents) and should be treated with caution.*

Sensitivity analysis

We perform sensitivity tests on our regression model. In these sensitivity tests, we make the following changes to the baseline model:

- Sensitivity test (1): We re-estimate average marginal effects using an outcome variable, $cashuser_i$, a binary variable for individual i that is equal to 1 if the individual is a cash user, defined as using cash for most or everything including bills and as much as other payment methods, and equal to zero if the individual uses cash occasionally or rarely.
- Sensitivity test (2): We re-estimate average marginal effects using a broader definition of digital capability, low capability, which also considers whether an individual has low confidence or knowledge in managing financial matters as well as digital capability.
- Sensitivity test (3): We re-estimate average marginal effects using a related definition of being in a low-income household, low financial resilience, which considers whether an individual has over-indebtedness or low savings in addition to low income.

Table A5: Average marginal effects from sensitivity tests

Variable	**Average marginal effect**		
Sensitivity test	(1)	(2)	(3)
Digitally excluded	0.18*** (0.033)	-	0.15*** (0.028)
Household income of less than £15,000 per year	0.18*** (0.017)	0.069*** (0.013)	-
Not in employment	0.091*** (0.011)	0.034*** (0.0067)	0.043*** (0.0064)

70+ years old	0.034** (0.015)	-0.0044 (0.0076)	-0.018** (0.0084)
Living in an urban area	0.018* (0.0097)	0.020*** (0.0058)	0.019*** (0.0058)
Poor health	0.031* (0.019)	0.017* (0.011)	0.017* (0.010)
Geographical area (relative to England)	Northern Ireland: 0.12*** (0.021) Scotland: 0.035** (0.016) Wales: 0.055*** (0.018)	Northern Ireland: 0.061*** (0.018) Scotland: 0.025** (0.011) Wales: -0.0061 (0.0096)	Northern Ireland:0.064*** (0.018) Scotland: 0.026*** (0.012) Wales: -0.0031 (0.0099)
Missing indicator: household income	0.090*** (0.011)	0.040*** (0.0082)	-
Missing indicator: not in employment	0.18*** (0.073)	0.15*** (0.052)	0.11*** (0.046)
Missing indicator: age	-0.13** (0.049)	-0.033 (0.020)	-0.028 (0.023)
Low capability	-	0.073*** (0.011)	-
Low financial resilience	-	-	0.049*** (0.0077)

Table notes: *1. Figures are reported to two significant figures. 2. P-values reported are for the logistic regression coefficients: *** p<0.01; **p<0.05; *p<0.1. 3. Standard errors relate to estimates of average marginal effects and are in brackets. 4. Estimates for poor health, Northern Ireland, Wales and Scotland are based on small sample sizes (approximately 1,000 respondents) and should be treated with caution.*

We also assess the predictive power of our model. Ideally, we would use holdout or test data to conduct these tests but since no such data is available, we observe the predictive power of our model using FLS 2022 data. We find that our model can only correctly predict frequent cash usage for 65% of frequent cash users as shown in Table A7 below. These results suggest that while demographic characteristics in our model suggests an individual is more likely to rely on cash, there are other individual characteristics that can drive cash reliance which are not captured in our model.

Table A7. Power of our model to accurately predict if an individual relies on cash

Actual	**Model prediction**	
	Not a frequent cash user	**Frequent cash user**

Not a frequent cash user	68%	32%
Frequent cash user	34%	66%

The predictive power of the model decreases further when trying to predict cash usage more generally, suggesting that there are a wider range of characteristics which can be associated with individuals that use cash less frequently. This could be because some people prefer to use cash for specific but infrequent cases, for example, tipping at a restaurant, but generally prefer to use other payment methods.

Table A8. Power of our model to accurately predict if an individual is a cash user

Actual	Model prediction	
	Not a cash user	**Cash user**
Not a cash user	67%	33%
Cash user	44%	56%

Limitations

The key limitations of this analysis and the extent to which they impact our findings in are set out below.

Logit regression assumes a linear relationship between the covariates and the logit of the outcome which can hide more complex, non-linear relationships. For example, the effect of household income on the probability of relying on cash might not increase or decrease at a constant rate but might instead follow a curve.

As noted when setting out our findings, some variables in our model are correlated which can bias our estimates. For example, digital exclusion may be correlated with age. Although this reduces the accuracy in our estimated average marginal effects, after testing different specifications in which we exclude one variable at a time, the estimated effects do not change significantly so far as that the significance of the effect changes or the characteristics that have the strongest associations with cash reliance.

As assessed through classification tables above, the predictive power of our model is relatively weak. This means our model cannot identify individuals that rely on cash with a great degree of certainty. Our model includes relevant variables based on existing literature and therefore this suggests that the low predictive power of our model could be related to difficulties in predicting cash reliance based on demographic characteristics alone. This could be explored further with a larger sample size or future FLS results.

The data we use to measure cash reliance is self-reported frequency of use. A more accurate measure of cash reliance would be observed volume of cash transactions or use of cash access services.

When estimating average marginal effects, we are essentially calculating the change in the predicted probability when a particular characteristic changes, averaged over the distribution of other covariates in the sample. This means for a binary characteristic we compare the predicted probability if respondents had and did not have this characteristic, holding all other covariates constant. An alternative method would be to estimate marginal effects at means. With this approach, we would again calculate the change in the predicted probability when a particular characteristic changes, but this time evaluated when the other covariates are set to their mean values. However, applying this method to binary characteristics means we could make estimates for respondents who are 0.6 digitally excluded which less intuitive. Therefore, we estimate average marginal effects as we consider they are easier to interpret in the context of this analysis.

This analysis does not assert a direction of causality between the outcome variable and a given covariate. Instead, this analysis only estimates associations. It could be that cash reliance drives digital exclusion. We consider that the direction of causality does not impede the application of this analysis.

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