

Technical Annex to Consultation Paper 23/29

07/12/2023

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1 Introduction

1.1 In Chapter 3 of [CP23/29](#) we summarise coverage in the UK and provide details on current coverage in local areas grouped by characteristics. This technical annex gives an outline of:

- Current cash coverage in the UK
- Our approach to defining local areas
- How we have developed archetypes

1.2 We structure this annex as follows:

- chapter 2 describes cash coverage in the UK at a national level
- chapter 3 describes our data collected from banks, building societies, the Post Office and LINK alongside data on demographics and socioeconomic characteristics
- chapter 4 details our methodology, the assumptions we have made and outlines other variations of our analysis we ran to test our results
- chapter 5 sets out the main empirical results which have generated our four archetypes

2 Coverage across the UK

- 2.1 Cash usage in the UK has been in decline. Between 2015 and 2021, the volume of annual cash payments fell by 11.2 billion, a reduction of 65.3%.¹ Covid accelerated the decline in cash payments. Between 2015 and 2019 cash payment volumes fell by a compounded average rate of 14% per year. However, between 2019 and 2020 cash payments declined by 34.8%, more than twice the average rate in the prior 4 years.²
- 2.2 Cash's share of total payments between 2015 and 2021 fell more significantly as people switched to other payment methods. From 45% in 2015, the volume of cash payments as a share of total payments fell to 23.3% in 2019.³ As general economic activity declined during Covid, the volume of other payments also fell. However, this decline was not as significant as that for cash. As economic activity rebounded in 2021, the volume of other payments increased whilst cash payments remained flat. As a result, cash payments share of total payments fell from 23.3% in 2019 to 14.8% in 2021.⁴
- 2.3 The UK has also seen a decline in the number of certain types of cash access points.
- between 2012 and 2022, the number of bank and building society branches fell from 13,345 to 8,060, a reduction of 39.6%.⁵ More recently, 634 branch closures have occurred or been announced in 2023.⁶
 - after a sustained period of growth, the number of ATMs (both free and pay-to-use) fell from a high of 70,588 in 2015, to 50,300 in 2022, a reduction of 28.7%⁷
 - the introduction of the first Banking Framework (access to cash at the post office) added around 11,500 new cash access points when it came into effect in January 2017. The distribution of Post Offices is protected and so has remained stable since 2009, reducing only slightly to 11,635 in 2022, a decline of 2.7%⁸
- 2.4 These trends and other market developments have impacted overall provision of cash access. However, to understand access, we need to consider how the geographic spread of cash provision relative to population has changed.
- 2.5 Since Q1 2021, the FCA has been monitoring access to cash coverage. On a regular basis we collect data from cash access providers including banks, building societies, post office, LINK for ATMs and Visa and Mastercard for cashback⁹ on the locations of

¹ House of Commons Library, September 2023, Statistics on access to cash, bank branches and ATMs, <https://commonslibrary.parliament.uk/research-briefings/cbp-8570/>

² House of Commons Library, September 2023, Statistics on access to cash, bank branches and ATMs, <https://commonslibrary.parliament.uk/research-briefings/cbp-8570/>

³ House of Commons Library, September 2023, Statistics on access to cash, bank branches and ATMs, <https://commonslibrary.parliament.uk/research-briefings/cbp-8570/>

⁴ House of Commons Library, September 2023, Statistics on access to cash, bank branches and ATMs, <https://commonslibrary.parliament.uk/research-briefings/cbp-8570/>

⁵ House of Commons Library, September 2023, Statistics on access to cash, bank branches and ATMs, <https://commonslibrary.parliament.uk/research-briefings/cbp-8570/>
LINK, 2023, Overview of branch closures announced by banks since January 2022, <https://www.link.co.uk/initiatives/bank-branch-closures/>

⁷ LINK, 2023, Statistics and trends, <https://www.link.co.uk/about/statistics-and-trends/>

⁸ House of Commons Library, September 2023, Statistics on access to cash, bank branches and ATMs, <https://commonslibrary.parliament.uk/research-briefings/cbp-8570/>

⁹ While we have made every effort to ensure the data we collect is complete and up to date, there may still be some omissions or other discrepancies. The dataset does not include ATMs that were temporarily closed at the time the data was collected. Data on some smaller banking companies may be missing, and not all recent branch closures, openings or other changes may be reflected. Where a bank or building society has not provided data, we use submissions from

cash access points. Combining with publicly available data on residential addresses, we then calculate the distance as the crow flies from an address to its nearest cash access point. These results are estimated for different combinations of access points, geographic areas and distances to provide overall coverage statistics as a proportion of the population.

National coverage

- 2.6 HMT's policy statement informs the FCA's approach to what constitutes reasonable provision of cash access services in the UK. Using the FCA's own analysis of coverage, which measure distances as the crow flies, HMT outlines that at least 95% of the population have access to cash deposit and withdrawal facilities within:
- 1 mile of where they live when in predominantly urban areas
 - 3 miles of where they live in predominantly rural areas
- 2.7 Based on these criteria, in our latest monitoring report, for 2023 Q1¹⁰, we judge current access to cash to be good based on HMT's Policy Statement.
- 2.8 Table 1 provides details on access to cash coverage for access points where customers can deposit cash or use assisted cash services. We estimate that for larger banks and building societies providing PCA and Post Office: all branches, including mobile:
- 97.4% of the urban UK population are currently within 1 mile of a free-to-use cash access point offering deposits
 - 98.3% of the UK rural population are currently within 3 miles of a free-to-use cash access point offering deposits
- 2.9 Table 2 provides details on access to cash coverage for free-to-use access points (excluding cashback). We estimate that for access to any bank, building society, Post Office branch, or free ATM:
- 99.3% of the UK urban population are currently within 1 mile of a free-to-use cash access point offering withdrawals
 - 98.7% of the UK rural population are currently within 3 miles of a free-to-use cash access point offering withdrawals
- 2.10 Within the UK there are some general trends which apply at all distances:
- The Post Office and ATM networks provide the broadest range of coverage with coverage of banks and building societies being generally lower.
 - The rural population have lower coverage than the urban population. However, the difference between coverage in rural and urban areas reduces as we increase the distance from which a household would need to travel to its nearest cash point.
 - Coverage in Northern Ireland is similar to Great Britain in urban areas at 1 mile and is only slightly lower in rural areas at 3 miles. However, overall coverage is lower due to a higher proportion of the population living rurally.
 - Within Great Britain, relative to England:

previous quarters. Of the Post Office branches, we include only those classified by the Post Office as active at the time the data was collected. Cashback locations are the unique locations of vendors which are known to have offered cashback at some point in the prior year to customers using either a Mastercard or a Visa card. There could be other merchants offering cashback not included in this dataset, either because no transaction involving cashback took place or because such transactions did not involve Visa or Mastercard.

¹⁰ FCA, December 2023, Access to cash coverage in the UK 2023 Q1, <https://www.fca.org.uk/data/access-cash-coverage-uk-2023-q1>

- Wales has similar coverage levels in urban and rural areas at 1 mile and 3 miles respectively. However, as a higher proportion of the population live in rural areas overall coverage is slightly lower.
- Scotland has lower coverage in urban areas and rural areas at 1 mile and 3 miles respectively. The difference is larger for rural areas with coverage around 10 percentage points lower than for rural areas in England. However, Scotland has a lower proportion of the population living in rural areas. The overall effect is that Scotland’s overall coverage is only slightly lower than England’s.

Table 1: Access to cash coverage in the UK for larger banks and building societies providing PCA and Post Office: all branches, including mobile 2023 Q1

Location	Rural / Urban	Population, 000's	1mi	3mi
UK	Overall	67,071.9	92.7	99.6
UK	Rural	12,046.4	70.9	98.3
UK	Urban	55,025.4	97.4	99.9
GB	Overall	65,176.3	93.0	99.7
GB	Rural	11,337.1	72.1	98.5
GB	Urban	53,839.2	97.5	99.9
NI	Overall	1,895.5	79.8	98.5
NI	Rural	709.3	51.8	96.0
NI	Urban	1,186.2	96.5	100.0

Source: FCA, December 2023, Access to cash coverage in the UK 2023 Q1, <https://www.fca.org.uk/data/access-cash-coverage-uk-2023-q1>

Table 2: Access to cash coverage in the UK for all free-to-use cash access points (excluding cashback) 2023 Q1

Location	Rural / Urban	Population, 000's	1mi	3mi
UK	Overall	67,071.9	95.1	99.7
UK	Rural	12,046.4	75.8	98.7
UK	Urban	55,025.4	99.3	99.9
GB	Overall	65,176.3	95.4	99.7
GB	Rural	11,337.1	77.0	98.8
GB	Urban	53,839.2	99.3	99.9
NI	Overall	1,895.5	83.3	99.1
NI	Rural	709.3	56.7	97.6
NI	Urban	1,186.2	99.2	100.0

Source: FCA, December 2023, Access to cash coverage in the UK 2023 Q1, <https://www.fca.org.uk/data/access-cash-coverage-uk-2023-q1>

Local coverage

- 2.11 Whilst overall coverage may be good, each local area's experience will be different. Perceptions of what constitutes a local area may differ among individuals. These perceptions can be shaped based on where an individual lives, works and accesses services, and available travel options. Official definitions such as region, county, local authority district, constituency or council / metro area maybe too large or inflexible to use as a definition of local areas. Other definitions used for statistical purposes may not reflect how people behave.
- 2.12 However, for the purposes of rule development, supervision and consumer understanding we need to illustrate the types of cash services that are currently available at a local level.
- 2.13 The rest of this annex outlines how we have defined and grouped the local areas outlined in Chapter 3 of the CP.

3 Data

- 3.1 In this section we outline the different data sets we have used in our analysis. These include:
- Banks and Building Societies
 - Post Office
 - LINK
 - Census Geography Boundaries
 - Population Estimates
 - CACI
 - IMD
- 3.2 Data relating to Banks and Building Societies, Post Office, and LINK are the same as that which we use for our monitoring of access to cash.
- 3.3 In the summary statistic tables presented in this section we provide information on the averages (mean and median), range (minimum and maximum) and spread (standard deviation) of relevant variables collected for our analysis.

Banks and Building Societies

- 3.4 We collect data three times a year on bricks-and-mortar branches operated by larger PCA providers and mobile bank branches as measured by stops. Characteristics on the following areas are included in this dataset:
- Location
 - Opening hours
 - Facilities
 - Accessibility
 - Activity / Usage
- 3.5 All data undergo general data cleaning and processing before being used in our analysis. This includes data quality checks on the locational information provided.
- 3.6 For the purposes of this analysis, the key data used are the coordinates and postcodes supplied by firms as of Q1 2023.¹¹ Coordinates are used to assign the 4,183 bricks-and-mortar branches and 777 mobile branches to local areas.¹² Postcodes are used to join branch data to the ONS postcode directory, which lists all UK postcodes, alongside links to other geographical levels.

¹¹ In Section 3 onward in the development of the local area archetypes, we remove bricks-and-mortar bank and building society branches of larger PCA providers that were proposed to be closed in firm submissions during Q1 2023. Our Q1 2023 monitoring report is inclusive of these branches.

¹² The sources for the 4,183 branches referenced here and the 8,060 branches mentioned at the start of this annex are different. The difference in figures mainly reflect: i) branches of smaller banks or building societies not included in our analysis; ii) branches which are cashless, so therefore do not support cash access iii) closures of branches during the period between 2022 and 2023.

Table 3a: Summary statistics for bricks-and-mortar branches of larger banks and building societies offering PCA

	Minimum	Median	Mean	Standard Deviation	Maximum
Total no. of counters	0	2	2.5	1.2	13
Total no. of Automated Deposit Machines	0	1	1.7	1.4	10
Total no. of ATMs	0	3	3	1.7	14
Total opening hours per week	0	34.5	34.9	7.8	69
Total no. of days closed during quarter	0	0	0.5	4	81

Source: Bank and building society data, FCA analysis

Table 3b: Percentages of bricks-and-mortar branches of larger banks and building societies offering PCA with common accessibility characteristics

	Wheelchair accessible			Has step-free access			Has hearing / induction loop available		
	Yes	No	Unreported	Yes	No	Unreported	Yes	No	Unreported
Sample	Yes	No	Unreported	Yes	No	Unreported	Yes	No	Unreported
All data	94.1	5.9	-	69.2	2.1	28.6	95.3	4.7	-
Excluding unreported	94.1	5.9	x	97.0	3.0	x	95.3	4.7	x

Source: Bank and building society data, FCA analysis

Table 3c: Summary statistics for mobile bank and building society data.

	Minimum	Median	Mean	Standard Deviation	Maximum
Total no. of counters	2	2	2	NA	2
Total no. of ATMs	0	0	0.2	0.4	1

Source: Bank and building society data, FCA analysis

Table 3d: Percentages of mobile bank and building society branches with common accessibility characteristics

	Wheelchair accessible			Has step-free access			Has hearing / induction loop available		
	Yes	No	Unreported	Yes	No	Unreported	Yes	No	Unreported
Sample									
All data	55.5	22.7	21.9	0	78.1	21.9	78.1	0	21.9
Excluding unreported	71.0	29.0	x	0	100	x	100	0	x

Source: Bank and building society data, FCA analysis

Post Office

- 3.7 We collect quarterly data on Post Office branch locations directly from the Post Office. This dataset contains a subset of the fields we collect from Banks and Building Societies, as well as Post Office-specific fields, for instance, the type of Post Office branch. These cover:
- Location
 - Opening hours
 - Facilities
 - Accessibility
- 3.8 For the purposes of this analysis we use data provided by Post Office as at Q1 2023, which covers 11,683 Post Office branches. This includes 1,815 mobile/outreach branches.
- 3.9 Coordinates are supplied by the Post Office for the location of branches, and we transform these from the coordinate reference system used as the basis for the British National Grid to EPSG:4326 to align with other datasets in this section.¹³

¹³

EPSG:4326 is a coordinate system based on the World Geodetic System 1984 (WGS 84) ellipsoid.

Table 4a: Summary statistics for Post Offices branch data as of Q1 2023.

	Minimum	Median	Mean	Standard Deviation	Maximum
Total opening hours per week	0	46.5	48.5	29.4	167.9

Source: Post Office data, FCA analysis

LINK

3.10 We receive monthly data on ATM locations from LINK. This dataset includes information on:

- The ATM operator
- Geography and location
- Whether the ATM is located within a bank branch or remotely
- Whether the ATM is internal or external
- Whether the ATM is free-to-use or pay-to-use

3.11 For this analysis, the data used is that provided by LINK as of April 2023. This covers 49,513 ATMs.

Table 5a: Characteristics of LINK ATMs as at April 2023

	Yes	No
Pay-to-use ATM	10,787	38,726
Branch ATM	12,246	37,267
External ATM¹⁴	23,003	20,307

Source: LINK data, FCA analysis

¹⁴ 6,203 ATMs are marked as unknown.

Table 5b: Location of LINK ATMs as at April 2023

Location	Percentage of ATMs
Convenience Store	38.8%
Branch	24.6%
Supermarket	11.5%
Motoring	7.3%
Other Retail	5.7%
Leisure	3.2%
Post Office	3.1%
Other	5.8%

Note: Definitions used by reporters of this data may vary so some location types could be assigned differently
Source: LINK data, FCA analysis

Census Geography Boundaries

- 3.12 Where we need to allocate or aggregate data to an area we use the lowest level of census geographic boundaries as defined by the ONS for England and Wales, by Scotland's Census for Scotland, and by NISRA in Northern Ireland. These are called output areas (OAs) in Great Britain and small areas in Northern Ireland.¹⁵ We subsequently aggregate these into larger areas where necessary.
- 3.13 The definitions used for rural-urban classification are based on those assigned by ONS and NISRA. They differ between Great Britain and Northern Ireland. For the countries of Great Britain they are based on the output area assignment. In the case of Northern Ireland, for simplicity, we have reallocated the 165 out of 4,537 small areas originally assigned to a mixed rural/urban category to either rural or urban category based on their band. We have allocated bands A-E as urban and F-H as rural; see NISRA Urban-Rural Classification 2015 for more details.
- 3.14 Using the boundaries of these areas, we calculate their geographic centroids i.e. the centre point of a shape given its boundaries to support our analysis; for further details about how these are used, see Section 4.¹⁶

Population Estimates

- 3.15 All population estimates are based on 2011 census output area (OA) geographies (small areas in Northern Ireland). These are updated to the latest data available, the

¹⁵ 2011 Census geographies - Office for National Statistics (ons.gov.uk)

¹⁶ Although these boundaries are from separate sources for England and Wales, Scotland, and Northern Ireland, some organisations have combined them together for the whole of the UK: 2011 Census Geography boundaries (Output Areas and Small Areas) - Dataset - UK Data Service CKAN

mid-2020 estimates of the usual resident population for OAs in England¹⁷ and Wales,¹⁸ small areas in Northern Ireland,¹⁹ and for Data Zones²⁰ in Scotland.

- 3.16 Population estimates for OAs in Scotland are obtained by proportionally adjusting the 2011 census estimates using the aggregate mid-2020 population estimates for Data Zones.²¹ We compute the population estimates for arbitrary areas based on the assumption that population density is uniform over each OA.

CACI

- 3.17 Geographical locations of 'retail centres', where cash usage is determined to be high, are sourced from CACI, a data and technology company.

- 3.18 The retail centres are derived using clustering techniques and datasets on the locations of services such as banks, post offices, newsagents, supermarkets, convenience stores, petrol stations, as well as other services. These locations are categorised according to their size and function, with clusters defining locations that include any of the following services:

- Banks
- Post Offices
- Newsagents
- Convenience Stores
- Supermarkets & Hypermarkets
- Pharmacies
- Petrol Stations
- Specialist Food Stores
- Off Licences
- Rail or Tube Stations
- Take-aways
- Hairdressers
- Beauty Salons
- Nail Salons
- Opticians
- Video Rental

¹⁷

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/censusoutputareaestimatesinthelondonregionofengland>

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/censusoutputareaestimatesinthenorthwestregionofengland>

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/censusoutputareaestimatesintheyorkshireandthehumberregionofengland>

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/censusoutputareaestimatesinthenortheastregionofengland>

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/censusoutputareaestimatesinthewestmidlandsregionofengland>

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/censusoutputareaestimatesintheeastmidlandsregionofengland>

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/censusoutputareaestimatesinthesouthwestregionofengland>

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/censusoutputareaestimatesintheeastregionofengland>

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/censusoutputareaestimatesinthesoutheastregionofengland>

¹⁸

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/censusoutputareaestimatesinwales>

¹⁹ 2020 Mid Year Population Estimates for Small Areas | Northern Ireland Statistics and Research Agency ([nisra.gov.uk](https://www.nisra.gov.uk))

²⁰ Scottish Datazones are made up of census output areas and are the main geography for the release of small area statistics in Scotland.

²¹ KS101UK (Usual resident population) - Nomis - Official Census and Labour Market Statistics ([nomisweb.co.uk](https://www.nomisweb.co.uk))
Mid-2020 Small Area Population Estimates for 2011 Data Zones | National Records of Scotland ([nrscotland.gov.uk](https://www.nrscotland.gov.uk))

- Dry Cleaners
- Laundrettes

This generates a large number of clusters across the UK. However, not all clusters will be associated with cash use e.g. industrial business parks. Therefore, only clusters where there are retailers assumed to be cash accepting are retained. The result of this process is a set of 7,965 retail centres, which are often locations of town centres and local high streets but can also span suburban locations and small villages. Each retail centre has information on:

- Location
- Number of retailers within a 1km radius
- Number of bank branches (split by brand) within a 1km radius
- Population and demographics

IMD

- 3.19 Indices of multiple deprivation ('IMD') are publicly available measures of relative deprivation levels calculated separately across England, Wales, Scotland, and Northern Ireland. IMD measures and combines data on income, employment, education, healthcare, crime rates, housing, and other factors to establish relative rankings of Lower Super Output Areas in England and Wales, Data Zones in Scotland, and Super Output Areas in Northern Ireland.
- 3.20 IMD is not directly comparable across England, Wales, Scotland, and Northern Ireland, primarily because they are calculated separately for each, but also due to temporal differences in the data; the rankings are from 2019 for England and Wales, 2020 for Scotland, and 2017 for Northern Ireland.

4 Methodology

4.1 In this section we outline how we go about generating the four archetypes. The section is split into 2 stages:

- creating local area geographies
- grouping local areas into archetypes

Local areas

4.2 As outlined the definition of a local area is dependent on a number of factors and is to some extent arbitrary.

4.3 For our purposes we wanted to define a local area that accounted for where:

- people live i.e. residential locations
- spending takes place / people are likely to want to access cash
- access points are located

4.4 We also wanted these local areas to:

- cover the entire land area and population of the UK
- utilise well-established geographic areas
- allow us to link other information which maybe relevant to cash access

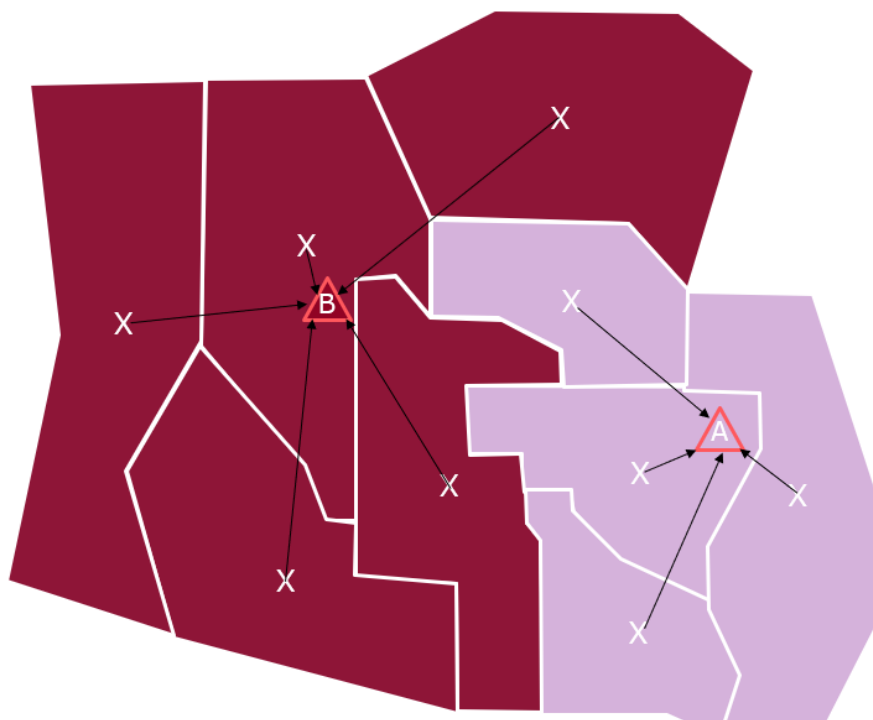
4.5 To achieve this we followed a two-step process:

- **Step 1:** we assigned access points to output areas (in England, Wales, and Scotland) and small areas (in Northern Ireland), based on the nearest access points to geographic centroids of output areas / small areas
- **Step 2:** we assigned all output areas (small areas in Northern Ireland) and their populations/access points to retail centres as defined by CACI, based on the nearest retail centre to the geographic centroid of the output area / small area

4.6 In both cases we measured this as the shortest straight-line (Euclidean) distance between the relevant points. This is in line with our approach to estimating coverage in our monitoring analysis.

4.7 An example of this is shown in Figure 1. The triangles represent retail centre locations. Each polygon represents an output area boundary, with the X representing the geographic centroid. In this example there are five output areas whose centroids are closest to retail centre A and four output areas closest to retail centre B. This is shown by the arrows. This generates two local areas where the boundaries of each would be the outer boundaries of the grouped output areas. Local area A is coloured in lilac and local area B in maroon.

Figure 1: Simplified local area drawing – X's represent output area centroids, A and B represent retail centres



4.8 Looking at all 7,960 local areas this approach generates together, we observe that:²²

- Most local areas are made up of predominantly urban areas, given more people live in urban areas than rural areas in the UK
- The mean typical local area contains 3,900 residential addresses and has a total population of 8,400.
- There are generally a mix of types of access points in local areas which contribute to current access to cash, in particular each local area
 - does not necessarily contain a large PCA provider bricks-and-mortar branch, with only 18.1% containing at least one
 - will generally contain at least one Post Office, with these access points being particularly important for access to cash in more rural areas
 - will generally contain several ATMs

4.9 Table 6 outlines summary statistics for all the local areas produced. This gives an indication of the general distribution of local areas. We provide an overview on several characteristics:

- **Output areas, residential addresses, and population:** Output areas (small areas in Northern Ireland) are defined in terms of numbers of households/population and so can vary considerably in geographical size and shape across the UK. A local area with 30 output areas in a rural environment will be considerably larger in size than a local area with 30 output areas in a central urban location. Local areas with a very small number of output areas are typically located in areas where retail centres are very close to one another. Conversely, local areas with a very large number of output areas are ones where other retail

²² Five retail centres had no output areas (small areas in Northern Ireland) assigned to them. This is because no output areas had these as their closest retail centre. This occurred in areas where other retail centres are very close by, alongside output areas being relatively large in size for an urban environment. We do not assign to these five retail centres the output areas that they are contained in as doing so would create a new and more complex rule which affects the assignment of other output areas to other retail centres.

centres are much further away. Note that cases where there are a very small number of output areas or a very large number of output areas in a local area are reasonably rare.

- **Urban share of population:** Each output area (small area in Northern Ireland) is assigned a label of urban or rural as described in paragraph 3.13. There are more output areas (small areas in Northern Ireland) classified as urban than rural in the UK. As discussed, each local area is comprised of a collection of output areas (small areas in Northern Ireland). In each local area, we divide the number of output areas (small areas in Northern Ireland) that are classified as urban by the total number of output areas (small areas in Northern Ireland) in the local area. Note that non-urban output areas (small areas in Northern Ireland) are rural, so equally, one minus these values can be read as the rural share of population in a local area.
- **Approximate average age of population:** An approximate average age is calculated using the mid-interval values in age bands and the population in each of those bands. The age bands are 0-17, 18-24, 25-34, 35-44, 45-54, 55-64, 65+. For the last band, we take the mid value as 77.5, which results in the overall median age in the UK being approximately equal to its true value.
- **Index of multiple deprivation:** IMD rankings are at a different geographical level to our local area definition. Specifically, they are at Lower Super Output Area level in England and Wales, Data Zone level in Scotland, and Super Output Area in Northern Ireland. To establish an approximate IMD value in each local area, we first use the rankings to calculate IMD percentiles for England and Wales, Scotland and Northern Ireland. We then aggregate to the local area level by taking a population weighted mean of each local area's IMD percentiles. This aggregation results in these values being non-uniformly distributed, and so we can consider these values an approximate "IMD score" rather than percentiles. The IMD scores shown in Table 6 range between 0 and 99 (rounded to the nearest whole number), with lower values indicating more deprived local areas. For more details on IMD, see paragraphs 3.19 and 3.20.
- **Cash access points:** Information on cash access points which fall within the boundary of the local area, including bricks-and-mortar branches of larger banks and building societies offering PCA, Post Offices, free-to-use ATMs and pay-to-use ATMs.
- **Free-to-use deposit points within 1 and 3 miles:** This is the percentage of the population in each local area that have access to larger banks and building societies providing PCA and Post Office (all branches including mobile) within 1 and 3 miles as at Q2 2022. These figures are taken directly from those produced through our monitoring analysis. This means that this coverage may come from access points in other nearby local areas that are within these distances.
- **Free-to-use withdrawal points within 1 and 3 miles:** This is the percentage of the population in each local area that have access to any free-to-use cash access point (excluding cashback) within 1 and 3 miles as at Q2 2022. These figures are taken directly from those produced through our monitoring analysis. This means that this coverage may come from access points in other nearby local areas that are within these distances.
- **Mean distance from output areas (small areas in Northern Ireland) to retail centres:** We take the average distance from output area centroids to retail centres within local areas to understand more about how far people are from

areas where cash prevalence is high. These distances are smaller in more urban local areas and typically for local areas with less output areas. These distances can be very large for local areas in much more rural settings, with increased travel distances and a sparser population.

- **Distance from retail centre to other retail centres:** In central urban areas, retail centres are typically nearby one another, and this results in cases where these values are small. Conversely, in more rural local areas, these distances can be much larger, as other retail centres are much further away.

Table 6: Summary statistics for local areas

	Minimum	Median	Mean	Standard Deviation	Maximum
No. of output areas (small areas in Northern Ireland)	1	22	29.2	24.2	258
No. Addresses	72	3,167	3,880	2,690	27,572
Population	89	6,969	8,426	5,920	61,895
Urban share of population	0	100	87.1	27.7	100
Approximate Average Age of population	23.3	40.8	40.6	4.9	65.7
Index of Multiple Deprivation	0	45.6	46	23.2	99
No. of bricks and mortar branches of larger banks and building societies offering PCA	0	0	0.5	1.5	12
No. mobile bank branches	0	0	0.1	0.6	23
No. Free-to-use ATMs	0	3	4.9	7.1	92
No. Pay-to-use ATMs	0	1	1.4	1.9	48
No. Post Offices	0	1	1.5	2	27

Free-to-use deposit points within 1mi	15.4	100	95	10	100
Free-to-use deposit points within 3mi	66.7	100	99.7	1.6	100
Free-to-use withdrawal points within 1mi	37.7	100	96.6	7.8	100
Free-to-use withdrawal points within 3mi	66.7	100	99.8	1.4	100
Mean distance from output areas (small areas) to retail centres (miles)	0.05	0.37	0.67	0.84	16.80
Distance from retail centre to next nearest retail centre (miles)	0.05	0.42	0.91	2.20	103.18
Mean distance from retail centre to next five nearest retail centres (miles)	0.20	0.82	1.75	3.26	132.45

Source: Bank and building society data, Post Office data, LINK data, ONS data, FCA analysis

Grouping local areas

Our approach

- 4.10 Once we generated our local areas, described in Table 6, we then sought to cluster them into groups with similar characteristics. The aim of this clustering is to generate a model that helps us to draw clear distinctions in provision and characteristics across different types of local areas.
- 4.11 This approach is not aimed at producing a general description of areas within the UK, but to illustrate current access to cash provision at a more local level than we produce coverage figures at. This approach is not intended to reveal an underlying

“true” structure of areas and their associated cash provision, as this is relative to an individual’s perception and behaviour.

4.12 The characteristics we used to cluster were:

- Number of output areas (small areas in Northern Ireland)
- Total population
- Number of residential addresses (proxy for number of households)
- Proportion of urban output areas (small areas in Northern Ireland) i.e., share of urban population
- Coverage of free cash withdrawal access points at 1 mile and 3 miles²³
- Coverage of free cash deposit access points at 1 mile and 3 miles²⁴
- Mean distance from output areas (small areas in Northern Ireland) to retail centres within local areas
- Distance from retail centre to next closest retail centre
- Mean distance from retail centre to the 5 next closest retail centres

4.13 The number of output areas (small areas in Northern Ireland), total population, and the number of residential addresses within local areas are positively correlated with one another.²⁵ Including these variables in our groupings allows us to distinguish between local areas that have a large number of output areas, say where many people live and other retail centres are far away, versus areas that have a lower number of households and perhaps are located near multiple high streets.

4.14 The proportion of urban output areas (small areas in Northern Ireland) in local areas is useful to include given there is a known difference in cash coverage between urban and rural areas.

4.15 Coverage of free cash withdrawal access points and free cash deposit access points at 1 and 3 miles is used to distinguish between areas with higher and lower levels of free cash provision. The distances used are those set out by HMT in the Cash Access Policy Statement.

4.16 The median distance from output area centroids (small area centroids in Northern Ireland) to retail centres helps us understand distances people must travel for cash services within local areas. In more rural local areas, these distances will generally be larger.

4.17 Distances from the retail centre that defines a local area to retail centres in other local areas are useful to differentiate between highly concentrated urbanity where other retail centres are nearby, versus areas that may contain a local high street but other retail centres are much further away.

4.18 Other factors could have been included in our clustering. We chose to omit the number of access points within local areas in favour of coverage. This is as when included alongside coverage statistics, which are a function of cash point location, the additional impact of including this did not contribute to a meaningful improvement given our aims and led to less interpretable results. This also reflects that in denser urban areas nearby alternatives may be a very short distance away in distance and travel time, albeit provided by access points in a different local area.

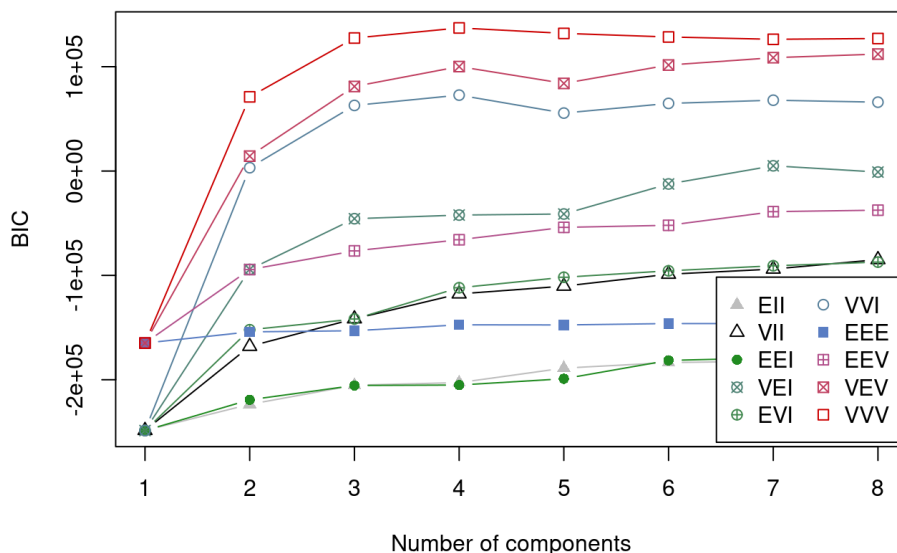
²³ This includes all free-to-use cash access points (excluding cashback)

²⁴ This includes larger banks and building societies providing PCA and Post Office: all branches, including mobile..

²⁵ Local areas in our approach comprise a collection of output areas (small areas in Northern Ireland). Output areas (small areas in Northern Ireland) are defined by the number of households/population in an area, and so are smaller in geographical size in areas where population density is high.

- 4.19 We applied an unsupervised learning method known as a Gaussian mixture model ('GMM').²⁶ This is a probabilistic model that assumes observations (in our case, local areas) are generated from a mixture of a finite number of Gaussian distributions with unknown parameters. In practice, that means that local areas fit roughly into one of a few 'types' with some variation within each type – which corresponds to the intuition that say inner urban areas are likely to have different characteristics and provision to outlying rural ones. Importantly, this algorithm is fit in a data-based way, rather than having the rules defining the areas chosen by human input.
- 4.20 In a GMM, the parameters of the distributions are fit using the expectation-maximization ('EM') algorithm. However, at times, maximum likelihood estimation ('MLE') using the EM algorithm may fail due to singularities or degeneracies. To circumvent this issue, we use the maximum a posteriori ('MAP') estimator instead of the MLE, alongside a modified version of the Bayesian Information Criterion ('BIC'), where the likelihood is evaluated at the MAP as opposed to the MLE for the model parameterization and choosing the number of components.²⁷
- 4.21 Initialisation of the EM algorithm is performed using the partitions obtained from agglomerative hierarchical clustering.
- 4.22 Figure 2 shows the BIC versus the number of components under this approach, and we see that this is maximised for four clusters under a varying shape, volume, and orientation specification. This is the model for which we describe results in Section 5.

Figure 2: BIC for the local area dataset



Source: Bank and building society data, Post Office data, LINK data, ONS data, FCA analysis

Limitations

- 4.23 Local areas are diverse and idiosyncratic. Many will not fall neatly into one of our groupings. Gaussian mixture models fall into the category of soft clustering algorithms in that each local area will be assigned a probability of falling into one of our clusters. Using this method, as compared to a hard clustering algorithm, allows

²⁶ For further details on this model, see Hastie et al., 2009, p.214 & p.275

²⁷ See Fraley, C., Raftery, A. Bayesian Regularization for Normal Mixture Estimation and Model-Based Clustering. *Journal of Classification* **24**, 155–181 (2007). <https://doi.org/10.1007/s00357-007-0004-5>

us to retrieve how uncertain we are that a given local area falls within a given cluster, thus recognising cases where it is not clear which cluster a given local area should be assigned to.

- 4.24 This approach and the variables selected may result in some local areas being categorised in a way that does not match intuition. In these cases, it might be that the local area could easily be assigned to a different cluster in slightly different circumstances.

Robustness checks

- 4.25 As an initial step in determining if clustering was a reasonable approach, we carried out a Hopkins test on the data which compares to a uniform distribution. In this test we rejected the null hypothesis, meaning that there is evidence that the data is non-equally spaced. This indicates clustering tendency in the data.
- 4.26 To conduct our clustering we made several methodological choices. We could have made different decisions which may have changed our results.
- 4.27 One of these was our choice of the unsupervised learning algorithm. There are several methods which are used in the literature and could have been applied in this case. We tested our approach using two of these and found that:
- DBSCAN tended to produce a very uneven number of local areas in each cluster, which is not very helpful in our case given the policy context
 - K-means can be viewed as a specific case of GMMs. In the k-means case, we considered a wide range of measures for determining the optimal number of clusters, for example silhouette score, the SD index, the Dunn index, and the Gap statistic
- 4.28 Another choice was regarding the number of groups in which to cluster our local areas. We tested several different cluster sizes but ultimately decided on four as:
- Two clusters did not seem to add much information beyond a simple rural / urban split.
 - The BIC (see above) was maximised in the four-cluster solution.
 - From a policy and applicability perspective, it's helpful to explain local areas in a small number of groupings; the clusters might be quite unintuitive and hard to apply if we had chosen a larger number e.g., 20.

5 Empirical findings

- 5.1 Based on the clustering analysis, the 7,960 local areas are grouped into four different archetypes based on their characteristics. Details on these are outlined below.
- 5.2 These archetypes reflect a data driven approach to grouping local areas based on current provision and characteristics. As cash demand and supply develops over time, local area archetypes may change in response. As such we will seek to update our analysis over time to ensure it remains true to the state of cash access in the UK.
- 5.3 Details of each archetype are outlined and compared in the rest of this section.

Archetype A – Urban centres

- 5.4 Archetype A is the largest archetype with 4,336 local areas accounting for 39% of the UK population. Generally, these are more urban areas, with populations living closer to retail centres and with smaller, denser populations. Coverage for deposit and withdrawal facilities at 1 mile is very high at 100% on average for both free-to-use deposit and withdrawal access points. This reflects greater population density and relative closeness to other local areas with facilities that are still within easy access. Although they tend to have less access points compared to other local areas, the provision per head of population is generally higher.

Table 7: Summary statistics for Archetype A

	Minimum	Median	Mean	Standard Deviation	Maximum
No. of output areas (small areas in Northern Ireland)	1	16	18	10.2	74
No. Addresses	72	2,430	2,688	1,477	10,113
Population	89	5,441	5,995	3,433	23,488
Urban share of population	100	100	100	NA	100
Approximate Average	23.3	38.3	38.5	4.3	65.7

Age of population					
Index of Multiple Deprivation	0	34.6	38.2	22.7	99
No. of bricks and mortar branches of larger banks and building societies offering PCA	0	0	0.5	1.6	12
No. mobile bank branches	0	0	0	0	1
No. Free-to-use ATMs	0	2	4.3	7.4	86
No. Pay-to-use ATMs	0	1	1.3	1.8	48
No. Post Offices	0	1	0.6	0.7	6
Free-to-use deposit points within 1mi	99.6	100	100	0	100
Free-to-use deposit points within 3mi	100	100	100	NA	100
Free-to-use withdrawal points within 1mi	99.7	100	100	0	100
Free-to-use withdrawal points within 3mi	100	100	100	NA	100

Mean distance from output areas (small areas) to retail centres (miles)	0.05	0.26	0.28	0.11	0.85
Distance from retail centre to next nearest retail centre (miles)	0.05	0.33	0.37	0.18	1.46
Mean distance from retail centre to next five nearest retail centres (miles)	0.20	0.61	0.65	0.24	1.70

Source: Bank and building society data, Post Office data, LINK data, ONS data, FCA analysis

Archetype B – Urban fringes

Archetype B accounts for 1,322 local areas and 19% of the UK population. Like Archetype A they are more urban, but residents are typically twice as far in distance from a retail centre and have almost double the population. Whilst coverage levels for deposit and withdrawal facilities are lower than Archetype A, coverage is still very high at 98.2% and 99.2% on average for free-to-use deposit and withdrawal access points within 1 mile, respectively. Local areas in this archetype tend to have more access points of all types than Archetype A, particularly so in the case of Post Offices, but provision per head is generally lower.

Table 8: Summary statistics for Archetype B

	Minimum	Median	Mean	Standard Deviation	Maximum
No. of output areas (small areas in Northern Ireland)	2	36	42.8	29.4	243
No. Addresses	536	3,952	4,616	2,608	17,343
Population	712	8,368	9,721	5,769	43,985
Urban share of population	81.1	100	97.5	3.6	100
Approximate Average Age of population	24.4	41.7	41.5	4.3	59.8
Index of Multiple Deprivation	0	48.7	49.8	21.9	97.6
No. of bricks and mortar branches of larger banks and building societies offering PCA	0	0	0.6	1.6	12
No. mobile bank branches	0	0	0	0.2	3
No. Free-to-use ATMs	0	4	5.8	7.9	92
No. Pay-to-use ATMs	0	1	1.6	2.1	35

No. Post Offices	0	1	1.3	1.1	8
Free-to-use deposit points within 1mi	86.9	99.2	98.2	2.3	100
Free-to-use deposit points within 3mi	99.8	100	100	0	100
Free-to-use withdrawal points within 1mi	91.8	100	99.2	1.3	100
Free-to-use withdrawal points within 3mi	99.8	100	100	0	100
Mean distance from output areas (small areas) to retail centres (miles)	0.09	0.48	0.51	0.23	1.53
Distance from retail centre to next nearest retail centre (miles)	0.07	0.50	0.60	0.38	2.79
Mean distance from retail centre to next five nearest retail centres (miles)	0.28	1.05	1.19	0.58	3.64

Archetype C – Mixed urban rural

5.5 Archetype C accounts for 1,620 local areas and 28% of the population. Population sizes tend to be larger than that of Archetype B and are more rural. On average, residents are approximately twice as far from a retail centre. Coverage at 1 mile is generally lower at 86.8% for deposit facilities and 92.3% for withdrawal facilities on average. Average provision is slightly lower than Archetype B both in terms of number of cash access points and provision per head, although there is an increased reliance on Post Offices compared to the more urban archetypes.

Table 9: Summary statistics for Archetype C

	Minimum	Median	Mean	Standard Deviation	Maximum
No. of output areas (small areas in Northern Ireland)	1	32	36.1	20.7	136
No. Addresses	236	4,871	5,396	3,095	20,795
Population	281	10,492	11,696	6,797	46,670
Urban share of population	0	72.4	60.5	34.8	100
Approximate Average Age of population	25.9	43.7	43.8	3.7	58.4
Index of Multiple Deprivation	1.7	62	59.6	19.2	99
No. of bricks and mortar branches of larger banks and building societies	0	0	0.4	1.2	8

offering PCA					
No. mobile bank branches	0	0	0.1	0.4	3
No. Free- to-use ATMs	0	3	4.8	5.4	76
No. Pay-to- use ATMs	0	1	1.3	2	36
No. Post Offices	0	2	2.5	2.1	17
Free-to-use deposit points within 1mi	15.4	89.5	86.8	11.3	100
Free-to-use deposit points within 3mi	99.8	100	100	0	100
Free-to-use withdrawal points within 1mi	49.7	94.3	92.3	8.2	100
Free-to-use withdrawal points within 3mi	99.8	100	100	0	100
Mean distance from output areas (small areas) to retail centres (miles)	0.09	0.98	1.13	0.62	3.82
Distance from retail centre to next nearest	0.07	0.70	1.18	1.27	7.68

retail centre (miles)					
Mean distance from retail centre to next five nearest retail centres (miles)	0.39	2.03	2.57	1.78	9.52

Source: Bank and building society data, Post Office data, LINK data, ONS data, FCA analysis

Archetype D – Rural

- 5.6 Archetype D accounts for 682 local areas and 14% of the population. These local areas have larger populations that are more dispersed, more rural and residents are further in distance from retail centres. These areas contain more cash access points of all types than all other archetypes but provision per head is broadly similar to Archetype C. The exception to this is Post Offices where absolute and per head provision is much greater, reflecting a greater reliance on these access points. Although provision per head is similar to other archetypes, coverage at 1 mile is generally lower at 76.3% for deposit and 80.4% for withdrawal facilities on average. This reflects the more rural nature of these local areas and longer distances consumers must generally travel for services of all types.

Table 10: Summary statistics for Archetype D

	Minimum	Median	Mean	Standard Deviation	Maximum
No. of output areas (small areas in Northern Ireland)	6	47	57.7	37.6	258
No. Addresses	572	5,747	6,429	3,557	27,572
Population	940	11,948	13,602	8,187	61,895
Urban share of population	0	55	47.5	39.7	100
Approximate	33.7	45.4	45.1	3.6	56

Average Age of population					
Index of Multiple Deprivation	6.9	56.2	56.1	15.2	95.2
No. of bricks and mortar branches of larger banks and building societies offering PCA	0	0	0.9	1.6	9
No. mobile bank branches	0	0	0.8	2	23
No. Free-to-use ATMs	0	5	6.8	6.4	54
No. Pay-to-use ATMs	0	1	1.4	1.8	17
No. Post Offices	0	4	4.7	3.6	27
Free-to-use deposit points within 1mi	19.1	78.4	76.3	12.8	100
Free-to-use deposit points within 3mi	66.7	98.7	96.8	4.7	100
Free-to-use withdrawal points within 1mi	37.7	82.2	80.4	12.3	100
Free-to-use withdrawal points within 3mi	66.7	99.2	97.4	4.3	100

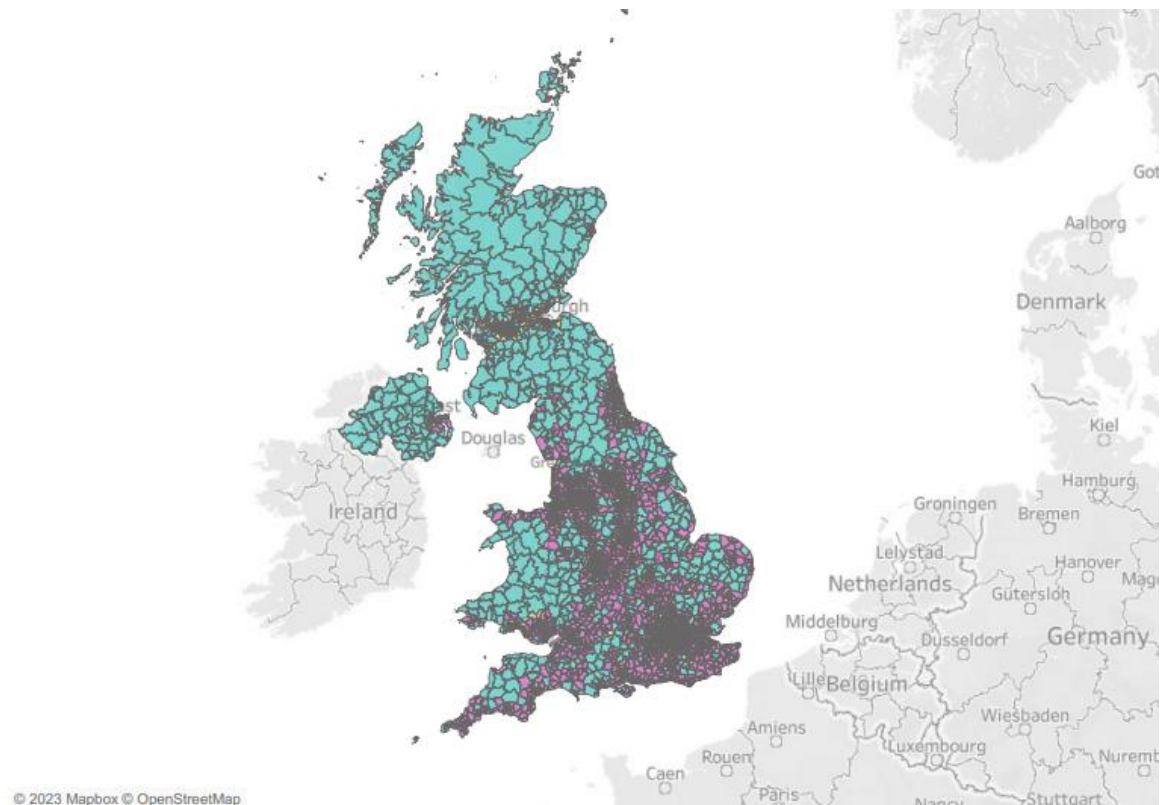
Mean distance from output areas (small areas) to retail centres (miles)	0.27	2.05	2.42	1.63	16.80
Distance from retail centre to next nearest retail centre (miles)	0.07	2.62	4.33	6.18	103.18
Mean distance from retail centre to next five nearest retail centres (miles)	0.55	6.79	7.94	8.23	132.45

Source: Bank and building society data, Post Office data, LINK data, ONS data, FCA analysis

Archetype comparison

- 5.7 The distribution of these archetypes across the UK is shown in Figure 3. Generally, these reflect differences in less or more urban areas alongside other characteristics based on the variables outlined above.
- 5.8 In Figure 3, Archetype D (coloured in turquoise) stands out on the UK-wide map. This illustrates that these areas are generally larger in size than other archetypes, with residents having to travel further for services on average. Archetype C (coloured in pink) and Archetype B (coloured in yellow) are also visible on the UK-wide map, albeit with the local areas in Archetype B being notably smaller in geographical size. Archetype A requires zooming in to central urban locations, usually near city centres where cash coverage levels are high. Local areas in Archetype A are often clustered in these concentrated urban environments, with high population density and smaller distances to cash services.

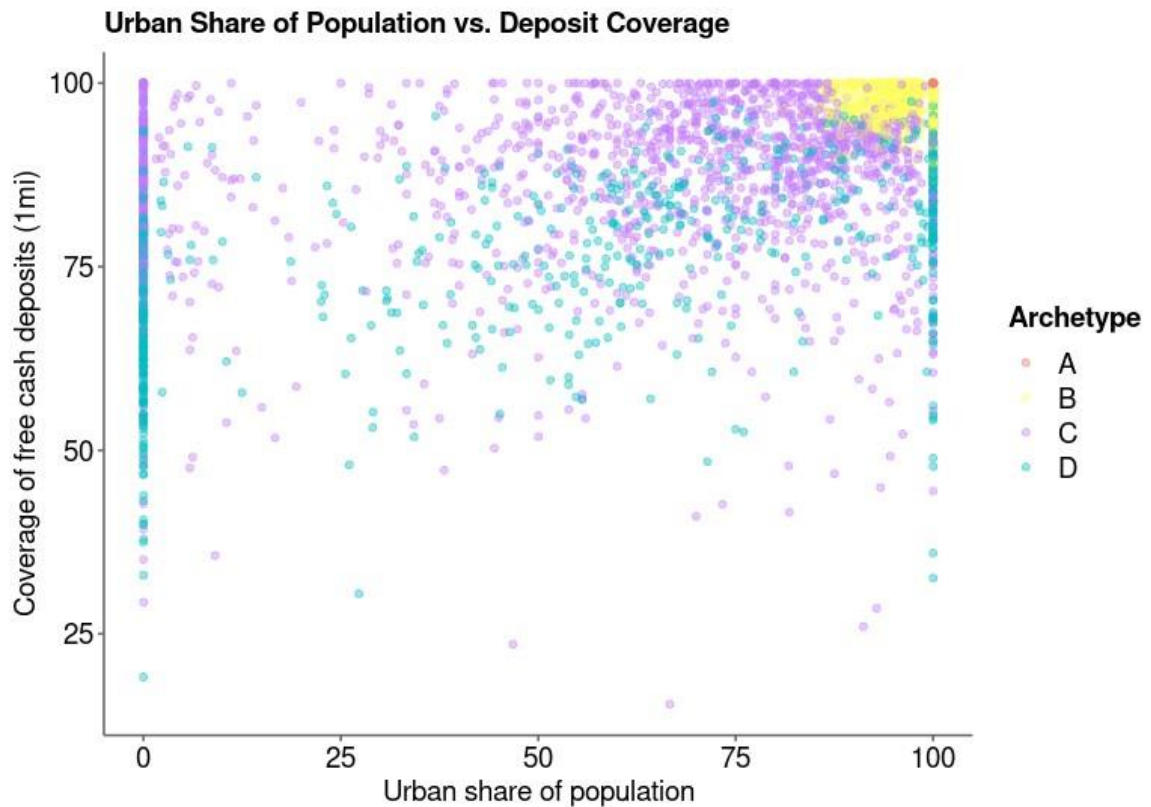
Figure 3: Distribution of local area archetypes across the UK



Source: Bank and building society data, Post Office data, LINK data, ONS data, FCA analysis

- 5.9 Figures 4 and 5 show the relationship between different local area characteristics. Each point represents a local area, and these are coloured by archetype. This provides a visual representation of the general trends of these characteristics in each archetype.
- 5.10 Figure 4 plots each local area's percentage of urban output areas (small areas in Northern Ireland) versus its coverage of free cash deposit access points at 1 mile. There is a positive correlation between these two local area characteristics, meaning that higher levels of urbanity in local areas are associated with higher levels of free cash deposit coverage at 1 mile.
- 5.11 In Figure 4, local areas in Archetypes A and B are concentrated in the top right-hand corner, where free cash deposit coverage at 1 mile is high (points that are high in the graph) as well as the urban share of population in the local area (points that are rightward in the graph).
- 5.12 Local areas in Archetypes C and D are more dispersed in Figure 4. This illustrates that these archetypes generally have more rural characteristics (points that are more leftward in the graph) and lower levels of coverage (points that are lower in the graph) than Archetypes A and B.

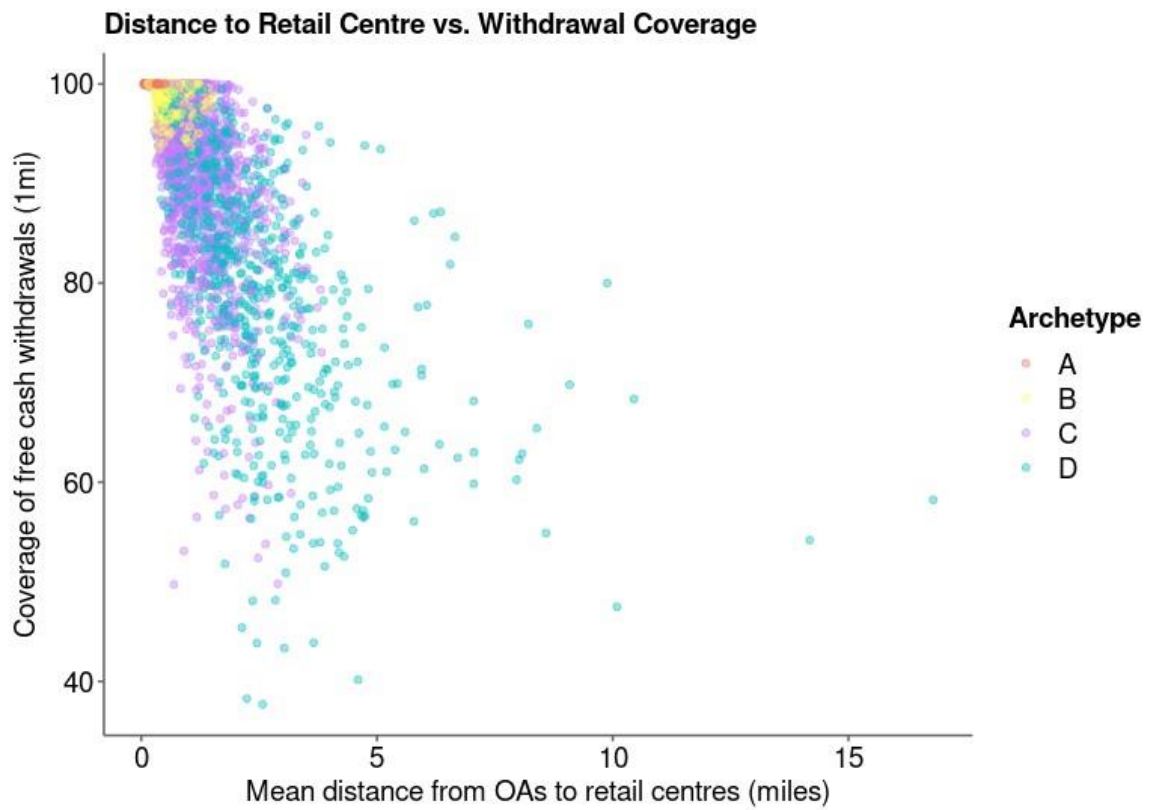
Figure 4: Urban share of population vs. Cash deposit coverage at 1 mile in local areas, coloured by archetype



Source: Bank and building society data, Post Office data, LINK data, ONS data, FCA analysis

- 5.13 Figure 5 plots each local area's mean distance from output areas (small areas in Northern Ireland) to retail centres within local areas versus its coverage of free cash withdrawal access points at 1 mile. There is a negative correlation between these two local area characteristics, meaning that larger mean distances from output areas (small areas in Northern Ireland) to retail centres in local areas are associated with lower levels of free cash withdrawal coverage at 1 mile.
- 5.14 In Figure 5, local areas in Archetypes A and B are clustered in the top left corner where free cash withdrawal coverage at 1 mile is high (points that are high in the graph) and the average distance from output areas to retail centres is low (points that are leftward in the graph).
- 5.15 Local areas in Archetypes C and D are much more spread out in Figure 5, with greater travel distances to retail centres (points that are more rightward in the graph) and lower coverage levels on average (points that are lower in the graph).

Figure 5: Mean distance from output area centroids to retail centres vs. Cash withdrawal coverage at 1 mile in local areas, coloured by archetype



Source: Bank and building society data, Post Office data, LINK data, ONS data, FCA analysis