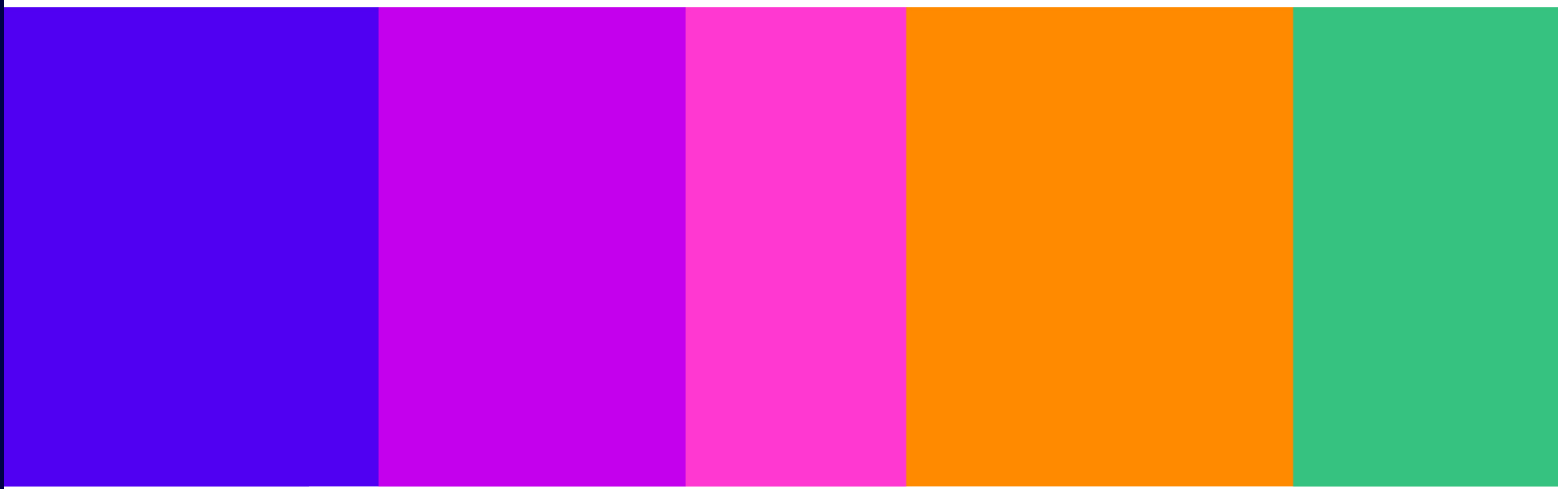


Monitoring Consumer Outcomes in the Mobile Sector

Research report

Report:

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Overview

In December 2022, Ofcom published the conclusions of its strategic review of its approach to mobile markets and spectrum (the “Mobile Strategy Paper”).¹ In that paper, we set out an aim to step up our work to monitor how well mobile markets are functioning and whether they continue to deliver good outcomes for consumers in light of the technological and market developments expected over the medium term.²

We also highlighted what we considered to be the important market outcomes for consumers, and mechanisms to achieve favourable market outcomes.³ Specifically, these outcomes relate to the prices of mobile services, network quality and innovation, with a particular focus on the services received by vulnerable customers. The primary mechanisms to deliver favourable market outcomes overall are competition among mobile providers and customers making informed choices about services and providers.

Our approach

In this research report, we set out an exploratory analysis of some of these market outcomes and mechanisms using customer-level data. We do this for residential customers covering the period from January 2019 to June 2023. We gathered the customer-level data from the main Mobile and Virtual Mobile Network Operators (MNOs/MVNOs, henceforth “mobile providers”).⁴ We present indicators that we plan to monitor going forward, which, alongside other evidence, will enable us to better understand outcomes and mechanisms in the mobile sector. None of the indicators are intended to be determinative, but we expect them to provide insights into outcomes for different customer groups and the effective functioning of the mobile market.

The immediate objective of this report is to be transparent about how we intend to use the customer-level data to monitor the market on an ongoing basis. We will engage with stakeholders on this approach and, through this feedback, refine our approach to analysing the customer-level data. We will also invite suggestions on further types of analysis that we could conduct using the data to monitor mobile market outcomes. The analysis of the customer-level data will form part of the evidence base that we will use to monitor outcomes in the sector. We do not foresee this analysis leading to new regular Ofcom publications, but it may contribute to existing publication series and/or one-off publications. Importantly, while our analysis of customer-level data may inform policy in the mobile sector in the future, the analysis presented in this report is exploratory and may need to be refined further.

The customer-level data provides insights about mobile markets that are unavailable from other sources. For example, the data allows us to measure how much consumers spend on mobile services, assess how this relates to the characteristics of the underlying tariffs and to understand differences between consumer groups. In addition, the data captures a customer’s services usage, such as mobile data usage, which we can compare to their tariff allowance. Taken together, the

¹ [Ofcom’s future approach to mobile markets and spectrum](#), Ofcom, 6 December 2022.

² The Mobile Strategy Paper notably considered consumers in a broader sense than this paper, including residential and business customers, whereas this paper focuses exclusively on residential customers.

³ [Ofcom’s future approach to mobile markets and spectrum](#), Ofcom, 6 December 2022, p. 8, paragraph 3.4.

⁴ The data was collected in two tranches, the first of which covers the period from 2019 to 2021 and the second of which covers January 2022 to June 2023.

information on prices and usage enables new analysis comparing consumers' chosen tariffs to alternative tariffs available in the market. Geographic information in the data allows us to analyse how consumers' choice of provider relates to the mobile network in different areas.

There are some important limitations to the analysis presented in this report. First, the analysis is not comprehensive in the sense that there is a wide range of additional analyses that are possible using the customer-level data which may be relevant for monitoring mobile markets in the round. Second, the data underlying this analysis does not capture information about all relevant aspects of consumer experiences in the mobile sector, and only captures demographic information for pay-monthly customers. In particular, comprehensive information on the quality of the network experienced by consumers is not available. Third, the data we have collected data from mobile providers does not cover the whole market but represents roughly 90% of the UK's residential mobile customers.

Analysis of indicators and summary of findings

We looked at several indicators to monitor consumer outcomes. The analysis included in this report sets out some insights about the functioning of the market and consumer behaviour during the period from January 2019 to June 2023.

- Use of data: Consumers typically used a small share of their mobile data allowance. About 67% of customers did not use their full monthly data allowance at any point during their contract or PAYG tariff. The percentage of data allowance used declined for most consumers until the end of 2021 and stayed broadly flat at a low level after this. Underlying this overall trend was increasing mobile data usage but also increasing take-up of tariffs with higher allowances, with the allowances rising faster than usage in the first three years.
- Consumer spend: We find that average monthly spend gradually declined between 2019 and 2021, by around £2 (or 7%) (in nominal terms).⁵ After that period the analysis shows prices rising in early 2022 and early 2023 when monthly spend rose by around 5% and 7%, respectively. These increases were most likely due to the high inflationary environment resulting in high in-contract price rises but also potentially due to higher prices for new tariffs. We also analyse consumer spend while controlling for changing tariff characteristics, such as rising data allowances, and rising data usage. This provides a richer understanding of how much consumers paid for mobile services, including consumers of different demographic groups, and of the differences in spend associated with certain tariff features.
- Comparison of consumer choices to cheapest alternatives: We analysed the price differences between consumers' chosen tariffs and alternative tariffs in the market. We focused on customers with SIM-only contracts to exclude confounding factors associated with handsets.⁶ The average price difference considering alternative tariffs that would cover customers' peak usage was around £5.20 per month for out-of-contract customers in 2022. For customers who had started their contracts that year, the chosen tariffs were, on average, £4.75 more expensive per month than the cheapest

⁵ We measure monthly spend on mobile services as the total of all charges for handset & airtime contracts and the total of all airtime charges for SIM-only, pay-as-you-go (PAYG), and split contracts.

⁶ Customers on SIM-only contracts accounted for about 41% to 46% of all customers in the data depending on the year.

available alternative covering their peak usage.⁷ The price differences were higher for customers on higher data allowances.

- Differences between consumer segments: Some of the outcomes we observe differed between consumer segments. Most notably, older customers typically chose tariffs with a lower data allowance and tended to use a smaller share of this allowance than younger consumers. Furthermore, older consumers (those over 75) paid around £1.15 less per month, on average, for SIM-only mobile tariffs with the same observable characteristics than younger consumers (those under 25). We also looked at how much vulnerable consumers spend for mobile services but there were significant limitations with the available data and the results were mixed. We will consider the scope for improvements to this analysis in the future.

Our ongoing monitoring

We will continue to monitor mobile markets and expect our work to involve methodological refinements and additional analysis, both through our internal review and in response to comments from external stakeholders. We plan to conduct similar analysis using customer-level data that we will collect from mobile providers on an annual basis. We also plan to include statistics based on customer-level data in our regular publications, such as our [Pricing Trends for Communications Services](#) reports.

Structure of this report

The remainder of this report is structured as follows:

- We provide an overview of the customer-level data obtained from mobile providers and explain how we combine the data with complementary information from other sources;
- We present an analysis of the relationship between local customer shares and providers' predicted network coverage;
- We analyse customers' data allowances and usage to look at changes in the utilisation of data allowance over time and by different consumer groups;
- We analyse customer spend over time and differences in spend between consumer groups using regression analyses to control for tariff characteristics; and
- We compare the monthly prices of consumers' chosen tariffs to the cheapest alternative tariffs available to them, taking into account their chosen tariff's characteristics and their actual mobile data usage.

⁷ The corresponding median price differences for SIM-only customers were £3.50 at the end and £3.00 at the beginning of their contracts in 2022.

Overview of the customer level data

In this section, we describe the information we obtained from mobile providers. One of the key benefits of the customer-level data is that it allows us to reflect differences in outcomes between groups of consumers. In this section, as a backdrop to our analysis, we provide an overview of the proportion of consumers by tariff type (e.g. pay-monthly or PAYG) and by data allowance and we look at differences by customer age for pay-monthly customers.

Customer-level data obtained

We collected customer-level data on tariff choices and services used from mobile providers for residential customers covering the period from January 2019 to June 2023. We collected the data in two tranches: the first covering January 2019 to December 2021 and the second covering January 2022 to June 2023. For the first tranche of data, we collected information from BT, EE, O2, Plusnet, Sky Mobile, SMARTY, Tesco Mobile, Three, Virgin Mobile, Vodafone, and VOXI. For the second tranche, we expanded the number of providers in the data to also include giffgaff, iD Mobile, and Talkmobile.⁸ The providers included in the first tranche of data cover about 87% of the UK residential customers; those in the second tranche of data cover about 93%.

The data provided to Ofcom was anonymised and does not include information that would enable us to identify individuals (such as names, addresses, or phone numbers). While the data includes some demographics and customers' approximate home location, this information is sufficiently broad that individuals cannot be identified.

We obtained information for a 5% random sample of residential customers that were active at any point during the calendar years 2019, 2020, and 2021 in the first data tranche and those active at any point during the 18-month period in the second data tranche.⁹ For each customer in either tranche, we then obtained information for the entire period (to the extent available), irrespective of the year in which the customer was sampled. For example, if a customer was in the 2020 sample, for instance, we still obtained information for that customer for the calendar years from 2019 to 2021. If the customer had left the provider before the end of 2021 or started their first contract with the provider after January 2019, we obtained the information for the whole period of the tranche available. In total, the first tranche of the data from January 2019-December 2021 covers about 9.8 million customers and the second tranche from January 2022-June 2023 covers around 4.6 million customers.

Given the large sample, the customer-level data likely includes most of the tariffs offered by the above providers. It almost certainly covers all tariffs that have a meaningful level of take-up. This is important, because for some of the analysis in this report we rely on the customer-level data for information on which tariffs are available in the market.

⁸ Some of these brands no longer accept new customers or are in the process of being wound down. Subsequent data tranches will therefore not cover all these brands.

⁹ Customers were defined as individual subscribers (according to SIMs). This excludes business customers, to the extent possible.

The data requested broadly covers the following three areas:¹⁰

- **Contract/tariff history:** The data includes general information about a customer's contracts or Pay-As-You-Go (PAYG) bundles, including the start and end dates, contract type (e.g. SIM-only, handset & airtime, PAYG), minimum contract period (MCP), allowance of data/texts/voice minutes, and the monthly price. The data we requested also includes information on the mobile handset received as part of a handset & airtime bundle or split contract, such as the make and model of the handset. The second data tranche also includes information on whether the mobile tariff was bundled with other communications services, although most mobile tariffs are standalone tariffs.
- **Usage and charges information:** The data includes information about a customer's usage of mobile data, texts, and voice minutes and the charges incurred at a monthly level, for customers on pay-monthly and PAYG bundles. Customers on PAYG tariffs who did not purchase bundles are not covered. The usage of data, texts, and voice minutes is split between within-allowance and out-of-allowance usage, as are the associated charges.
- **Customer demographics:** The data includes information on the approximate location of a customer's address according to Lower-Layer Super Output Area (LSOA), year of birth of the lead account holder, and whether the provider classified the customer as vulnerable.¹¹ This information on customer demographics is only available for customers with pay-monthly contracts and not those on PAYG tariffs.

The information available for pay-monthly and PAYG contracts for each of the three areas also differs among mobile providers. Further details about this are summarised in Table 1 and Table 2 in the Annex.

Consumer mix by tariff characteristics

The tariffs chosen by consumers in the market reflect their individual preferences for mobile services. We look at the distribution of consumers along two key tariff characteristics: tariff type and data allowance.

Tariff type

At a high level, mobile subscriptions can be classified into pre-pay (i.e., PAYG) and post-pay (i.e., pay-monthly) tariffs. PAYG tariffs typically do not require the customer to enter into a contract with a MCP or to pass an associated credit check. They include traditional PAYG tariffs that require a pre-paid balance and deduct charges for services used from this balance. They also include "hybrid tariffs" that allow customers to purchase a 30-day allowance, from which used services are deducted, in addition to the traditional pre-pay feature for usage outside the allowance.¹² Pay-monthly tariffs, by contrast, require a contract over an MCP, although this can be as short as 30

¹⁰ The description of the data is not exhaustive and therefore only covers a subset of the variables, for which we received information.

¹¹ The second tranche of the data includes information on more granular geographic divisions called Output Areas (OA), which we aggregate to LSOAs for comparability over time. LSOAs and OAs are geographic divisions of the UK used for the UK Census and which are sufficiently broad to guarantee customers' anonymity for data protection purposes. LSOAs, for example, comprise of between 400 and 1,200 households and usually have a resident population of between 1,000 and 3,000 people. For more information, see [Census 2021 Geographies](#), Office for National Statistics.

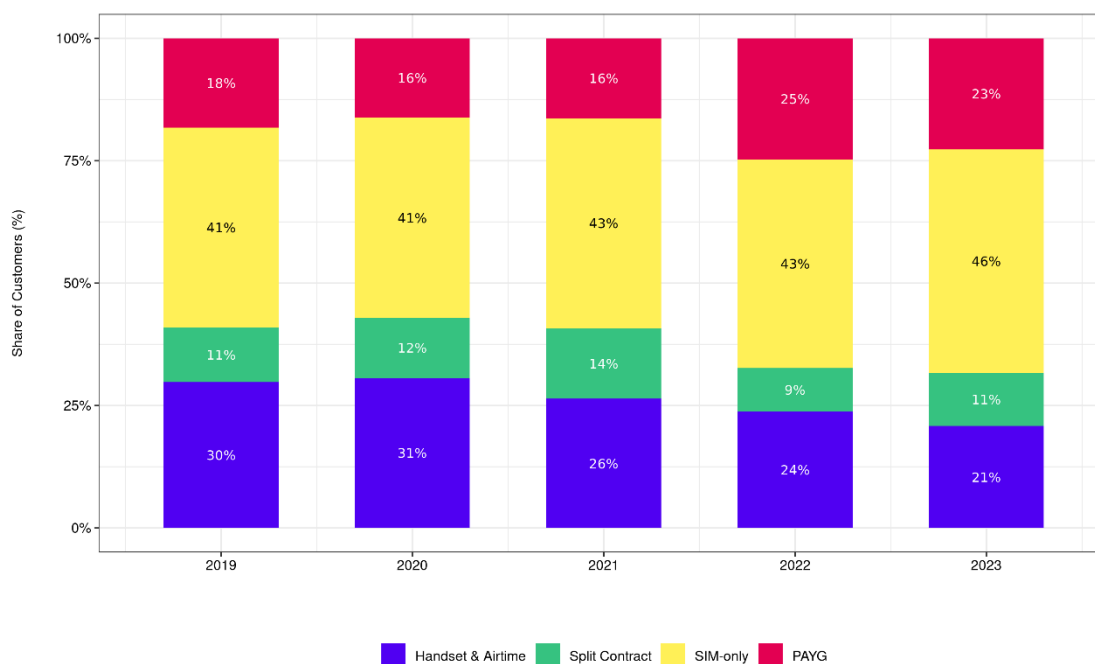
¹² This 30-day allowance may be recurring, but typically still involves a pre-payment of the services.

days, and they usually require a credit check. They typically involve billing customers in arrears for at least the out-of-allowance charges.¹³

Pay-monthly tariffs can be further divided into three different contract types: handset & airtime (combined) contracts, split contracts, and SIM-only contracts. Handset & airtime contracts are subscriptions that cover the handset and mobile services under a common contract with a single monthly recurring charge. Split contracts are subscriptions that include a handset but have separate contracts for the handset and mobile services and separate monthly recurring charges for each.¹⁴ Finally, SIM-only contracts are post-pay subscriptions that cover only mobile services and do not involve a handset.

Figure 1 shows the share of active customers in the data by tariff type on 30th June for each year from 2019 to 2023. PAYG customers accounted for a share of 23% in 2023. Monthly handset & airtime contracts became less common among customers, falling from 30% in 2019 to 21% in 2023. Over the same period, SIM-only became more common among consumers.

Figure 1: Contract-type share of pay-monthly and PAYG customers by year



Notes: Contracts active as of 30th June in 2019, 2020, 2021, 2022, and 2023. Figure likely understates the PAYG share as the data does not cover some providers that are prominent in terms of PAYG tariffs (especially for 2019 to 2021) and does not include PAYG customers that did not purchase PAYG bundles.

Data allowance

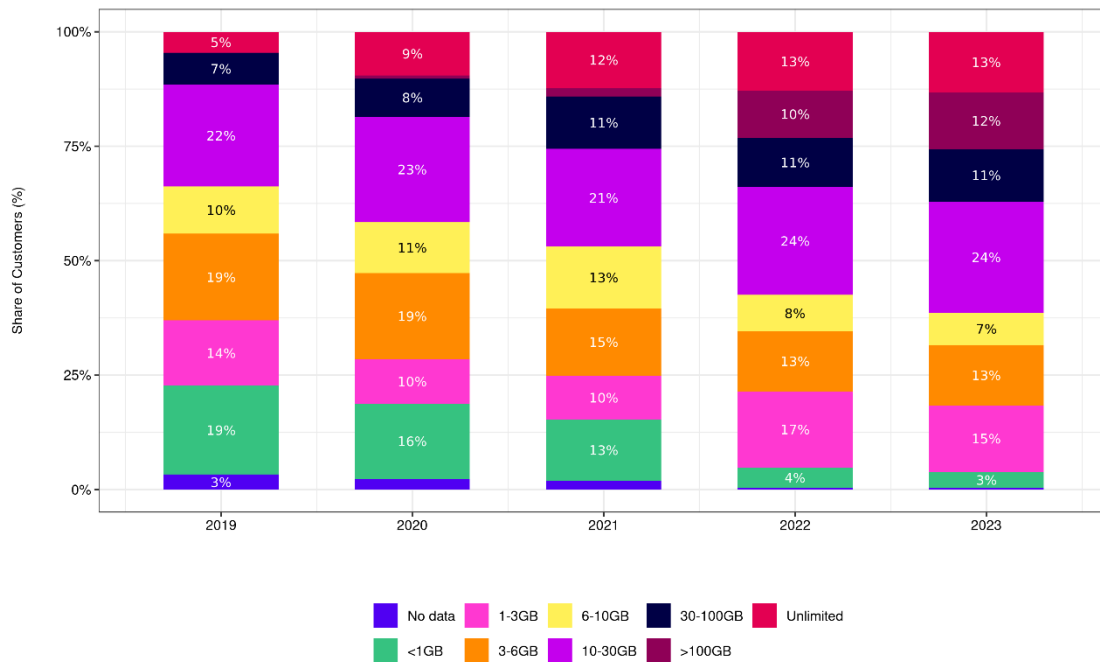
A key distinguishing feature between mobile tariffs is their monthly data allowance. Given the large number of tariffs available in the market and for ease of comparison, we group tariffs into data-allowance bands. Figure 2 shows the share of active customers by data allowance on 30th June for each year from 2019 to 2023. This figure includes both pay-monthly and PAYG customers. The

¹³ Pay-monthly tariffs may involve billing customers in advance for the monthly recurring charge but have at least some post-pay components, e.g., for out-of-bundle charges associated with services used.

¹⁴ These contracts may still be linked in the sense that the airtime tariff may not be available without the handset component (i.e., on a SIM-only basis).

customer-level data indicates that most customers selected a mobile tariff with at least some data allowance and that data allowances were increasing over time. For instance, customers on unlimited data-allowance tariffs made up just 5% in 2019 but represented 13% in 2023. Lower data-allowance packages became less common among customers over the same period.

Figure 2: Data-allowance share of customers by year



Notes: Contracts active as of 30th June in 2019, 2020, 2021, 2022, and 2023.

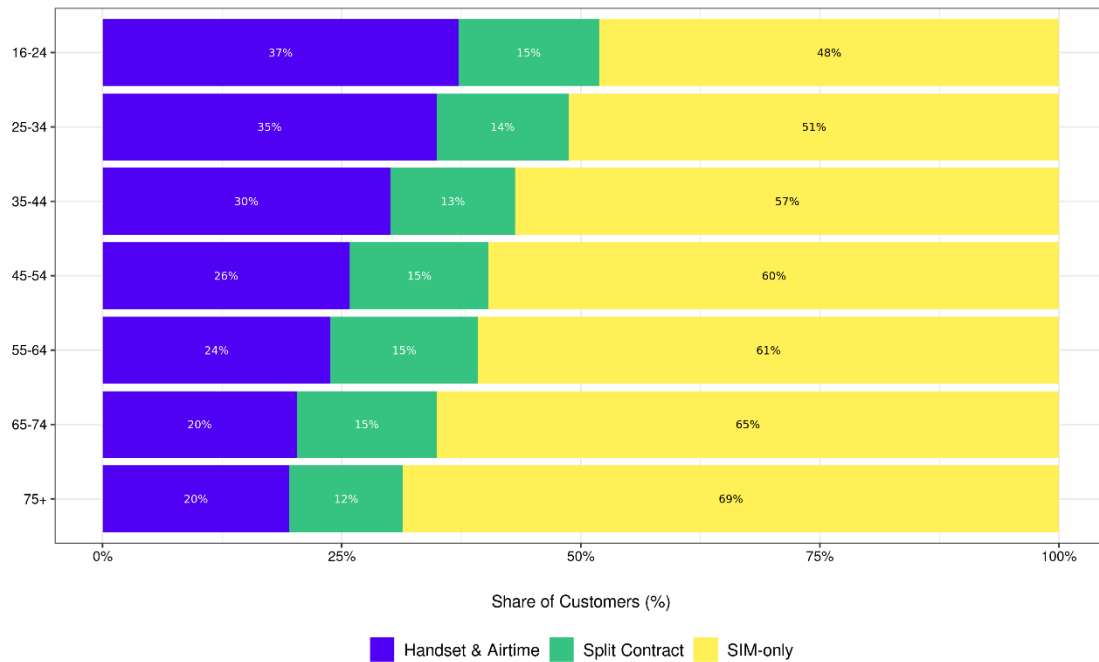
Tariff type and data allowance by customer age

The pay-monthly customer-level data further allows us to assess differences in consumer choices and market outcomes according to demographic characteristics. One such characteristic is a customer’s age.

Figure 3 shows the share of contract types selected by different age groups for pay-monthly contracts active as of 30th June 2023. The data indicates that older customers (those aged 65-74 and 75+) tended to opt for a higher proportion of SIM-only tariffs compared to younger customers. In contrast, younger customers (those aged 16-24 and 25-34) were more inclined to purchase handset & airtime or split contracts than older customers.¹⁵

¹⁵ This general pattern is consistent with findings from Ofcom’s Technology Tracker survey for 2023. See [Technology Tracker 2023 data tables](#), Ofcom, 8 June 2023, Table 41.

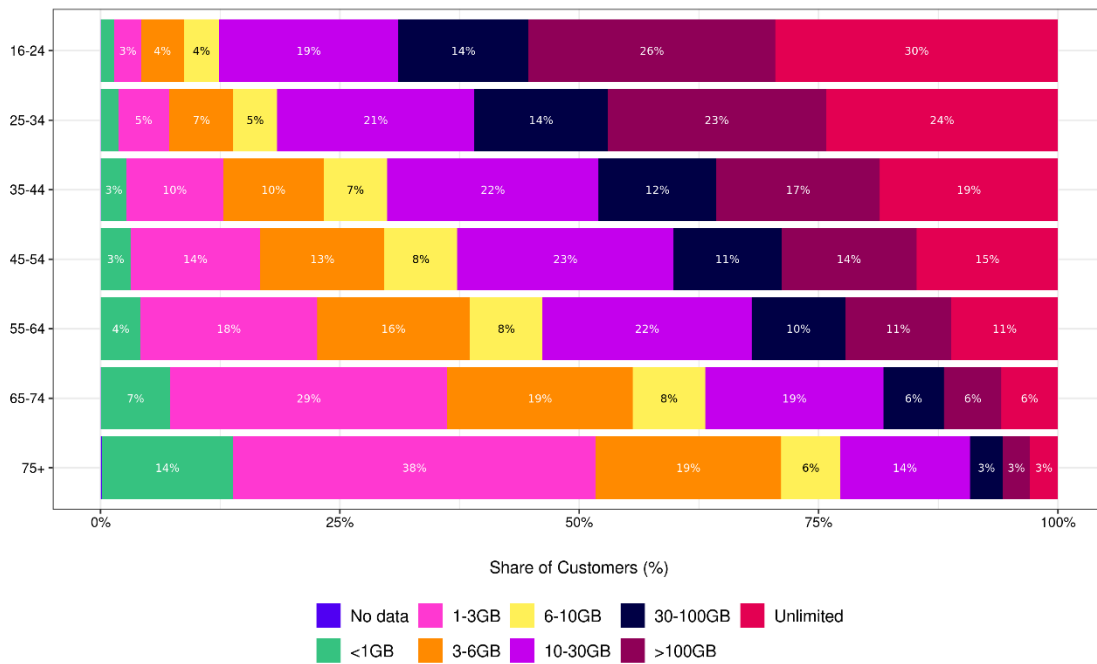
Figure 3: Contract-type share of pay-monthly customers by age group



Notes: Pay-monthly contracts active as of 30th June 2023.

Figure 4 provides information on data allowances selected by different age groups as of 30th June 2023. It shows that younger customers tended to choose tariffs with higher allowances and that older customers typically chose tariffs with lower allowances. Almost a quarter of customers in the 16-24 and 25-34 age groups, for instance, held tariffs with an unlimited data allowance. These customers were also more likely to purchase contracts with higher limited data allowances (>100 GB and 30-100 GB) compared to older customers. By contrast, less than 10% of customers in the 65-74 and 75+ age group held unlimited tariffs and more than half of customers who are 75+ held a tariff with a data allowance of less than 3 GB.

Figure 4: Data-allowance share of customers by age group



Notes: Pay-monthly contracts active as of 30th June 2023.

Local customer shares and providers' predicted coverage

Competition is an important mechanism for achieving desirable outcomes for consumers, but it depends on customers' responsiveness to differences or changes in the market. Mobile providers' incentives to compete on price or network quality rely on the extent to which consumers are aware of and value differences in network quality and then choose providers accordingly. In this section, we present an exploratory analysis that seeks to shed light on these incentives by studying the relationship between mobile providers' predicted network coverage and their share of consumers. A possible hypothesis would be for provider shares to be higher in areas in which the provider has better network coverage than competitors. We recognise that coverage is only one aspect of network quality and therefore do not expect the relationship between shares and predicted coverage to reflect the full importance of network quality.

The customer-level data for pay-monthly tariffs offer unique information to understand this relationship, because they include geographic details as determined by the customers' LSOA that can be linked to local data about the available mobile networks.¹⁶ For the analysis presented here, we compute providers' share of customers and their predicted network coverage by year and Local Authority District (LAD). We study the relationship between local provider shares and network coverage using regression techniques.

Ofcom collects predicted signal strength data from network providers across the UK for use in our annual Connected Nations reports and these reports also include established network coverage thresholds.¹⁷ We use this information to compute the following coverage metric for our analysis: the share of premises in each LAD where the provider's predicted signal strength exceeds the 4G coverage threshold.¹⁸ We recognise that providers' predicted coverage is not a comprehensive representation of network availability and, further, does not capture other key aspects of the mobile network that are important to consumers. Therefore, the analysis presented is only an indication of the type of work that we may pursue with the customer-level data on this topic rather than one that offers firm conclusions about the market at this stage.¹⁹

Figure 5 plots a provider's predicted network coverage against their share of customers in each LAD on 30th June of each 2022 and 2023.²⁰ Both variables are adjusted to control for provider-specific differences that may otherwise distort the relationship we are trying to understand. Some mobile

¹⁶ This geographic detail is not available for customers on PAYG tariffs.

¹⁷ [Connected Nations update](#), Ofcom, 24 April 2024

¹⁸ The threshold values are determined for 2G, 3G and 4G networks, by identifying the minimum signal strength required to make a 90 second telephone call successfully 98% of the time. In the case of 4G, the threshold definition also delivers a 95% chance of getting a download speed of at least 2Mbit/s in a given area. Please refer to paragraphs A1.37- A1.42 of Ofcom's [Connected Nations 2022 Annex 1: Methodology](#) for more details.

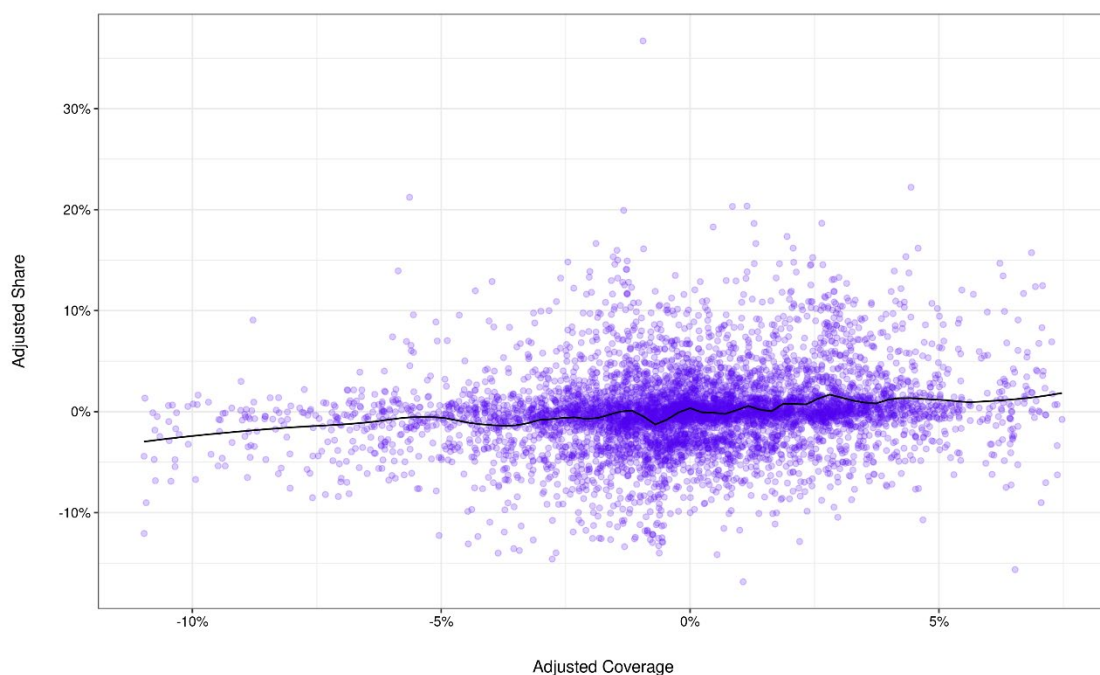
¹⁹ The data on network coverage, for example, may not reflect the features of mobile networks about which consumers care the most. Ofcom is currently exploring alternative measures that relate to network quality and may be better suited. Furthermore, the relatively simple methodology applied here may not be the most appropriate to uncover the extent to which consumers choices depend on the mobile network available for their tariff. We are also conducting further work to refine the analysis in this respect.

²⁰ We measure relative coverage as the difference between a provider's 4G coverage and the average coverage within the LAD across all four 4G mobile networks.

providers with lower network coverage in most LADs and years, for instance, may also have lower prices on average than their competitors. The lower prices for this provider would lead to higher shares of customers than we would expect purely based on the provider's network coverage. The adjustment we implement is one way of addressing several potential confounding variables like this in a simple fashion.

Figure 5 also shows the estimated relationship between the two variables as the best-fit curve from a local linear regression.²¹ We find that there was a weakly positive relationship between a provider's relative network coverage and their share of customers. This suggests that network coverage at the customer's home location may have played a role in their choice of mobile provider, although the positive relationship is not very pronounced.

Figure 5: Relationship between customer share and relative 4G coverage



Notes: Based on pay-monthly contracts active as of 30th June 2022 and 2023. This figure shows the central part of the distribution of predicted coverage. Each point represents a single provider's predicted network coverage and local share of customers, controlling for provider-specific differences, in a given LAD and year. The line plots the predicted values of a local linear regression between these variables.

We plan to build on this exploratory analysis of the relationship between consumer choices and network coverage in the future by exploring measures of network quality that may be more important to consumers than coverage. For example, factors such as bandwidth, download speed and the proportion of times that the connectivity meets the needs of the application being used could play an important role in determining a customer's experience when using a provider's network and could affect a customer's tariff choice. Finally, there are many factors in addition to network quality that contribute to tariff choices which we intend to look at in more detail.

²¹ Local linear regressions take small portions of the observations in turn and plot a best-fit line for these points, joining the lines fitted for many portions to create the best-fit curve shown. This allows us to view the non-linear relationship between relative coverage and customer share.

Data allowance and usage

Mobile tariffs in the UK typically feature an allowance of services (voice, text and data) that is provided in return for a monthly recurring charge. This has been the case for pay-monthly tariffs for over 25 years, but it has recently also become common among “hybrid” PAYG bundle tariffs, under which consumers buy an allowance of services. Allowances provide consumers with a degree of certainty over how much they will pay for mobile services and consumers may value such certainty even if allowances are not fully used. At the same time, if consumers consistently use only a small share of their allowance, even during peak-usage months, then they might arguably be paying for services they do not need and could pay less while using the same services on an alternative tariff.

We analyse customers’ mobile data usage and compare such usage to the allowance that is included with their tariffs by computing the utilisation of mobile data allowance.²² We focus on mobile data and do not include other services, such as text and voice. This is because the mobile market has shifted towards data, and there is less of an emphasis on text and voice as differentiating tariff features – over 75% of active contracts in 2023 had an unlimited allowance for voice and text. We look at data utilisation over time and by tariff and consumer characteristics including data allowance, mobile provider, and consumer age group. This analysis helps us learn about consumer experiences and outcomes that would otherwise have been masked in aggregate data. In our analysis, we find that mobile data usage tends to be consistently and substantially below the allowance limit.

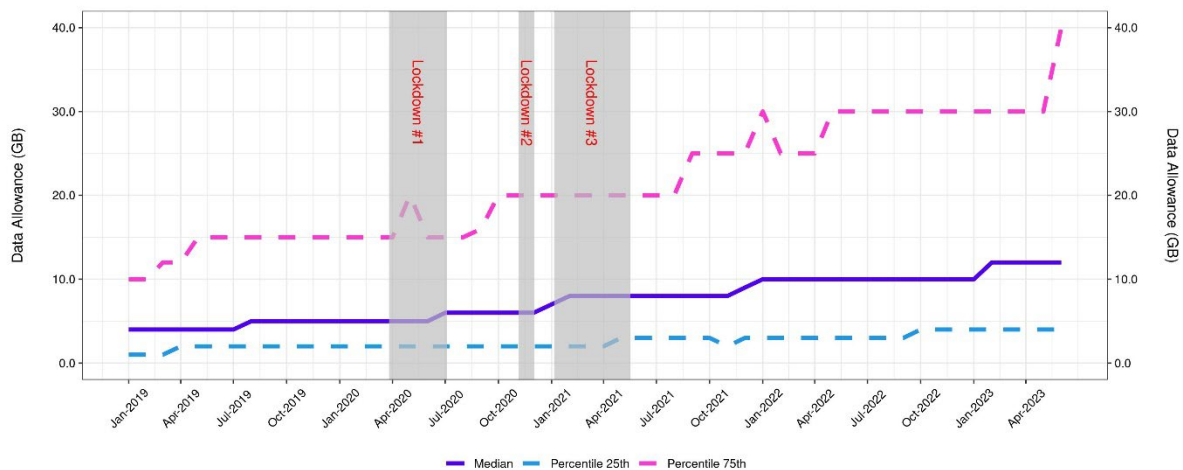
Mobile data allowance

We begin by investigating the evolution of data allowances included with customer tariffs. Data allowances are important as they give an indication of how much data consumers expect to need during their highest-usage months, even if they use less in most months.

Figure 6 shows the evolution of data allowances over time. To understand how allowances differ between consumers, we order consumers by the data allowance included in their tariff and looked at the data allowance for the median consumer and for the consumers at the 25th and 75th percentiles over time. For the median consumer, data allowance increased from 4 GB in January 2019 to 12 GB in June 2023, which is a threefold increase. Consumers at the 25th and 75th percentiles saw a greater increase compared to the median customer with a fourfold increase. Specifically, over the same period, data allowance increased from 10 GB to 40 GB for customers at the 75th percentile and from 1 GB to 4 GB for the consumers at the 25th percentile. Overall, the analysis shows that data allowances increased across the board and substantially for a large portion of consumers.

²² We define utilisation as the ratio between total data used and the standard in-bundle data allowance, excluding any additional data allowances. Utilisation may exceed 100% as mobile data usage can exceed the in-bundle data allowance.

Figure 6: Monthly data allowance from January 2019 to June 2023



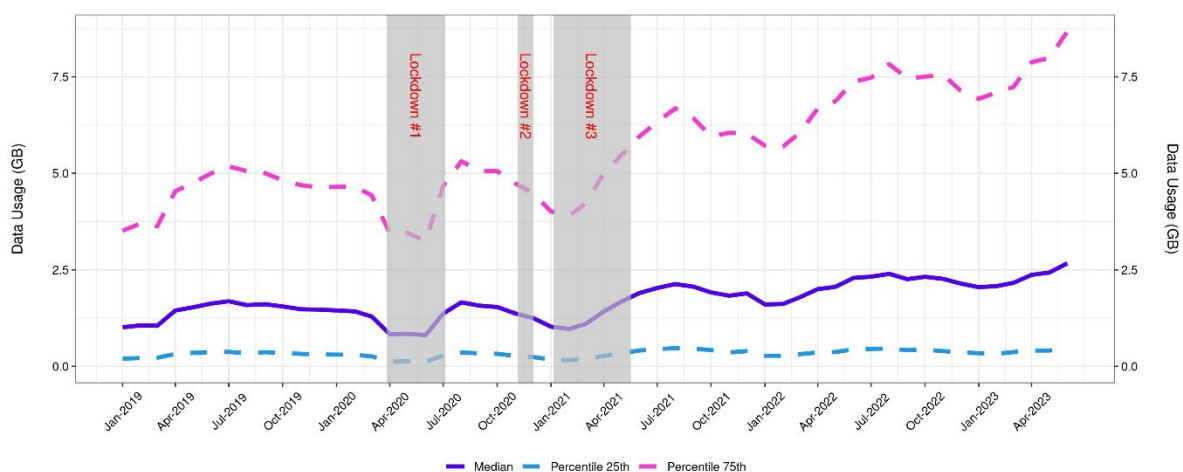
Notes: Information on data allowance is only available for part of this period for some providers. Please see Table 1 and Table 2 in the Annex for more information. Customers with unlimited or no data allowances are excluded from this analysis. Lockdown periods are shown for illustrative purposes as exact start and easing of restriction dates varied by nation.

Mobile data usage

Data usage over time

Next, we analyse mobile data usage. Figure 7 shows the evolution of data usage, considering again the median consumer and the consumer at the 25th and 75th percentiles. The median data usage more than doubled from about 1.0 GB in January 2019 to about 2.7 GB in June 2023. The 75th percentile showed a similar increase from around 3.5 GB to about 8.7 GB during the same period. The bottom quarter of the distribution also exhibited increases in data usage but to a much smaller extent.

Figure 7: Monthly data usage from January 2019 to June 2023



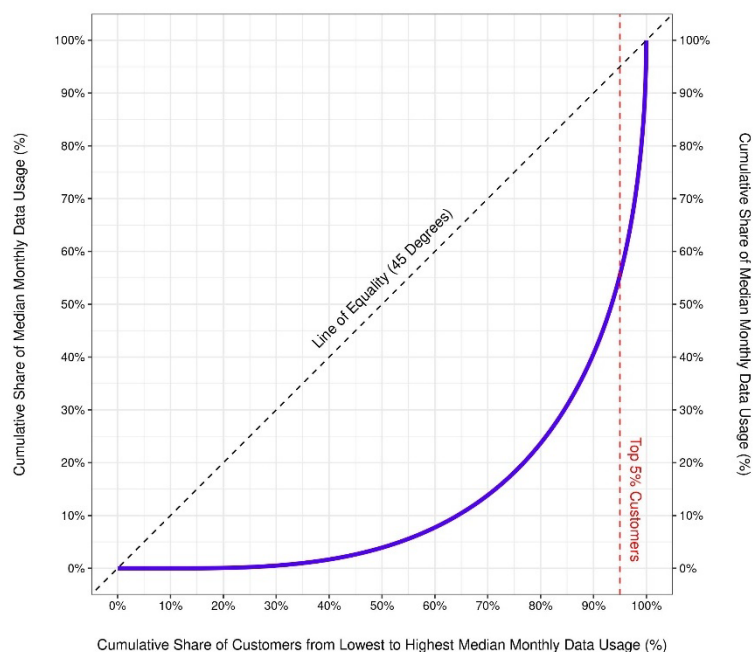
Notes: Information on data usage is only available for part of this period for some providers. Please see Table 1 and Table 2 in the Annex for more information. Customers with unlimited or no data allowances are excluded from this analysis. Lockdown periods are shown for illustrative purposes as exact start and easing of restriction dates varied by nation.

Data usage is highly skewed between consumers

Figure 7 indicates that the distribution of data usage is skewed. This reflects the fact that consumer preferences for mobile services depend on how they use their mobile devices and are potentially very diverse. We analyse this skewness of mobile data usage between customers further by plotting the so-called Lorenz curve in usage profiles – i.e., the cumulative share of customers across all the mobile providers ranked from the lowest to the highest median monthly data usage (on the horizontal axis) and the corresponding share of total data those customers account for (on the vertical axis).²³ The results confirm that there was considerable heterogeneity in consumers’ mobile data usage with a minority of consumers accounting for a disproportionate share of the total amount of data used. For example, the figure shows that between July 2022 and June 2023, the bottom 50% of customers accounted for under 5% of total data usage, whilst the top 5% of consumers accounted for more than 40% of total data usage. This result is similar to separate findings reflected in Ofcom’s Net Neutrality Review Statement from October 2023.²⁴

Underlying these shares are large differences in monthly data usage between customers. The median customer used about 2.6 GB of data per month. The top 5% of customers used at least 35.6 GB of data per month, while the bottom 25% of customers used less than 400 MB of data per month.

Figure 8: The distribution of median monthly data usage from July 2022 to June 2023



Notes: Based on the available data as indicated in Table 1 and Table 2 in the Annex. Customers with unlimited or no data allowances are included in this analysis.

²³ The Lorenz curve, named after Max O. Lorenz, is commonly used in economics to illustrate income or wealth inequality. Usage profiles are defined as the customer’s median monthly total data usage (in GB) over the course of their available billing history in the given time period. Total data usage is measured by the sum of in-bundled data allowance, additional out-of-bundle or roaming data allowances purchased, and allowances drawn from data piggy banks or gifted by family members or friends.

²⁴ [Net Neutrality Review](#), Ofcom, 26 October 2023, p.120, paragraph 9.27-9.28.

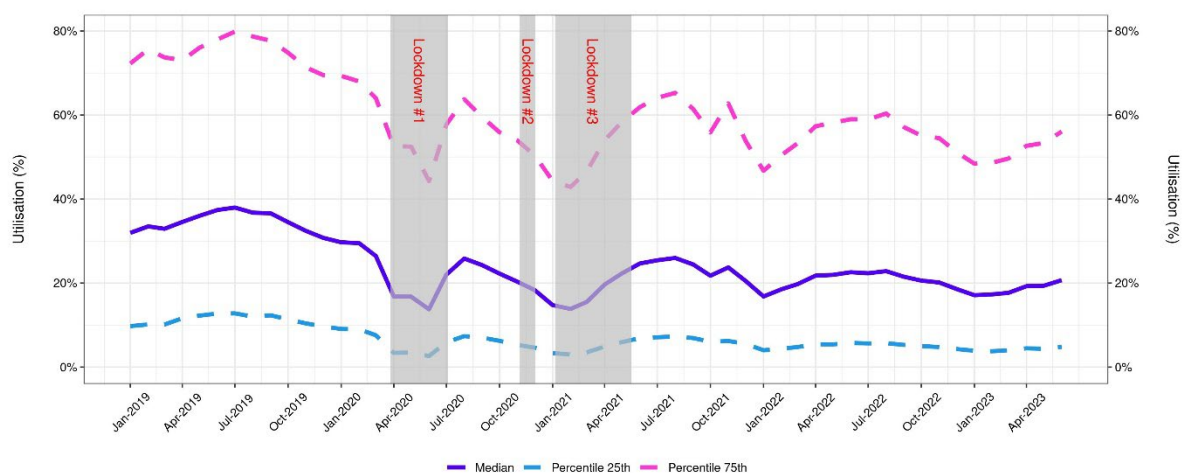
Mobile data utilisation

When signing up to a tariff, customers need to choose which data allowance would suit their needs. If they choose an allowance that is too low, they may face relatively high costs to purchase additional allowance or may be unable to use services that require mobile data. If they select allowances that are greater than their usage, this may mean they are paying for allowance they do not need. However, we recognise that customers may value some allowance buffer, even above peak usage, to account for unforeseen mobile data needs.

Mobile data utilisation over time

Figure 9 shows monthly data utilisation from January 2019 to June 2023 in terms of the median and the 25th and 75th percentiles. Overall, in any given month utilisation was low – more than 50% of consumers tended to use 40% or less of their monthly data allowance. About 67% of customers did not use their full monthly data allowance at any point during their contract or PAYG tariff. Over time, data utilisation was gradually declining up until the COVID-19 pandemic. Underlying this trend was the increase in both mobile data usage and allowances, with the latter having risen faster than the former. The utilisation of data allowance shows marked drops during the COVID-19 lockdowns and some seasonal fluctuation (higher during summer) but does not show a downward trend after the pandemic. The fluctuations in data utilisation are likely due to an increased use of Wi-Fi rather than mobile data during the lockdowns and more time spent away from home and offices during the summer months.

Figure 9: Monthly utilisation of mobile data allowance from January 2019 to June 2023



Notes: Information on data allowance and data usage is only available for part of this period for some providers. Please see Table 1 and Table 2 in the Annex for more information. Customers with unlimited or no data allowances are excluded from this analysis. Lockdown periods are shown for illustrative purposes as exact start and easing of restriction dates varied by nation.

Mobile data utilisation by tariff and consumer characteristics

The aggregate view of mobile data utilisation across all consumers masks important differences between them. To investigate these differences further, we focus on the last year in the data (i.e., July 2022 to June 2023) and consider utilisation rates separately by different tariff types and

consumer segments.²⁵ We focus on the last year of available customer-level data to exclude the fluctuations caused by COVID-19 pandemic lockdowns.

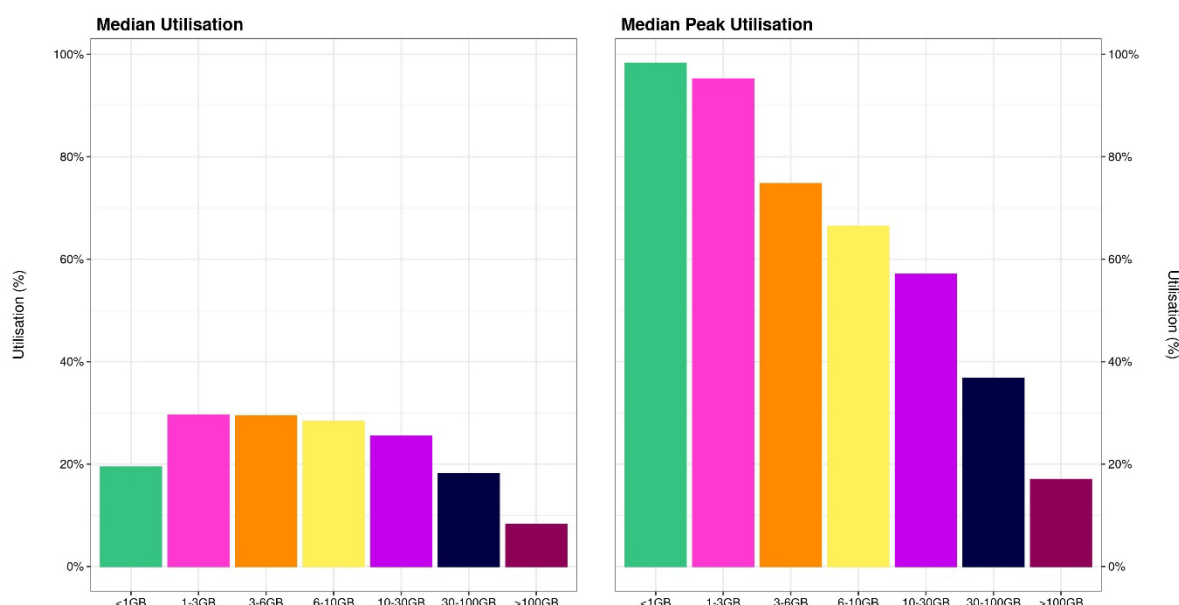
We consider two measures of utilisation of mobile data allowance for a given customer during this period: (i) the median monthly utilisation, and (ii) the peak-month utilisation. The latter measure is of interest because consumers’ data utilisation varies from month to month and they may choose a tariff whose allowance is sufficient to cover the highest-usage month. We measure peak utilisation as the utilisation of the month with the highest usage for a given tariff during the period July 2022 to June 2023.

Once we have the profiles of sampled customers’ median monthly utilisations and peak-month utilisations, we then aggregate across customers by showing the median customer, meaning that 50% of customers have less than the given median or peak utilisation during the period from July 2022 to June 2023.

Data utilisation by data allowance band

Figure 10 shows the median utilisation and median peak utilisation by data allowance band. Both measures of utilisation broadly exhibit a negative relationship with the tariff’s data allowance – i.e., consumers with higher allowances used a smaller share of their allowance.

Figure 10: Median utilisation and median peak utilisation of mobile data allowance by data allowance band – July 2022 to June 2023



Notes: Based on the available data as indicated in Table 1 and Table 2 in the Annex. Customers with unlimited or no data allowances are excluded from this analysis.

Data Utilisation by Mobile Provider

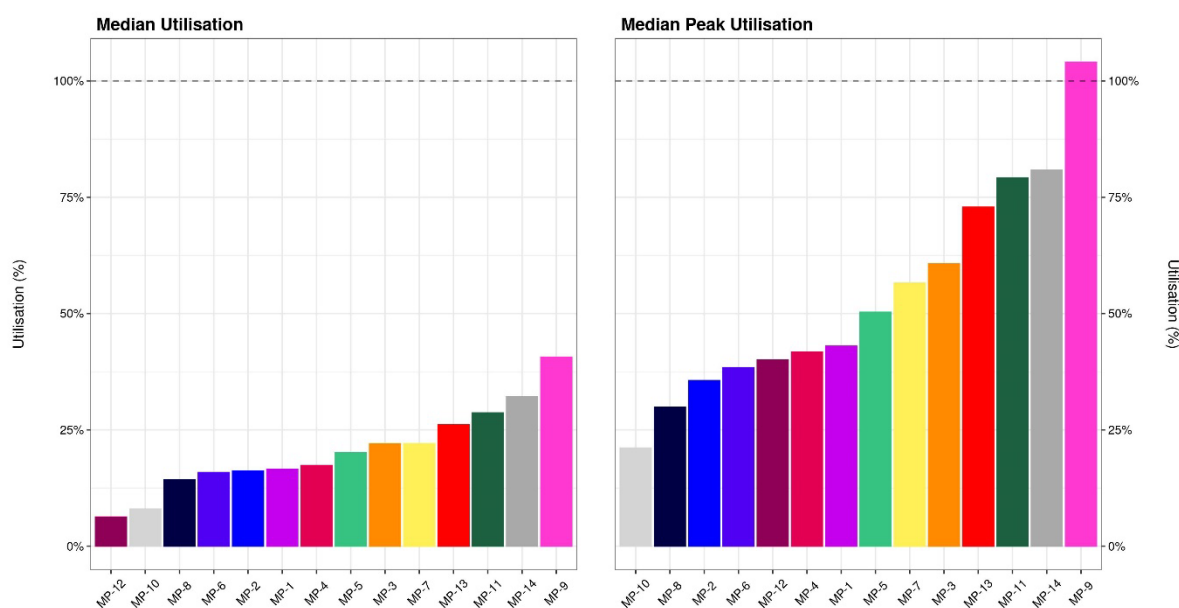
The utilisation of data allowances may differ across mobile providers for several reasons. First, mobile providers differ in the tariffs they offer and how they allow customers to use their mobile

²⁵ We also limit the data to customers with at least three bills for the customer utilisation profiles to be meaningful.

data allowance. Some providers, for instance, offer data rolling schemes that allow customers to transfer unused data allowance between months. Secondly, consumers' usage patterns may differ between mobile providers since the tariffs and services offered may appeal to some consumers more than others. All these factors are expected to have an impact on tariff choices, mobile data usage, and ultimately utilisation of mobile data allowance.

Figure 11 shows the utilisation of data allowance by customers of different mobile providers for the period from July 2022 to June 2023. We anonymised the mobile providers, referring to them as MP-1 to MP-14, to keep their identities confidential. The results show that there is a wide range of utilisation rates among mobile providers. For example, the median customers of seven mobile providers (MP-12, MP-10, MP-8, MP-6, MP-2, MP-1, MP-4) used less than 20% of their data allowance in a typical month. In contrast, the median customer of MP-9 used more than 40% of their monthly data allowance. When considering median peak utilisation, the overall ranking is similar, with MP-9 again at the high end, followed by MP-14 and MP-11. The remaining mobile providers show a wide range of median peak utilisation rates between less than 25% and almost 75%.

Figure 11: Median utilisation and median peak utilisation of mobile data allowance by mobile provider – July 2022 to June 2023



Notes: Based on the available data as indicated in Table 1 and Table 2 in the Annex. Customers with unlimited or no data allowances are excluded from this analysis.

The differences in customers' utilisation of the mobile data allowance among providers, in part, reflect the differences in their tariff offerings to consumers. In addition, customer bases also differ among providers and this may contribute to the differences in utilisation rates.

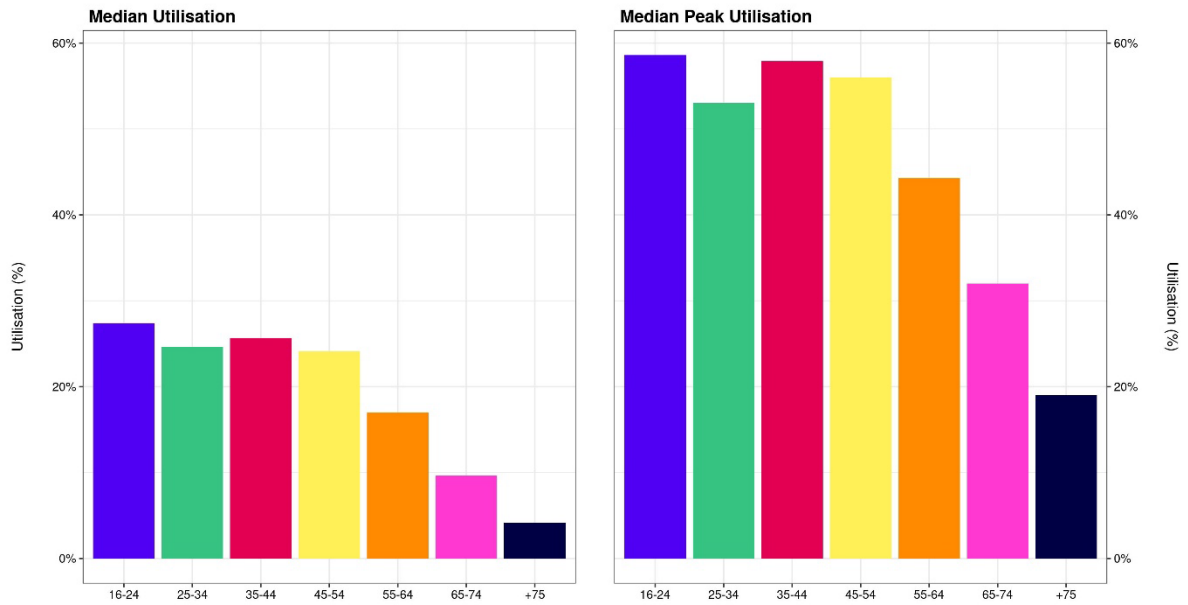
Data utilisation by consumer age band

We also looked at how customer age groups relate to differences in the utilisation of mobile data allowance for pay-monthly customers and the results are shown in Figure 12.²⁶ We found a clear inverse relationship between both measures of data utilisation – i.e., median utilisation and median

²⁶ This analysis is limited to customers on pay-monthly tariffs, because PAYG customers do not have demographic information in the customer-level data.

peak utilisation – and customers’ age. Those between 16 and 24 years old, for instance, had a median utilisation of around 27% while consumers over 75 years old had a median utilisation of less than 5%. Older consumers tended to use a lower share of their allowance than younger customers despite the fact that they were typically on lower-allowance tariffs.

Figure 12: Median utilisation and median peak utilisation of mobile data allowance for pay-monthly customers by age group – July 2022 to June 2023



Notes: Based on the available data as indicated in Table 1 in the Annex. Customers with unlimited or no data allowances are excluded from this analysis.

Consumer spend

Value for money is one indicator, amongst others, of a well-functioning market and as such consumer spend plays an important role in Ofcom's monitoring efforts. We analyse consumer spend over time and whether there are differences in spend between certain parts of the market (e.g., particular tariffs or consumer groups).

We measure consumer spend as the total monthly amount charged. This includes the recurring charges, which account for most of the total, and additional charges, e.g., for usage outside of a consumer's tariff allowance. All spend is in nominal terms and not adjusted for inflation. Our analysis covers a period of high inflation and the related inflation-linked in-contract price rises implemented in March/April 2022 and 2023.²⁷

We also monitor the spend and prices paid by mobile customers in our annual [Pricing Trends for Communications Services reports](#).²⁸ The analysis here complements this report and offers additional insights at a more granular level. We intend to use the data on consumer spend presented in this section in our future [Pricing Trends for Communications Services](#) reports.

Monthly spend over time

We begin by analysing the change of average consumer spend over time without controlling for changes in the tariff features. We do this by considering two outcomes: total monthly spend and total monthly spend divided by the GB of data used. The first offers a simple and comprehensive measure of how much consumers spend on mobile services. The second provides a measure of the effective spend for one of the most important aspects of the services received, recognising that this effective spend may vary for consumers on the same tariff depending on how much data they use.

Monthly spend

Figure 13 shows the average monthly spend for pay-monthly contracts across all providers that had complete data over the full period. The general pattern is similar for mobile providers whose data is not available for the whole period. Monthly spend (in nominal terms) declined from 2019 until the end of 2021, which reflects a longer trend of declining prices in the UK mobile sector.²⁹ It then exhibited two marked increases in Q2 of 2022 and 2023. These increases were likely to be due to the high level of inflation during those years, which resulted in high mid-contract price rises and potentially higher prices for new tariffs than in the period from 2019 to 2021. Given the high level of inflation in 2022 and 2023, we would expect that the monthly spend would be lower than presented here, depending on the deflator used to correct for inflation.

The difference in the level of average monthly spend between Q4 2021 and Q1 2022 reflects differences in measurement between the two data tranches for one provider. As we were unable to resolve these, we acknowledge that this difference may not fully reflect the changes in monthly

²⁷ Since 2020, most of the UK's largest mobile providers had introduced inflation-linked price variation terms with an additional fixed percentage for new contracts, e.g., increases by the Consumer Price Index (CPI) plus 3.9%, effective from the following spring. UK inflation rose substantially during the second half of 2021, which became particularly relevant for the mid-contract price rises in spring 2022.

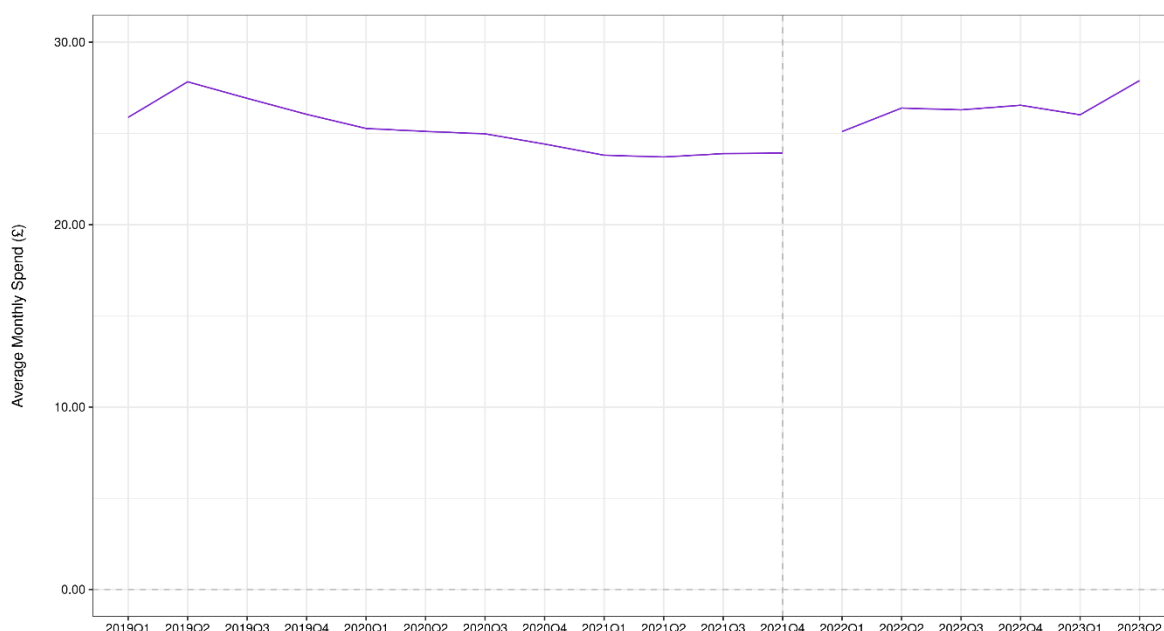
²⁸ [Pricing trends for communications services in the UK](#), Ofcom, 12 December 2023.

²⁹ This trend has been documented by Ofcom (e.g., in [Pricing trends for communications services in the UK](#), Ofcom, 12 December 2023).

spend in the market at that time and have therefore not joined the data points between Q4 2021 and Q1 2022 in the charts below. We expect that we will be able to ensure comparability from the second data tranche going forward, which will provide a reliable evidence base for Ofcom’s monitoring work.

The changes in average spend calculated using the customer-level data offer insights over other analysis of mobile prices that Ofcom has previously published, such as our Pricing Trends reports. Most importantly, the customer-level data captures mid-contract price rises and charges beyond the monthly recurring airtime charge that do not feature in the Pricing Trends data, which is focused on the monthly price of new contracts. In addition, the customer-level data allow us to weight individual tariffs according to the number of customers who purchased them. The resulting measure of monthly spend therefore reflects the fact that tariff price changes may not apply to all customers (e.g., those switching to a new tariff in the case of mid-contract price rises). Overall, the analysis presented here offers a more comprehensive picture of the how much consumers are paying for mobile services.

Figure 13: Average monthly spend from Q1 2019 to Q2 2023

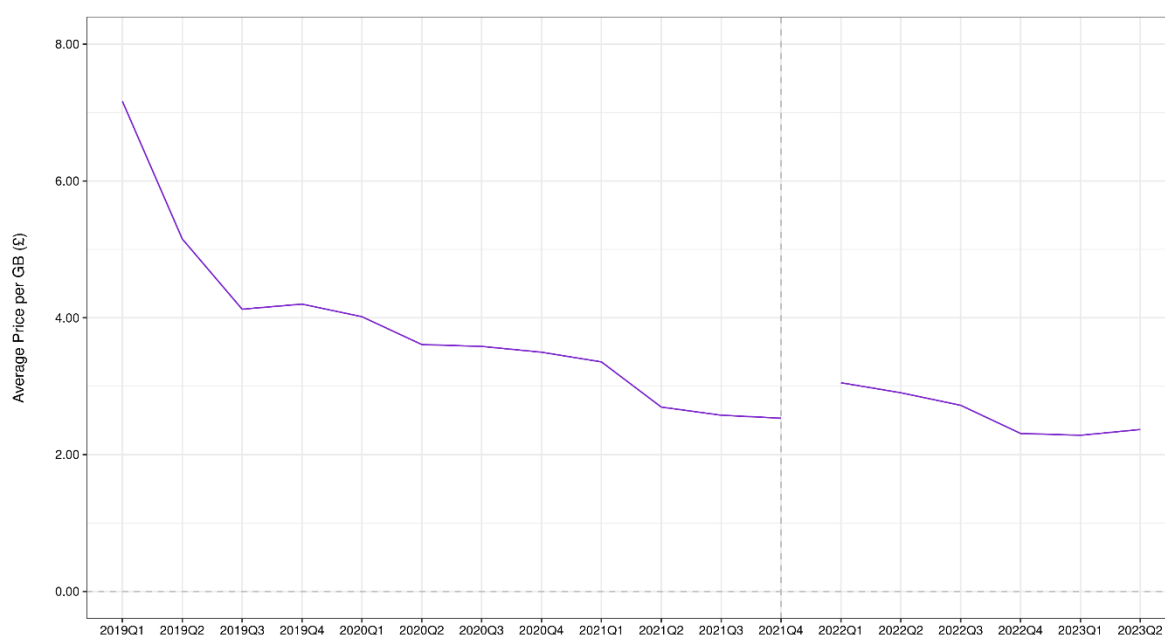


Notes: Based on pay-monthly contracts only, excluding those providers which had incomplete data for the period (iD Mobile, O2, Talkmobile, and Vodafone). Prices are nominal.

Monthly spend per GB used

While monthly spend is a helpful measure for understanding how much consumers pay for mobile services, it does not reflect other changes in the mobile services offered to consumers. Given that mobile data usage has increased substantially over the period covered by the data, we therefore compute a per-unit measure by dividing monthly spend by the number of GB of data used. Figure 14 plots the average monthly spend per GB used between 2019 and 2023. It shows that monthly spend per GB decreased considerably during this period. Notably, this normalised measure of spend does not exhibit increases in Q2 2022 and Q3 2023, when in-contract price rises due to high inflation took effect for most providers. One possible explanation is that the impact of the high mid-contract price rises have been offset by increased data usage around the same time.

Figure 14: Average monthly spend per GB from Q1 2019 to Q2 2023



Notes: Based on pay-monthly contracts only, excluding those providers which had incomplete data for the period (iD Mobile, O2, Talkmobile, and Vodafone). Prices are nominal.

Regression analysis of monthly spend

Methodology

One challenge when assessing price differences in mobile contracts is that tariffs vary a lot in the features that they offer. For instance, some tariffs offer low data allowances, while others provide users unlimited access to data. Even when two contracts have the same data allowance, there may be additional features, such as free access to video or social media, that affect pricing considerations for the provider and the spending decisions of the customer. In other words, making a direct comparison of prices in the mobile market is challenging because each tariff can differ significantly across multiple characteristics.

We therefore also analyse monthly spend using regressions that allow us to control for changing tariff characteristics. These regressions are useful in the mobile context as they facilitate comparisons among tariffs that vary in some or all their observable characteristics.³⁰ Intuitively, these regressions break down the monthly spend into the value attributed to different tariff features. By decomposing spend in this way, we can gauge the value associated with individual tariff features while keeping all other characteristics constant. Including consumer demographics in the regression further allows us to assess how monthly spend differed between consumer segments (e.g., different age groups), again holding constant the tariff characteristics. The regressions also enable us to track how spend evolved over time while accounting for changes in tariff attributes.

³⁰ Regression analysis notably cannot account for all tariff characteristics. Importantly, we cannot control for unobserved features, such as certain aspects of network quality or the model specifications of handsets obtained as part of handset & airtime or split contracts. In addition, the exact regression specification also assumes certain types of relationships between tariff prices and their features. For example, we assume that the value attributed to mobile data is the same between different providers.

The results presented in this section focus on customers on SIM-only contracts, but the methodology can be applied to other pay-monthly contracts and PAYG tariffs in a similar fashion. This focus allows for the most straightforward spend comparisons as we do not need to consider differences in handsets, in respect of which differences are harder to measure. Notably, for combined airtime & handset contracts, variations in the handset model affect monthly spend but cannot be extracted in the same fashion from all the mobile providers' customer-level data. Nonetheless, we also conducted the regression analysis including all pay-monthly contract types as a robustness test and the results are qualitatively similar to the results based on SIM-only tariffs.

For additional details about the regression analysis, please see the Annex.

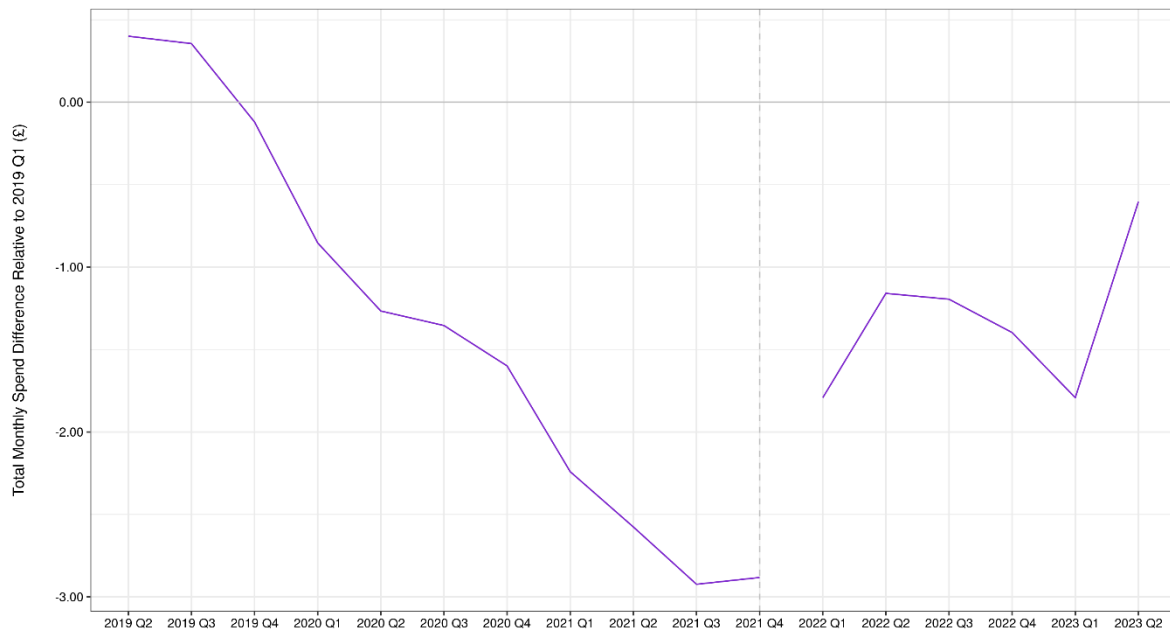
Monthly spend over time controlling for tariff characteristics

The regression analysis allows us to track how tariff prices have evolved over time while holding tariff characteristics constant. This is important because, as monthly spend changes over time, so do the underlying tariffs and their characteristics. Merely monitoring average spend therefore overlooks the fact that customers are receiving different services. This analysis therefore enables better like-for-like comparison.

Figure 15 displays the results from the regression analysis for changes in monthly spend over time. We find that the results from the regression analysis confirm the general pattern observed in the non-regression analysis above, although the magnitudes are somewhat different. Monthly spend decreased by approximately £3.00 per month between Q1 2019 and the Q4 2021 (i.e., a reduction in annual spend of about £36). It then increased in early 2022 and 2023 by approximately £0.75 per month between Q1 and Q2 2022 and by roughly £1.25 per month during the same time in 2023 as high inflation resulted in higher than average mid-contract price rises.

Despite the methodological improvement that the regression analysis delivers, there are still some limitations. Improvements in network quality over our period of study, for example, are not reflected, nor are changes in unobservable contract features, such as additional or reduced social media or video allowances. Consequently, the quality-adjusted price changes we estimated may include some inaccuracy as we do not account for these factors. We aim to reduce these limitations in refinements to the analysis as we monitor monthly spend and tariff prices going forward.

Figure 15: Change in average monthly spend for SIM-only tariffs controlling for contract characteristics, relative to Q1 2019



Notes: Based on SIM-only contracts only. Coefficients are estimated from a regression of total monthly spend on tariff characteristics and time fixed effects. Prices are nominal.

Differences in consumer spend

We look at differences in consumer spend by different providers, data allowance band and different consumer segments.

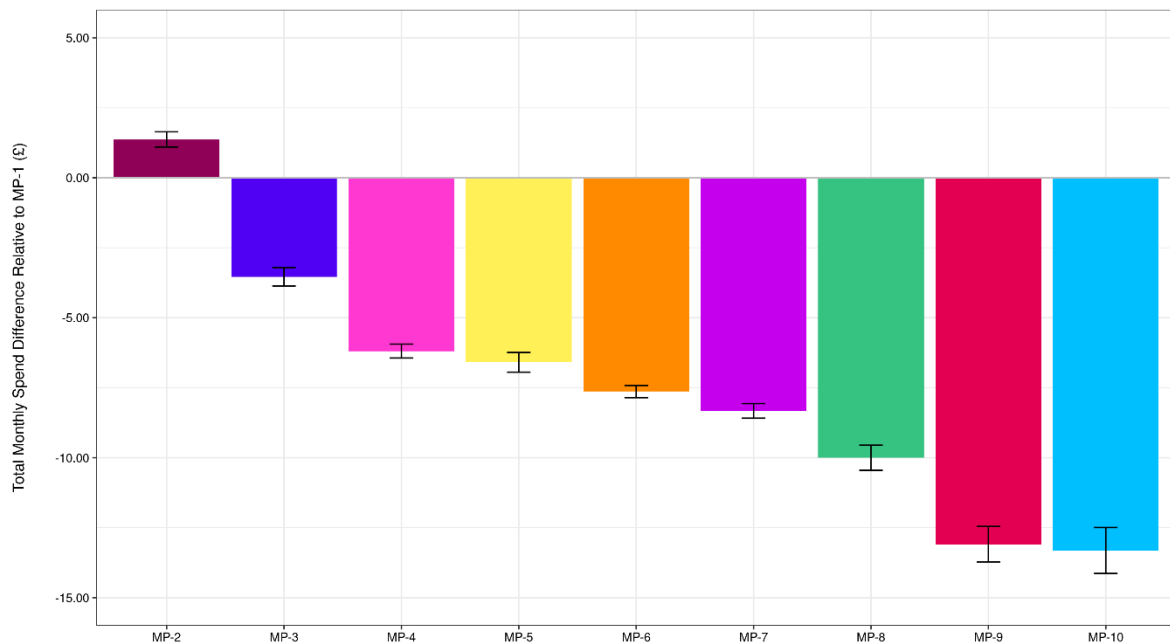
Comparison of provider prices

The regression analysis also allows us to compare the prices of tariffs offered by different providers, controlling for a wide range of tariff characteristics.

Two important tariff features, for which we are currently unable to control, however, are mobile providers' network quality and service quality. The omission of these factors means that the price comparison is not on a complete like-for-like basis and that the results are only illustrative of the price differences we may estimate with richer data and improved methods in the future.

The results show that there are differences in provider prices even controlling for observable differences in tariff characteristics. Figure 16 shows the average price difference relative to the anonymous benchmark provider, MP-1. The monthly spend is highest, on average, by customers of MP-2 at approximately £1.00 above the spend by MP-1's customers. MP-10 customers have the lowest monthly spend, on average, at almost £13.00 less than the benchmark provider.

Figure 16: Difference in provider price, relative to the benchmark provider



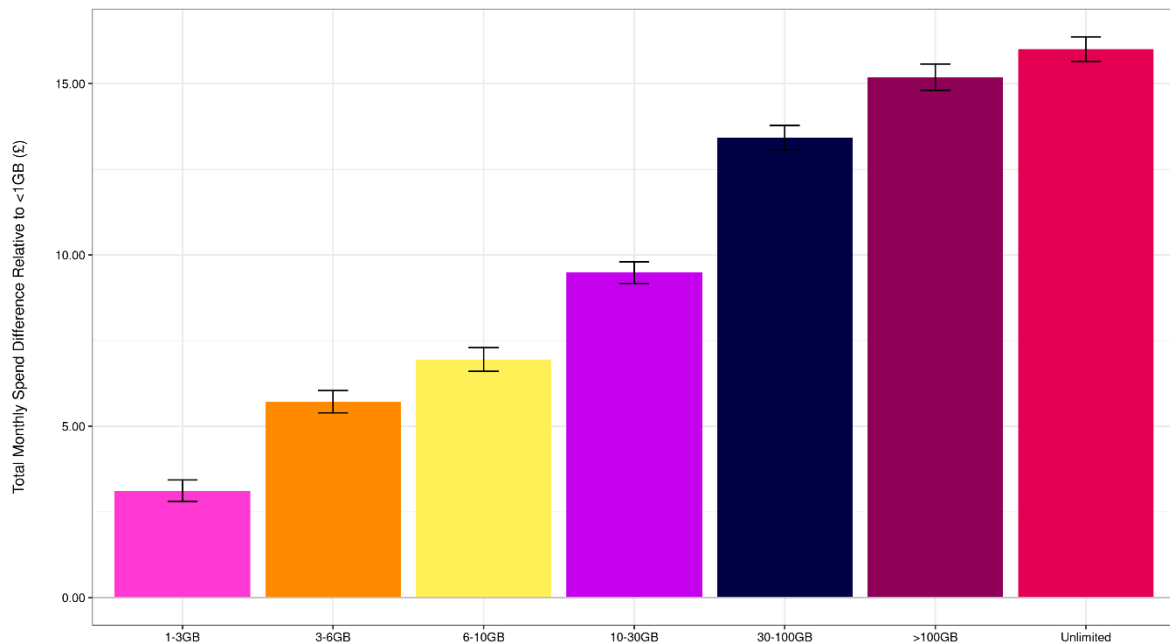
Notes: Based on SIM-only contracts only. Coefficients are estimated from a regression of monthly bill on tariff characteristics and time fixed effects. Prices are nominal.

Differences in monthly spend by data allowance

The regression analysis also allows us to decompose the total monthly spend into its underlying components, determining the value associated with each tariff feature. Focusing on one of the most salient features, we examine differences in the average spend attributable to the data allowances, controlling for other tariff characteristics.

As shown in Figure 17 and as expected, we find a positive relationship between data allowance and monthly spend – tariffs with a higher data allowance cost more. A tariff with unlimited data allowance, for example, incurs an average additional spend of around £16 per month compared to an equivalent contract with less than 1 GB data allowance. The results suggest that incremental data allowance is cheaper for higher-allowance tariffs. The spend difference between tariffs with more than 100 GB allowance and those with 30-100 GB allowance (around £2.00), for instance, is less than the spend difference between tariffs with 30-100 GB and 10-30 GB allowance (around £3.50).

Figure 17: Difference in monthly spend for SIM-only tariffs by data allowance band, relative to less than 1GB



Notes: Based on SIM-only contracts only. Coefficients are estimated from a regression of total monthly spend on tariff characteristics and time fixed effects. Prices are nominal.

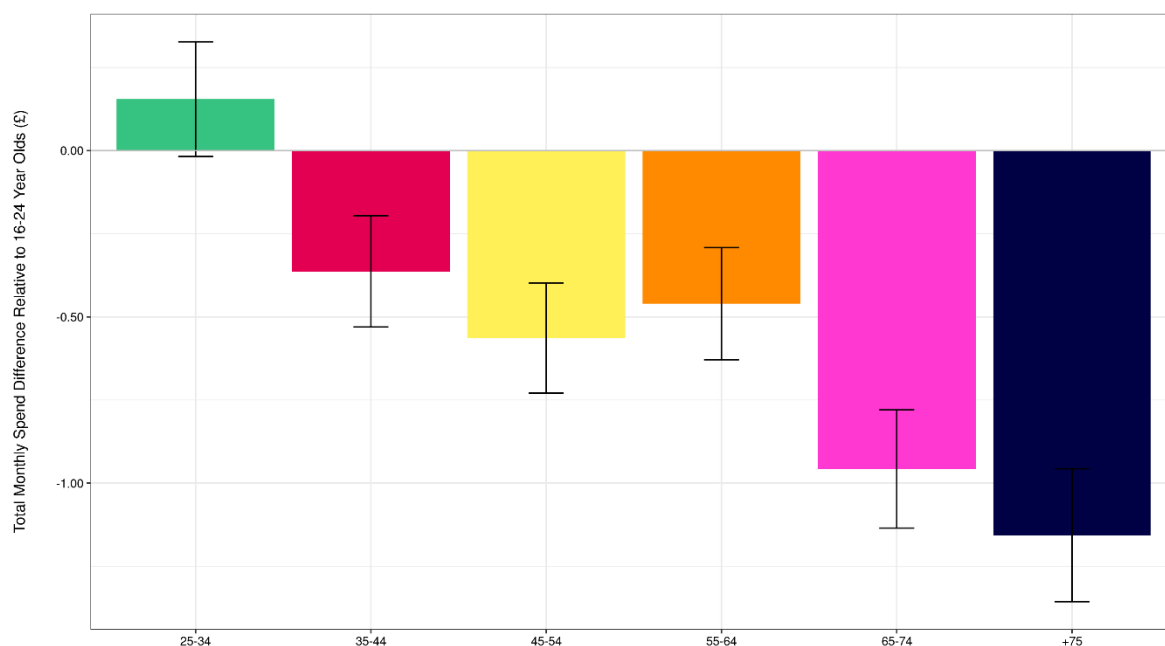
Differences in monthly spend by consumer age

The customer-level data is uniquely suited to analysing prices paid by different groups of pay-monthly customers. We incorporate demographics into the regression analysis to assess potential differences in monthly spend between customer groups. The regression framework allows us to explore whether these differences are attributable to the characteristics of the tariffs that customers choose (e.g., opting for relatively higher-priced tariffs) or if the spend disparities persist even when controlling for mobile provider and other observable tariff features.

One of the customer demographics we consider is age. The corresponding results are reported in Figure 18 and can be interpreted as the average difference in monthly spend by customers in a specific age group when compared to customers aged 16-24, while keeping tariff characteristics constant. The negative values for most age groups indicate that, on average, customers over the age of 34 paid less for their mobile tariffs than those aged 16-24, and this price difference tends to increase with age. The most substantial average price difference is observed for customers who are in the 65-74 and 75+ age bands. Customers in the 75+ age band paid around £1.15 less per month than those aged 16-24.

It is important to recognise that our regression analysis does not control for all aspects of a mobile tariff, despite accounting for numerous attributes. If younger age groups disproportionately opt for tariffs with unobservable contract features, such as multiple or particularly valuable extras related to social media or video streaming, then the influence of these features could be captured within the age variable. This might lead to an overestimation of the impact of customer age on the average prices paid.

Figure 18: Difference in monthly spend by age group, relative to 16-24 year old customers



Notes: Based on SIM-only contracts only. Coefficients are estimated from a regression of total monthly spend on tariff characteristics, age groups indicators, and time fixed effects. Prices are nominal.

Differences in monthly spend by vulnerable consumers and those in living in more deprived areas

We can use the regression analysis to assess whether the monthly spend differs systematically between customers according to vulnerability, controlling for tariff characteristics. We do this in two ways: (i) using the vulnerability classification included in the customer-level data and (ii) using the information on household deprivation from the ONS which we combine with the customer-level data by using the customers' home location.

Ofcom expects mobile providers to capture information about the needs of vulnerable customers to ensure that they understand and meet their needs.³¹ In our first approach looking at monthly spend for vulnerable consumers, we use information submitted by mobile providers on which customers on pay-monthly tariffs they identify as vulnerable.

There are, however, some significant shortcomings with the data on customer vulnerability which limits the reliability of the analysis. First, providers can take different approaches to categorising and flagging vulnerability and recording those customers' needs. This means that the type of customers categorised as vulnerable or having additional needs may vary somewhat across providers. Second, the information to determine vulnerability can be self-reported and consumers who are not aware of the benefits to flagging their vulnerability to providers might be less inclined to do so.

In our second approach, we use the approximate home location of pay-monthly customers as determined by their LSOA from the customer-level data combined with data on household deprivation from the ONS.

³¹ The definition of vulnerability is broad as it takes an inclusive approach to classify who is potentially vulnerable. A customer may be vulnerable, for example, due to circumstances such as age, disability, illness, low literacy, communications difficulties, or changes in circumstances such as bereavement. For further detail, see [General Conditions of Entitlement](#), Ofcom, 16 August 2023.

The deprivation data we use in this report is calculated by the ONS using the 2021 Census and defined across four dimensions: education, employment, health, and housing. We create an index of deprivation at the LSOA level by defining the average number of deprivations per household in each area. We then rank LSOAs into quintiles, where 1 represents the least deprived and 5 the most deprived. We note that LSOAs comprise quite large populations - between 1,000 and 3,000 people – which may reduce their value in identifying vulnerable customers. Please see the Annex for further details about the deprivation data.

The results from the analysis of monthly spend by vulnerable customers were mixed. Under one approach, the analysis suggested vulnerable consumers may be paying a small amount more per month than all other mobile customers, while the other approach suggested the opposite. Given that both measures of vulnerability used in the analysis have limitations, we did not consider these findings to be reliable and plan to explore possible improvements. In particular, analysing consumer demographics at lower levels of aggregation (such as OA instead of LSOA), may allow for greater precision in measuring deprivation.

Choice of tariff compared to alternatives

Mobile customers have a number of choices to make when choosing a mobile service including contract type, handset, mobile provider, inclusive allowances for data, texts, and voice, and whether to opt for tariff “extras”, where available.

In this section, we compare the prices of tariffs chosen by consumers with alternatives available in the market. We take into account their chosen tariff’s characteristics and their actual mobile data usage. The analysis sheds light on whether consumers are choosing the cheapest tariffs available and provides an indication of the aspects of a tariff’s characteristics that they may value.

We recognise that some degree of price dispersion is expected in a differentiated product market like that for mobile services and therefore would expect some differences between customers’ chosen and the cheapest alternative tariffs. This holds even for similar tariffs where all relevant tariff characteristics and other features like network quality could be captured perfectly.

Methodology and factors underlying price differences

We calculate the difference in the monthly recurring airtime charge between a customer’s chosen tariff and the cheapest alternative tariff with similar characteristics available in the market.³² If there is no alternative tariff that is cheaper than a customer’s chosen tariff, we consider the price difference to be zero. We focus on customers with SIM-only contracts to exclude confounding factors associated with handsets.

We conducted several variations of the analysis to understand the relative contribution of underlying factors to the price differences:

- Maintaining data allowance vs. matching allowance to peak usage: We consider two sets of alternative tariffs in terms of data allowance. For the first set, alternative tariffs must have at least the same mobile data allowance as a consumer’s chosen tariff. For the second set, we require that alternative tariffs’ data allowances cover the consumers’ observed peak data usage (but may be different to the chosen tariff’s allowance).³³
- Points in the contract life-cycle (out-of-contract vs. beginning-of-contract): We analyse the price differences for two sets of consumers according to their position in the contract life-cycle. The first set comprises consumers at the end of their MCP who have remained out of contract for at least three months. The second set are consumers at the beginning of the contract when they have just chosen a new tariff.
- Market-wide vs. within-provider comparisons: Finally, we consider two sets of tariffs depending on the mobile provider. The first set includes alternative tariffs available market-wide (i.e., irrespective of the provider) while the second includes only tariffs

³² See the Annex for a more detailed description of the methodology. We match the customer’s chosen and alternative tariffs according to a range of key characteristics to get as close as possible to a like-for-like comparison between the customers chosen tariff and alternatives. However, we recognise that this match is not perfect and can impact some of the calculated price differences.

³³ Peak usage is measured as the maximum observed data usage for a given customer.

offered by the same provider as a consumer’s chosen tariff. We do not present the second set of within-provider results in the section below because we find that price differences and trends are very similar to others reported.

Figure 19: Summary of the comparison of tariffs presented

	Maintaining data allowance	Matching data allowance to peak usage
Out of contract	Figure 21	Figure 24
Beginning of contract	Figure 22	Figure 25

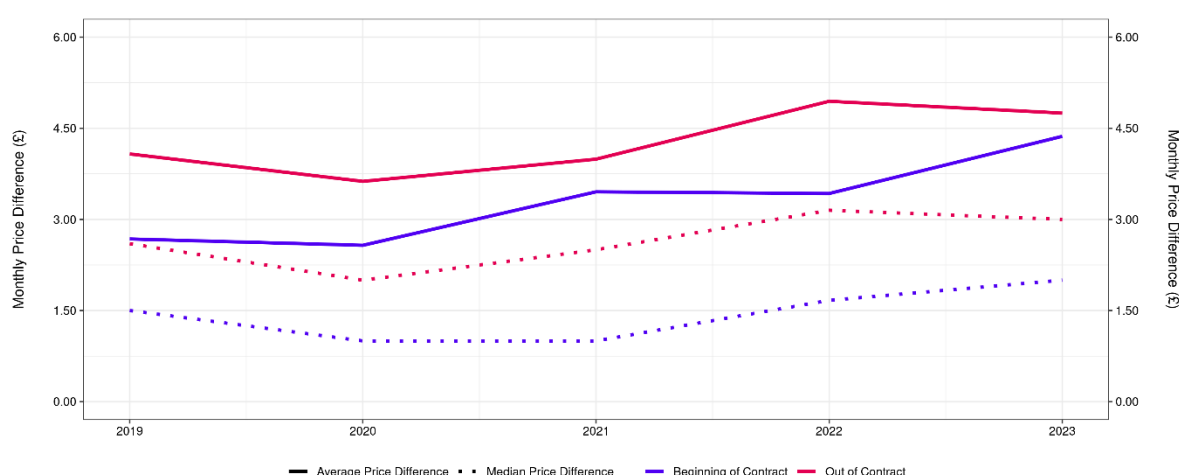
Comparisons for different alternative tariffs

Maintaining data allowance

We first focus on alternative tariffs that include at least the same data allowance as customers’ chosen tariffs. We compute the price differences separately for two groups of customers: out-of-contract customers at the end of their MCP and those at the beginning of their contract.

Figure 20 shows the average and median price differences for the two customer groups by calendar year. The average price difference among out-of-contract customers was around £4.00 per month in 2021 and rose to about £5.00 in 2022 (the median prices differences were about £2.50 and £3.00, respectively). The average price differences among customers at the beginning of their contracts were lower at about £3.50 in both 2021 and 2022 (the median prices differences were about £1 and £1.50, respectively).

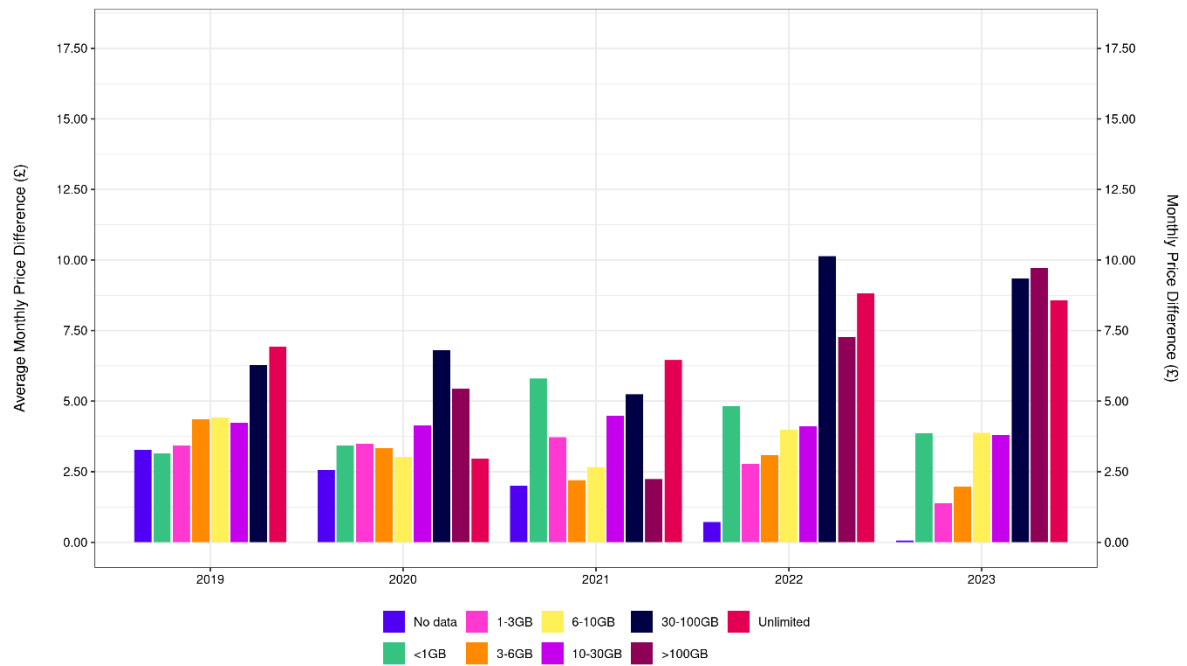
Figure 20: Average and median monthly price differences when out of contract and at beginning of contract (maintaining data allowance)



Notes: Based on pay-monthly SIM-only contracts. The analysis includes providers for which consistent data is available throughout the period of analysis.

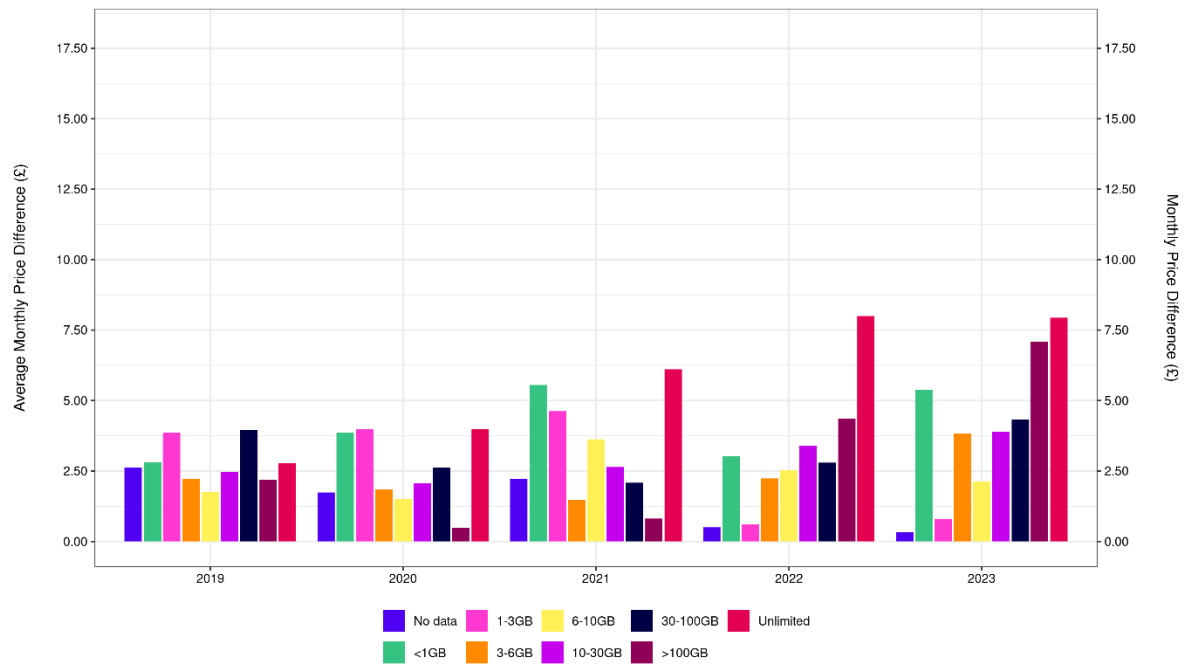
In Figure 21 and Figure 22, we look at these price differences by the data-allowance band of customers’ chosen tariff. We find that the price differences were greater for some of the higher data-allowances in 2022 and 2023.

Figure 21: Monthly price difference between chosen and alternative tariffs when out of contract (maintaining data allowance)



Notes: Based on pay-monthly SIM-only contracts only. The analysis includes providers for which consistent data is available throughout the period of analysis.

Figure 22: Monthly price difference between chosen and alternative tariffs at beginning of contract (maintaining data allowance)



Notes: Based on pay-monthly SIM-only contracts. The analysis includes providers for which consistent data is available throughout the period of analysis.

Matching usage to data allowance

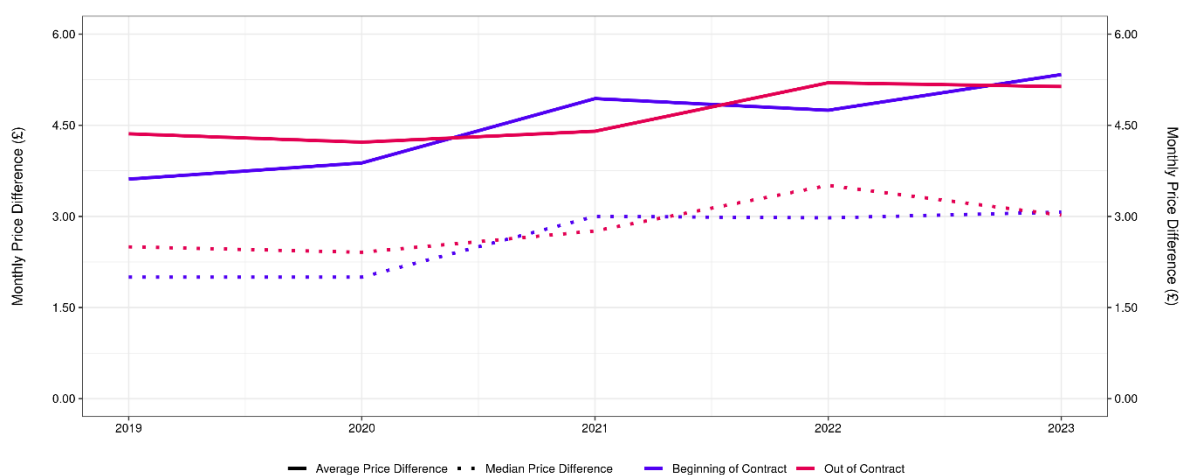
We next focus on alternative tariffs whose data allowance is sufficient to cover the customer’s observed peak usage, otherwise maintaining the same definitions as in the previous sub-section for comparability. Matching data allowance to peak usage tends to increase the number of potential tariffs a customer could choose and introduce cheaper alternatives given that i) prices are on average lower for tariffs with less data (Figure 17) and ii) most customers use less than their chosen tariff’s allowance even in peak months (see above analysis of data usage). While the price differences in this analysis reflect customers’ observed peak mobile data needs, they do not account for any additional allowance buffer they may value.

Figure 23 shows the average and median price differences for the two customer groups by calendar year. The average price difference among out-of-contract customers was around £4.50 in 2021 and rose to about £5.20 in 2022 (the median prices differences were about £2.75 and £3.50, respectively). These results are similar to those from the above analysis based on alternative tariffs that maintain the data allowance (i.e., Figure 20).

The average price differences among customers at the beginning of their contract were approximately £5.00 in 2021 and £4.75 in 2022 (the median prices differences were around £3.00 in both 2021 and 2022). These price differences are higher than those from the above analysis based on alternative tariffs that maintain the data allowance (i.e., Figure 20).

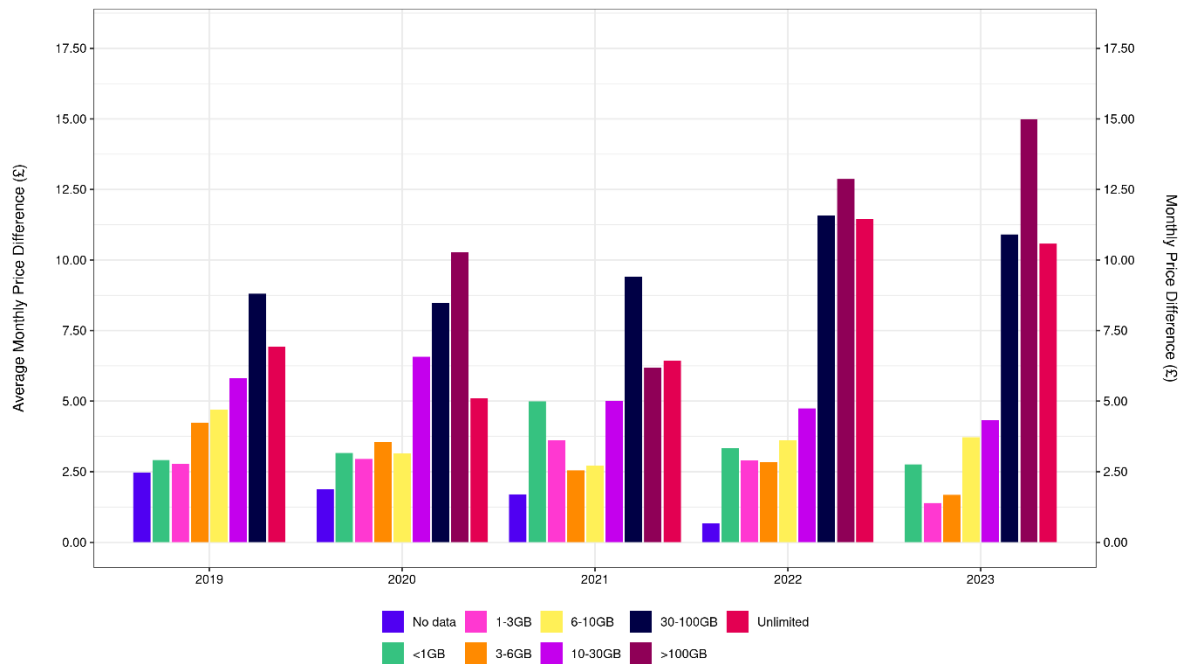
Contrary to expectations, price differences for out-of-contract customers were similar to price differences for beginning-of-contract customers over the period. This may in part have been driven by the trend to buy higher data allowances over time: consumers may have chosen cheaper tariffs for a given allowance when they are picking a new tariff, but a higher data allowance than they ultimately use.

Figure 23: Average and median monthly price differences when out of contract and at beginning of contract (matching data allowance to usage)



Notes: Based on pay-monthly SIM-only contracts. The analysis includes providers for which consistent data is available throughout the period of analysis.

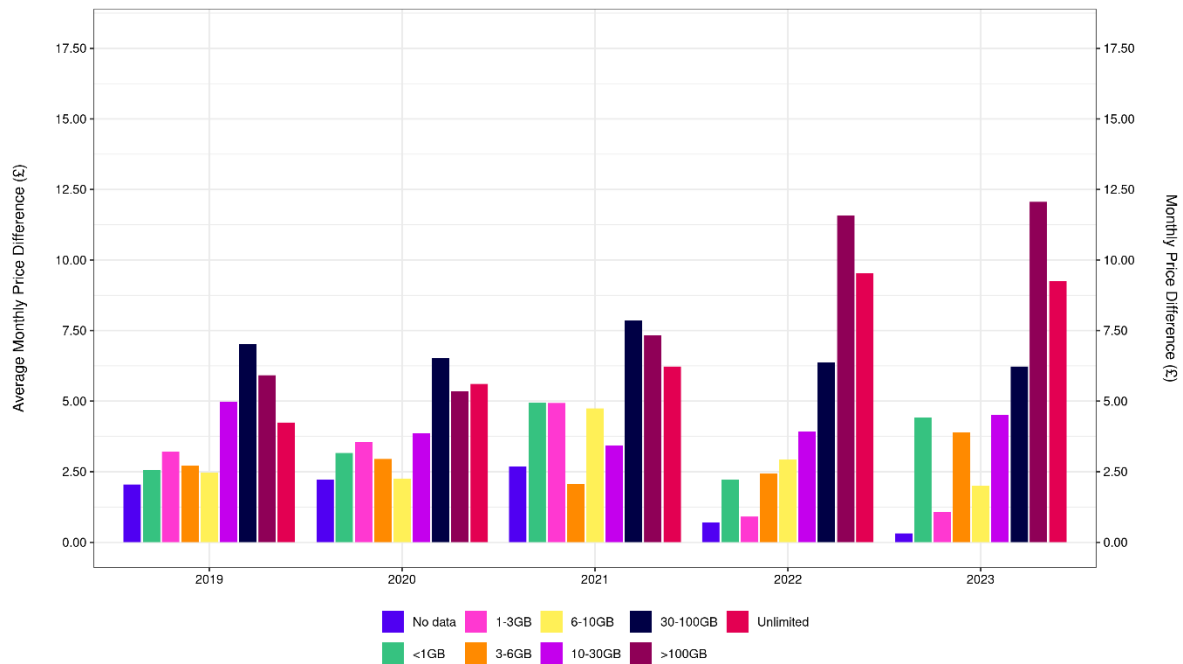
Figure 24: Monthly price difference between chosen and alternative tariffs when out of contract (matching data allowance to usage)



Notes: Based on pay-monthly SIM-only contracts. The analysis includes providers for which consistent data is available throughout the period of analysis.

Figure 24 and Figure 25 show the average price differences by data allowance bands for the analysis matching the alternative tariffs’ data allowance to customers’ peak data usage. The positive relationship between the price difference and the chosen tariff’s data allowance is more pronounced in this case than when we considered alternative tariffs that maintained the customer’s data allowance. The average price differences were generally increasing in the data-allowance bands.

Figure 25: Monthly price difference between chosen and alternative tariffs at beginning of contract (matching data allowance to usage)



Notes: Based on pay-monthly SIM-only contracts. The analysis includes providers for which consistent data is available throughout the period of analysis.

Market-wide vs. within-provider alternative tariffs

Finally, we also conduct the same variants of the analysis discussed above but considering only alternative tariffs by the same mobile provider as the chosen tariff (rather than all available alternatives irrespective of the provider). This is because the market-wide comparisons may reflect some differences between mobile providers that we cannot account for, including network quality or customer service.

The findings from this “within-provider” analysis are very similar to those from the “market-wide” analysis. This suggests that differences between mobile providers that we cannot account for (such as network quality) may not be the primary drivers of the price differences that we report in this section. One reason for the similarity between market-wide and within-provider results is that we require exact matching for a wide range of tariff characteristics, which leads to a narrow set of alternative tariffs in the market-wide analysis. On average, around half of the alternative tariffs considered in the market-wide comparison were from the same provider as the chosen tariff.

Annex

Further data description

Customer-level data

The available customer-level data varies between mobile providers. The following tables provide an overview of this.

Table 1: Data availability for pay-monthly contracts

Provider	Contract/tariff history	Usage and billing information	Customer demographics
BT	○	○	○
EE	✓	✓	✓
iD mobile	✓	✓	✓
O2	✓	○	✓
Plusnet	✓	✓	✓
Sky Mobile	✓	○	✓
Talkmobile	✓	✓	✓
Tesco	✓	✓	✓
Three	✓	○	✓
Virgin Mobile	✓	✓	✓
Vodafone	✓	○	○

Notes: ✓ indicates full data available, ○ indicates partial data available, and ✗ indicates no data available. Data may be unavailable, for various reasons including limited accuracy for example. The contract/tariff data covering 2019 to 2021 do not have information on whether a contract is bundled with other products such as landline, broadband or pay TV. The second tranche of data includes that information.

Table 2: Data availability for PAYG tariffs

Provider	Contract/tariff history	Usage and billing information	Customer demographics
EE	○	○	✗
giffgaff	○	○	○
iD mobile	○	○	✗
O2	✓	○	✗
SMARTY	✓	✓	✓
Tesco	✓	✓	✗
Three	✓	○	✗
Vodafone	✓	○	✗

Notes: ✓ indicates full data available, ○ indicates partial data available, and ✗ indicates no data available. Data may be unavailable for various reasons including limited accuracy for example. The contract/tariff data covering 2019 to 2021 do not have information on whether a contract is bundled with other products such as landline, broadband or pay TV. The second tranche of data includes that information.

Household deprivation data

The deprivation data we use in this report is calculated by ONS using the 2021 Census and defined across four dimensions as follows:³⁴

- **Education:** A household is classified as deprived in the education dimension if no one has at least level 2 (equivalent to GCSE grade A*- C) education and no one aged 16 to 18 years is a full-time student.
- **Employment:** A household is classified as deprived in the employment dimension if any member, not a full-time student, is either unemployed or economically inactive due to long-term sickness or disability.
- **Health:** A household is classified as deprived in the health dimension if any person in the household has general health that is bad or very bad or is identified as disabled. People who have assessed their day-to-day activities as limited by long-term physical or mental health conditions or illnesses are considered disabled. This definition of a disabled person meets the harmonised standard for measuring disability and is in line with the Equality Act (2010).
- **Housing:** A household is classified as deprived in the housing dimension if the household's accommodation is either overcrowded, in a shared dwelling, or has no central heating.

For each dimension, deprivation is measured on a binary basis based on a threshold set by the ONS. For example, a household is deemed to be deprived in terms of housing if it is either overcrowded, has no central heating or is in a shared dwelling. A holistic measure of deprivation can then be defined by counting the number of dimensions along which a household is deemed to be

³⁴ [Census Deprivation data](#), Office for National Statistics, 2021.

disadvantaged. Hence, the deprivation measure ranges from 0 (a household deprived on none of the dimensions) to 4 (a household deprived on all the dimensions). To avoid disclosing household-level information, the ONS publishes a count of the number of households who are deprived along a given number of dimensions (ranging from 0 to 4) for each LSOA in England and Wales.

We create an index of deprivation at the LSOA level by defining the average number of deprivations per household in each area. We then rank LSOAs into quintiles, where 1 represents the least deprived and 5 the most deprived. Table 3 details how different quintiles vary on the dimensions of deprivation.

Table 3: Average deprivations per household, quintile ranges

Deprivation Quintile	Minimum	Maximum
1 (<i>Least Deprived</i>)	0.22	0.55
2	0.55	0.65
3	0.65	0.77
4	0.77	0.94
5 (<i>Most Deprived</i>)	0.94	1.57

Notes: ONS Deprivation data is, at the time of writing, only available of England & Wales.

Regression analysis of consumer spend

Mobile tariffs vary significantly in the features that they offer consumers, including contract type, contract length, and allowances for data, voice, and texts. This complicates the comparison of prices or monthly spend between different tariffs and over time as the comparisons are usually not for identical products. In the analysis included in this report, we therefore analyse monthly spend using regressions that allow us to control for changing tariff characteristics in the spirit of a Hedonic Price Index (HPI).

Empirical Specification

The regressions we estimate broadly follow the academic literatures hedonic price indices for the mobile market.³⁵ Specifically, we estimate linear regressions of the following type:

$$y_{ijt} = \alpha + \mathbf{X}_{jt}\beta + \mathbf{Z}_{it}\gamma + \delta_t + \mu_{it} \quad [1]$$

To accommodate varying data availability, we implement these regressions separately for customers on pay-monthly and PAYG tariffs. Table 4 below provides an overview of the explanatory variables we include in the regressions by contract type.

In the pay-monthly case, the variable y_{ijt} represents the average nominal monthly spend (in £) for customer-group i on tariff-group j in quarter t . We aggregate the data to narrowly-defined customer and tariff groups according to the customer and tariff characteristics included in the regression to ease the computational burden. The vector \mathbf{X}_{jt} comprises the various tariff characteristics, including indicators for (i) contract provider, (ii) contract type, (iii) data allowance

³⁵ See [Comparing Mobile Communication Service Prices Among Providers: A Hedonic Approach](#), Schöni & Seger, 2010. [Hedonic modeling to explore the relationship of cell phone plan price and quality in Croatia](#), Forenbacher et al., 2016. [Impact of Competition, Investment and Regulation on Prices of Mobile Services: Evidence from France](#), Nicolle et al., 2019. [Impact of roaming regulation on revenues and prices of mobile operators in the EU](#), Grzybowski & Muñoz-Acevedo, 2021.

band, (iv) minimum contract period, (v) 5G, and unlimited allowances for (vi) voice and (vii) texts. For contracts including a handset, we also include dummy variables for (viii) the handset manufacturers Apple, Samsung, Huawei, Google, and Motorola.³⁶ Additionally, our detailed pay-monthly data allows us to incorporate a vector Z_{it} of user characteristics, including variables for the customer age group, classification as vulnerable, and the deprivation quintile of the home location. To account for changes in average prices over time, we also include time fixed effects. Finally, α represents a constant and μ_{it} represents the error term.

In the PAYG case, the variable y_{ijt} simplifies to y_{jt} as customer demographics are unavailable and y_{jt} represents the average nominal spend (£) for bundle-group j in quarter t . The bundle group is defined analogous to the tariff group according to the bundle characteristics included in the regression. The vector X_{jt} comprises these bundle characteristics and includes indicators for (i) contract provider, (ii) data allowance band, (iii) a 5G, and unlimited allowances for (v) voice and (vi) texts.

The coefficients $(\beta, \gamma, \delta_t)$ are estimated using weighted least squares (WLS), where the weights are derived from providers' sampling weights and account for different forms of attrition in the dataset. In the linear model, the β vector of coefficients can be understood as the difference in average monthly spend (in £) for a tariff or bundle with a specific feature relative to the feature's benchmark category.

The γ vector of coefficients can be understood as the difference in average monthly spend (in £) for a user with specific demographic characteristics relative to the demographic benchmark category.

The estimated coefficients δ_t represent the changes in quality-adjusted monthly spend by quarter, relative to the beginning of the sample (i.e., the benchmark category), holding tariff or bundle characteristics constant.

Table 4: Explanatory variables included in regressions by contract type

Explanatory variable	Description	SIM-only	Handset & airtime / split contracts	PAYG
Mobile provider	Controls for price differences between providers	✓	✓	✓
Tariff data band	Controls for differences in spend by data allowance band.	✓	✓	✓
Period	Controls for the changes in spend over time	✓	✓	✓

³⁶ This variable is an interaction term of handset provider and a dummy variable highlighting handset & airtime contracts. This is to account for the fact that handset prices are captured for these deals but not split contracts where the handset is purchased separately.

Handset brand	Controls for broad differences in handset values between associated tariffs	✗	✓	✗
Enabled 5G	Controls for differences between 5G-enabled and non-5G-enabled mobile contracts	✓	✓	✓
Tariff voice unlimited	Controls for differences in spend between contracts with limited or unlimited voice allowance	✓	✓	✓
Tariff text unlimited	Controls for differences in spend between contracts with a limited or unlimited text messages allowance.	✓	✓	✓
Minimum contract period	Controls for differences in spend by minimum contract period	✓	✓	✗
Age Band	Controls for differences in spend between customers of different age bands	✓	✓	✗

Choice of tariff compared to alternatives

This section provides further details about the methodology we use to compare customers' chosen tariffs and the cheapest alternative tariffs with similar characteristics that are available in the market.

At a high level, the comparison is based on differences in the chosen and alternative tariffs' monthly recurring airtime charges. When picking the cheapest alternative, we discard the bottom 2% of customers with the lowest monthly recurring charges to exclude tariffs that may for some reason not be available widely and erroneous entries.³⁷ If there is no alternative tariff that is cheaper than a customer's chosen tariff, we consider the price difference to be zero.

The monthly recurring airtime charges of the chosen and alternative tariffs of course do not perfectly capture what consumers pay for mobile services, but they allow for a reasonably like-for-like comparison. Importantly, they exclude overages (i.e., charges for out-of-allowance services) among both the chosen and the alternative tariffs.³⁸ In addition, they also exclude temporary discounts on both sides of the comparison.

The set of alternative tariffs include only those with broadly the same tariff characteristics as the chosen tariff. Specifically, we match on the following features:

- i) Contract type (e.g., SIM-only or split contract);

³⁷ We also focus on the providers for which consistent data is available throughout the period of analysis, including EE, BT, Plusnet, Three, Tesco, O2, and Virgin Mobile

³⁸ Capturing overages for customers' chosen tariff is straightforward. Calculating the total charges for all services used among alternative tariffs, however, is generally much more complex and, indeed, not feasible with the available customer-level data.

- ii) Minimum commitment period (MCP);
- iii) Unlimited vs. limited voice allowance;
- iv) Unlimited vs. limited text allowance;
- v) Inclusion of zero-rated products (separately for video/audio/social media); and
- vi) Inclusion of non-zero-rated extras.

In addition, we also match alternative tariffs according to their data allowance – requiring either that the tariff has sufficient allowance to cover a customer’s observed peak usage in any month covered by the data or requiring at least the same allowance as the customer’s chosen tariff.³⁹ We do not limit alternative tariffs based on supply-side features, such as the availability of physical stores in certain geographic areas or direct vs. indirect sales channels.

We compute the price differences following this general approach for individual customers in the data and then aggregate them by taking the average across consumers, e.g., for all customers that started a contract within a certain data-allowance band in a given year.

While we match the customer’s chosen and alternative tariffs according to a range of key characteristics (as given above), we recognise that this match is not perfect. Firstly, some of the tariffs that we consider alternatives may not be available to every consumer. One reason for this among handset & airtime or split contracts, for example, may be that airtime tariffs are linked to particular handsets, for which our analysis does not account. This is one reason why the analysis presented in this paper focuses on SIM-only tariffs. Secondly, the chosen and alternative tariffs may not offer exactly the same features. Extras (including zero-rated products), in particular, may differ between tariffs, because we only capture whether any such features apply. The chosen tariff, for example, may be more expensive because it includes a higher-value extra or multiple extras and we compare this tariff against cheaper alternatives with only one lower-value extra. Such imperfect measurement of extras may have led to an overstatement of the price differences to the cheapest alternative tariff for consumers.

³⁹ The number of months available to measure peak usage in the second tranche of data (covering January 2022 to June 2023) tends to be lower than in the first tranche of data (covering January 2019 to December 2021). This could potentially inflate the price differences in 2022 and 2023 compared to the earlier years when computed based on alternative tariffs that match peak usage.