# Appendices and glossary

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# APPENDIX A: Terms of reference

A.1 In exercise of its duty under section 33(1) of the Enterprise Act 2002 (the **Act**) the Competition and Markets Authority (**CMA**) believes that it is or may be the case that:

(a) arrangements are in progress or in contemplation which, if carried into effect, will result in the creation of a relevant merger situation, in that:

(i) Hutchison 3G UK Limited will cease to be distinct from enterprises controlled by Vodafone Group Plc and, conversely, Vodafone Limited will cease to be distinct from enterprises controlled by CK Hutchison Holdings Limited; and

(ii) the condition specified in section 23(1)(b) of the Act is satisfied; and

(b) the creation of that situation may be expected to result in a substantial lessening of competition within a market or markets in the United Kingdom for goods or services, including for the supply of: retail mobile telecommunications services to end consumers in the UK, including both consumers and business customers; and wholesale mobile services in the UK.

A.2 Therefore, in exercise of its duty under section 33(1) of the Act, the CMA hereby makes a reference to its chair for the constitution of a group under Schedule 4 to the Enterprise and Regulatory Reform Act 2013 in order that the group may investigate and, within a period ending on 18 September, decide the following questions in accordance with section 36(1) of the Act:

(a) whether arrangements are in progress or in contemplation which, if carried into effect, will result in the creation of a relevant merger situation; and

(b) if so, whether the creation of that situation may be expected to result in a substantial lessening of competition within any market or markets in the United Kingdom for goods or services.

**Julie Bon**
**Deputy Chief Economic Adviser**
**Competition and Markets Authority**
**4 April 2024**

# APPENDIX B: Conduct of the inquiry

B.1 On 4 April 2024, the CMA referred the anticipated joint venture between Vodafone Group Plc (**Vodafone**) and CK Hutchison Holdings Limited (**CK Hutchison**) concerning Vodafone Limited (**VUK**) and Hutchison 3G UK Limited (**3UK**) for an in-depth phase 2 inquiry.

B.2 We published the biographies of the members of the Inquiry Group conducting the phase 2 inquiry on the inquiry webpage on 4 April 2024.

B.3 The original administrative timetable for the phase 2 inquiry was published on the inquiry webpage on 12 April 2024. At the commencement of the inquiry, the statutory deadline was 18 September 2024, but this was subsequently extended to 12 October 2024 as a result of the failure by CK Hutchison to comply with the requirements of a notice issued on 17 April 2024 under section 109 of the Act to provide certain documents and information. On 10 May 2024, the Inquiry Group decided pursuant to section 39(4) of the Act that the reference period should be extended until CK Hutchison complied with the requirements of the section 109 notice, or the CMA published its decision to cancel the extension. A notice of extension was published on the inquiry webpage on 10 May 2024. Following receipt of the outstanding documents and information, we re-started the statutory timetable on 3 June 2024 and a notice of termination of the extension was published on the inquiry webpage the same day. On 3 June 2024, a revised version of the administrative timetable was also published on the inquiry webpage.

B.4 On 1 August 2024, the Inquiry Group decided to extend the reference period by eight weeks under section 39(3) of the Act to 7 December 2024. In reaching its decision that there are special reasons why the report on this reference could not be prepared and published within the prior reference period, the Inquiry Group had regard to: the very wide scope of this inquiry and the technical and regulatory complexity of the sector; the amount of technical material provided by the Parties in support of their submissions; the public announcement on 3 July 2024 of the new Beacon 4.1 agreement between Vodafone Limited and VMED O2 UK Limited, requiring the Inquiry Group to assess the implications of the agreement; and the need to complete the CMA's econometric estimation of consumer demand for mobile services. A notice of extension and a revised version of the administrative timetable were published on the inquiry webpage on 2 August 2024.

B.5 We invited a wide range of interested parties to comment on the Merger. These included the Parties' competitors, customers and other stakeholders, including Ofcom, the relevant sectoral regulator. Evidence, including written responses, internal documents and data, was obtained from third parties using questionnaires and written requests. A number of them also provided us with information through calls and meetings as well as by responding to supplementary written questions.

Evidence submitted during the CMA's phase 1 investigation has also been considered in phase 2.

B.6 We commissioned DJS Research to conduct two surveys aimed at understanding drivers of customer choice and customers' next best alternatives to the Parties. Copies of DJS Research's reports of the survey methodologies and findings are published on the inquiry webpage alongside this document.

B.7 We obtained data on mobile network quality in the UK from Open Signal, as well as other data from Ofcom and Pure Pricing, which we used to perform an econometric analysis.

B.8 We received written evidence from the Parties in the form of submissions and responses to information requests, including financial and consumer data, economic models and a large number of internal documents.

B.9 On 10 April 2024, members of the Inquiry Group, accompanied by CMA staff, attended a teach in with the Parties and their advisors. On 22 and 23 April 2024, members of the Inquiry Group, accompanied by CMA staff, attended site visits with each Party and their advisers.

B.10 On 2 May 2024, we published an Issues Statement on the inquiry webpage setting out the areas on which we envisaged that the phase 2 inquiry would focus. Non-confidential versions of third party responses to the issues statement were published on the webpage on 13 June and 12 July 2024. A non-confidential version of the Parties' initial submission was published on the inquiry webpage on 14 June 2024.

B.11 On 9 May 2024, we held a meeting with the Parties in which they set out their views on the competition issues raised in the CMA's phase 1 decision, expanding on their initial submission.

B.12 We held separate main party hearings with each of the Parties on 1 and 2 July 2024.

B.13 Prior to the hearings, we sent the Parties a number of working papers for comment. The Parties were also sent an Annotated Issues Statement, which outlined our emerging thinking to date prior to their respective main party hearings. The Parties provided comments on the Annotated Issues Statement and working papers on 8 July 2024.

B.14 On 7 August 2024, we held a meeting with the Parties in which they set out the key aspects from their efficiencies case.

B.15 On 13 August 2024, we disclosed a short additional working paper to the Parties. The Parties provided a response to this working paper on 20 August 2024.

B.16 A non-confidential version of our provisional findings report has been published on the inquiry webpage. As we have provisionally concluded that the Merger constitutes arrangements in progress or contemplation which, if carried into effect, will result in the creation of a relevant merger situation, and that the creation of that relevant merger situation may be expected to result in a substantial lessening of competition by reference to certain of the markets investigated by the Inquiry Group, a notice of possible remedies has also been published on the inquiry webpage. Interested parties are invited to comment on both of these documents.

B.17 We would like to thank all those who have assisted our inquiry so far.

# APPENDIX C: Parties' and third parties' internal documents

C.1 This Appendix contains our analysis of the Parties' and third parties' internal documents relating to:

(a) the importance of scale;

(b) network investment strategies;

(c) the retail market; and

(d) views on the impact of the Merger.

## Importance of scale

### Parties' documents

#### 3UK

C.2 Our review of internal documents has found mixed evidence of 3UK's perspectives of (i) its relative 'scale', (ii) the impact of this on its ability to grow and compete in the relevant markets, and (iii) its investment plans and financial performance expectations.

*3UK's [✂]*

C.3 We have seen some evidence to suggest that [✂]:

(a) In its budget setting document for FY23 [✂], 3UK discusses [✂].[1] [✂]. [2]

(b) Meeting notes from a 'Chairman's Meeting' in October 2022 discuss 3UK [✂].[3]

(c) The note from another of these meetings in February 2023 discusses 3UK [✂],[4] and minutes of a subsequent meeting in June 2023 [✂].[5]

(d) This is [✂],[6] [✂].[7]

C.4 While some of these documents (referenced above) specifically link capital expenditure [✂], we have also found evidence [✂] that there is a group-wide aim

[1] CK Hutchison internal document
[2] CK Hutchison internal document
[3] CK Hutchison internal document
[4] CK Hutchison internal document
[5] CK Hutchison internal document
[6] CK Hutchison internal document
[7] CK Hutchison internal document. This document also notes that [✂]. The document also discusses [✂].

[✂] across all operating segments of CK Hutchison's telecommunications division ([✂]).

(a) In an analyst call during the period in which 3UK was investing significantly in its network, CK Hutchison pointed out that 3UK was temporarily breaking this policy while it was funding investments into its network;[8]

(b) Recently, when discussing 3UK's H1 FY24 results (summarised in Chapter 8, 3UK's recent growth and financial performance), CK Hutchison pointed out the comparison between capex and depreciation across its operating companies and noted that 'for the group as a whole, we have brought capex within the envelope of depreciation' and that 'that's something we've been trying to do in our telecoms operations for a very long time, and it's very good to see that that has finally been accomplished'.[9] This focus is consistent with this comparison being reported across several of CK Hutchison's telecommunications division's public financial performance summaries, as seen in all half-year and full-year results since FY22.[10]

(c) A recent CK Hutchison group level document titled [✂].[11]

C.5 We have also seen evidence suggesting that [✂].

(a) A chairman meeting document from 2022 includes a request [✂].[12] [✂].[13]

(b) Another of these meetings in 2023 included [✂].[14]

C.6 One of these documents also demonstrates [✂]. A meeting in August 2022 includes [✂], with 3UK stating that [✂].[15] CK Hutchison submitted [✂]. We note that [✂], (i) the discussion of [✂] and (ii) [✂] suggests [✂].

[8] CK Hutchison, investor relations webcast, 18 March 2021, Webcast – CK Hutchison Group Telecom Holdings – 2020 Annual Results Presentation, 7:00 – 9:00 minutes, accessed by the CMA on 28 August 2024.
[9] CK Hutchison, investor relations webcast, 15 August 2024, Webcast – CK Hutchison Group Telecom Holdings – 2024 2024 Interim Results Analyst Presentation, 7:00 – 10:00 minutes, accessed by the CMA on 15 August 2024.
[10] CK Hutchison, public investor relations presentations: CK Hutchison Group Telecom Holdings 2022 Annual Results Presentation, 16 March 2023, page 7, accessed by the CMA on 20 August 2024; CK Hutchison Group Telecom Holdings 2023 Interim Results Presentation, 3 August 2023, page 7, accessed by the CMA on 20 August 2024; CK Hutchison Group Telecom Holdings 2023 Annual Results Analyst Presentation, 21 March 2024, page 7; CK Hutchison Group Telecom Holdings 2024 Interim Results Analyst Presentation, 15 August 2024, page 7, accessed by the CMA on 20 August 2024.
[11] CK Hutchison internal document
[12] CK Hutchison internal document
[13] CK Hutchison internal document
[14] CK Hutchison internal document
[15] CK Hutchison internal document

*3UK's [✂]*

C.7 We have found evidence that [✂] with the aim of [✂]. We see this for example in [✂],[16] and in documents relating to [✂].

(a) A document prepared in July 2021, appearing to discuss early 'synergies' expectations for the Merger, discussed [✂], being [✂].[17]

(b) A document referencing an [✂],[18] contemplated in 2020, [✂].[19] This document also references 3UK's [✂].[20]

C.8 We have also seen evidence of 3UK's [✂].

(a) 3UK's budgeting documents over recent periods indicate [✂],[21] [✂].[22]

(b) [✂],[23] [✂].[24]

(c) We have also seen some evidence of 3UK [✂]. For example:

(i) In December 2023, [✂].[25]

(ii) In May 2023, [✂].[26]

*3UK's expectations of future financial performance*

C.9 In addition to the documents set out in Chapter 8, 3UK's recent growth and financial performance, we see evidence of 3UK perceiving its own performance positively and [✂]. We have also reviewed evidence suggesting that [✂]. In more detail:

(a) 3UK's 2024 budget presentation [✂], suggests that 3UK is achieving [✂], in particular in its subscriber and revenue growth. In this document, 3UK notes that [✂], having achieved overall customer base [✂] year-on-year; [✂] year-on-year [✂].[27]

[16] Forecasts developed [✂]. (CK Hutchison internal document). Updated projections [✂] (see CK Hutchison internal document).
[17] CK Hutchison internal document
[18] [✂].
[19] CK Hutchison internal document
[20] Commentary in this document [✂]. CK Hutchison internal document.
[21] For example, [✂]. CK Hutchison internal documents
[22] An internal document shows [✂]. CK Hutchison internal document
[23] For example, [✂]. CK Hutchison internal documents
[24] 3UK's [✂]. CK Hutchison internal document
[25] CK Hutchison internal documents
[26] CK Hutchison internal document
[27] CK Hutchison internal document

(b) 3UK's long term forecast [✂],[28] [✂], [29] [✂].[30]

(c) 3UK's current five-year plan, [✂][31] [✂].[32]

**VUK**

*VUK's perceptions of its 'scale' and returns performance*

C.10 Regarding VUK's expectations of future ROCE (as compared to WACC) performance we see evidence in its internal documents that VUK [✂]. More recently, as set out in Chapter 8, VUK's recent financial performance, [✂] paragraph C.13) [✂].

(a) Vodafone's [✂], dated March 2020, [✂].[33]

(b) An update [✂] in November 2020, setting out a review of financial and strategic updates, set out that VUK was [✂].[34]

(c) Vodafone's [✂], dated March 2021, [✂].[35]

(d) A VUK [✂] from October 2021, summarised that [✂].[36]

(e) Vodafone's [✂], dated March 2022, outlined that [✂].[37]

(f) Vodafone's March 2023 [✂] noted that VUK was [✂].[38]

(g) Another March 2023 [✂], noted that VUK's [✂].[39]

C.11 We have also found evidence that VUK considers itself [✂] and [✂] in the consumer mobile segment:

(a) [✂], written in January 2021, from [✂] discusses the [✂].[40] It mentions [✂]. The [✂] discusses that, [✂], VUK is [✂].

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[28] This is based on 3UK's achieved FY23 figures (shown in Parties' response to the phase 1 Issues Letter, 4 March 2024) and projected FY24 performance. CK Hutchison internal document
[29] A 3UK internal document shows [✂]. CK Hutchison internal documents
[30] CK Hutchison Internal Document, [✂].
[31] TSA means the Telecommunications Security Act 2021, as described at CK Hutchison response to the CMA's RFI.
[32] Parties' response to the CMA's RFI
[33] Vodafone internal document. We note that Vodafone's performance reviews of VUK as set out in certain internal documents cited below, namely [✂]. [✂]. Our review of evidence relating to this, informing our provisional view, is set out later in this appendix.
[34] Vodafone internal document
[35] Vodafone internal document
[36] Vodafone internal document
[37] Vodafone internal document
[38] Vodafone internal document
[39] Vodafone internal document
[40] Vodafone internal document

(b) We have also reviewed a number of documents in which VUK [✂]. In some documents [✂] VUK perceives [✂]:

(i) A document from August 2021 [✂] by 'large converged players', and in which VUK 'remains in a sub-scale position'. This document also discusses that the [✂];[41]

(ii) In a February 2021 document, VUK discusses the advantages of other market participants [✂], and that it [✂].[42]

(iii) Another document from around this time (February 2021) discusses that [✂]and explores [✂].[43]

(iv) A later document, prepared in March 2023, also discusses a [✂], who [✂].[44]

(v) Another document dated in 2023 [✂].[45]

*VUK's perceptions of its growth performance*

C.12 A number of Vodafone's and VUK's internal documents demonstrate [✂]:

(a) In its Consumer (mobile and fixed) business, VUK regularly reports [✂]:

(i) A document from late 2021 [✂];[46]

(ii) The same commentary is made in a document from October 2022 [✂];[47]

(iii) The same graph updated for [✂] subsequently in April 2023, [✂].[48]

(b) This is consistent with Vodafone's perspective of [✂]. For example, Vodafone's [✂], which [✂].[49]

*Vodafone's treatment of [✂]*

C.13 In response to our Phase 1 Decision and Working Papers, Vodafone submitted that our consideration of VUK's financial performance [✂] should include [✂]. In response to this, we clarified our understanding of [✂]:

[41] Vodafone internal document
[42] Vodafone internal document
[43] Vodafone internal document
[44] Vodafone internal document
[45] Vodafone internal document
[46] Vodafone internal document
[47] Vodafone internal document
[48] Vodafone internal document
[49] Vodafone internal document

(a) We confirmed with Vodafone that [✂]. [50] [✂].

(b) We reviewed Vodafone's LRP documents over recent periods, and note that these suggest that it generally does not consider [✂]. More recently, it has considered [✂].[51]

(c) We note that Vodafone's submissions of VUK's management accounting [✂].[52]

(d) Documents from both of Vodafone and CK Hutchison, prepared during the course of negotiations relating to the Merger, confirm that [✂].[53]

C.14 We consider that [✂]. However [✂].

*Summary of evidence of the Parties' view of considerations relating to 'scale'*

C.15 As also set out in Chapter 8, overall, we provisionally consider that:

(a) 3UK documents show that it does, in some cases, [✂]. It also [✂]. While it has seen a [✂], this [✂]. It has [✂] been able to achieve [✂] in a number of areas, and its most recent internal documents and published results demonstrate this trend continuing, with improved [✂] metrics. Its most recent business plan expects [✂].

(b) VUK has historically perceived itself to be [✂], and has [✂]. Its perceptions of its [✂], and Vodafone perceives [✂].

**Third parties' documents**

C.16 BTEE's internal documents suggest that it views operating scale as an important factor in providing a competitive mobile offering. For example, [✂] states that BT's [✂]. The document further states that 'the market is highly fragmented', and as a result 'fewer scaled players will emerge with more competitive unit economics'.[54]

C.17 VMO2's internal documents suggest that it also views operating scale as an important factor in providing a competitive mobile offering. For example:

(a) A VMO2 'Strategic Plan' dated 28 May 2023 states that [✂], and the first of these is [✂]. However, the document does state that VMO2 [✂]. The other two levers are to [✂].[55]

[50] Vodafone response to the CMA's RFI
[51] Vodafone internal document
[52] Vodafone response to response to the CMA's s109 notice
[53] Vodafone internal documents; CK Hutchison internal document
[54] BTEE internal document
[55] VMO2 internal document

(b) A ‘Consumer Mobile Strategy’ dated 9 September 2021 provides an assessment of strategies in the mobile market, [✂]. For example, the document outlines a current strategy to [✂].[56]

(c) An internal document dated 15 December 2021 on ‘Mobile Market Opportunities’ states that [✂]. The document highlights [✂] mobile base, its revenue, and its estimated return on capital employed (**ROCE**), all of which [✂].[57]

C.18 Overall, we provisionally consider that BTEE’s and VMO2’s internal documents indicate that they view operating scale as an important factor in providing a competitive mobile offering.

## Network investment strategies

C.19 In this section we set out the documentary evidence from the Parties and third parties on:

(a) their current network investment strategies;

(b) their perception of other MNOs’ network quality; and

(c) their post-Merger network investment strategies.

### Current network investment strategies

#### Parties’ documents

C.20 In addition to the evidence from the Parties’ internal documents relating to their current network investment strategies set out below, we consider that the Parties’ internal documents relating to the importance of scale (and discussed in the previous section) are also relevant in relation to this topic.

*3UK*

C.21 A large number of 3UK’s internal documents provided to the CMA show that 3UK has spent considerable resources in recent years to improve its network – and customers’ perception of it – including to roll out NSA 5G at pace in certain areas.[58]

[56] VMO2 internal document
[57] VMO2 internal document
[58] For example, CK Hutchison internal documents. See also CK Hutchison internal document.

*VUK*

C.22 Vodafone's internal documents also convey [✂]. [✂] including as priorities both the [✂] together with the [✂].[59] [✂].[60]

C.23 In their response to the Working Paper, the Parties submitted that the CMA mischaracterised VUK's internal documents relating to its network ambitions. The Parties submitted that VUK's internal documents [✂] 5G rollouts, including the fact that VUK's [✂].[61] In more detail, the Parties submitted that:[62]

(a) VUK's forecasts of the number of 5G sites it would deploy over the coming years [✂];

(b) [✂]; and

(c) There is [✂].

C.24 We consider that many businesses – including Vodafone – may need to alter and adapt plans over time, taking into account strategic priorities, performance and funding abilities, as would be expected from a rational economic actor. A July 2021 document discussing VUK's network long-range plan illustrates this point.[63] In this document, [✂].[64] This document shows that, as of [✂].[65]

C.25 It remains that VUK's internal documents indicate its ambition and strategy [✂],[66] which the Parties accept in their submissions.[67] Further, we have not found evidence in Vodafone's internal documents to suggest that [✂] has hampered its ability to meet its customers' needs, nor have the Parties made this claim.

**Third parties' documents**

*BTEE*

C.26 Internal documents from BTEE show that it considers itself as having the best network in the UK, [✂].

(a) A [✂] refers to BTEE having the 'best and most reliable mobile network', referring to metrics such as 'overall population coverage across 4G', '4G

[59] Vodafone internal documents
[60] Vodafone response to the CMA's request for information (**RFI**); and see also 'VUK launches 5G Ultra, the UK's first 5G Standalone mobile network for consumers', June 2023.
[61] Annex 1 to the Parties' response to the AIS and working papers
[62] Annex 1 to the Parties' response to the AIS and working papers; Vodafone internal documents
[63] Vodafone internal document
[64] Vodafone internal document
[65] Vodafone internal document
[66] For example, Vodafone internal documents
[67] Annex 1 to the Parties' response to the AIS and working papers

geographic coverage' and '5G population coverage'. The document states that BT Group 'continue to prioritise [✂].[68]

(b) An [✂] states that BTEE's consumer priority is [✂]. The document sets out goals to achieve this, such as to [✂].[69]

(c) [✂] show that BT Group is monitoring third party benchmarks from RootMetrics and Umlaut, which in Q1 FY23/24 show that BTEE's '#1 Network performance continues in Mobile for the 10th year in succession'.[70]

C.27 Internal documents also discuss the value of network leadership to BTEE [✂]. In particular, BTEE considers [✂].

(a) The [✂] for the BT [✂] states [✂]. The document also states that the [✂]. [✂].[71]

(b) A [✂] illustrates the value of network leadership to BTEE. It states that [✂]. It states that [✂], as the [✂]. The document also highlights that [✂] with [✂] but [✂], suggesting that [✂] would [✂].[72]

(c) The [✂] states that BTEE's [✂] through EE's [✂] BT's strategy [✂].[73]

(d) A [✂] outlines key risks on the consumer risk register, with [✂].[74]

(e) A [✂] states that 'customers are willing to pay more for the quality of our [BTEE's] network', citing evidence that BTEE's brand reputation is stronger than 3UK's (based on having reliable network coverage, the largest network, the fastest network, and being the best for 5G), and is [✂].[75]

C.28 Internal documents outline that BTEE's strategy was to be the first to 5G in 2018, [✂]. More recently, [✂].

(a) An internal document dated [✂] shows that [✂]. The document shows that 'EE was the first to launch 5G' in May 2019, with VUK, 3UK and VMO2 following later in 2019 in that order. [✂]. Following this, the document states that BT [✂].[76]

(b) A [✂] outlines the role of standalone 5G, stating that it is 'a natural but critical technology evolution that brings clear improvements in speed, latency,

[68] BTEE internal document
[69] BTEE internal document
[70] BTEE internal document, BTEE internal document, BTEE internal document
[71] BTEE internal document
[72] BTEE internal document
[73] BTEE internal document
[74] BTEE internal document
[75] BTEE internal document
[76] BTEE internal document

responsiveness, security and reliability. It's the next stage for 5G – and will enable new and exciting use cases for consumers and enterprise customers.' The document outlines BT Group's approach to 5G SA, stating that when it was [✂]. But [✂], the document also outlines that [✂], and that [✂].[77]

C.29 Internal documents from BTEE also show that it considers itself [✂] with respect to 5G deployment, and assesses the threat from other MNOs (most particularly [✂], and [✂]) to this [✂].

(a) The [✂] show that BT Group is monitoring BTEE's 5G population coverage, which has [✂].[78]

(b) A [✂] states that [✂].[79]

(c) A [✂] states that BTEE [✂]. The document further states that BTEE's strategy includes [✂] and to [✂].[80]

(d) The [✂] also shows that BT Group [✂]. For example, the document states that [✂]. It also states that [✂].[81]

(e) An internal document dated [✂] discusses competitive dynamics in 5G, estimating other 5G coverage figures and outlooks for other MNOs. For example, it states [✂]. Another example states that [✂]. The document also states that [✂].[82]

C.30 Overall, we provisionally consider that BTEE's internal documents indicate that:

(a) BTEE considers itself to have the best network in the UK and to [✂] the market on 5G, which allows it to [✂] and [✂];

(b) BTEE considers that [✂], and to some extent [✂], are posing some threat to BTEE's [✂] 5G. [✂]; and

(c) BTEE considers that [✂].

*VMO2*

C.31 Internal documents from VMO2 show that it considers its network performance [✂].

(a) An internal document dated 13 September 2022 on 'Mobile Network Investment' states that VMO2's [✂]. The document shows [✂] ranked first

[77] BTEE internal document
[78] BTEE internal documents
[79] BTEE internal document
[80] BTEE internal document
[81] BTEE internal document
[82] BTEE internal document

and [✂] ranked second by four network research providers, and states that [✂]. The document further states that VMO2's [✂], and that for VMO2 [✂].[83]

(b) The 'Strategic Plan' dated 21 June 2023 states that VMO2's [✂] and [✂].[84]

(c) An internal document dated 27 November 2023 on '4G / 5G Investment' states that [✂], showing that VMO2 is [✂]. The document outlines a [✂].[85]

(d) An internal document dated 18 April 2023 on 'Mobile Network Improvements' states that VMO2 has the [✂]. It states that one of VMO2's goals is an [✂]. The document further outlines VMO2's network performance compared to other MNOs, claiming that [✂].[86]

C.32 Internal documents from VMO2 show that it has [✂]. VMO2 considers [✂] and [✂] to be the market leaders in 5G rollout.

(a) A Board Meeting document dated 17 November 2021 states that VMO2 [✂]. The document also states that 'VMO2 is [✂]. For example, [✂] and [✂], and [✂].[87]

(b) A Board Meeting document from 1 March 2022 states that VMO2 'will [✂], with [✂]. The document also states that [✂] in their networks due to [✂].[88]

(c) An internal document dated 5 April 2022 titled 'State of the Sector Q4-21', by [✂], states that [✂].[89]

(d) An internal document dated 20 February 2024 for the VMO2 CEO on 'Network Performance against key KPIs' states that VMO2's [✂] in 2023, but [✂].[90]

C.33 Internal documents from VMO2 show that it [✂] intends to invest [✂] particularly in 5G high-band coverage.

(a) An internal document dated 16 April 2024 on 'Strategic Priorities' states that one of VMO2's strategic priorities is to [✂].[91]

[83] VMO2 internal document
[84] VMO2 internal document
[85] VMO2 internal document
[86] VMO2 internal document
[87] VMO2 internal document
[88] VMO2 internal document
[89] VMO2 internal document
[90] VMO2 internal document
[91] VMO2 internal document

(b) An internal document dated 11 July 2023 on VMO2's 'Strategic Plan 2024-2026' shows that VMO2 has the [✂]. The document states that VMO2 [✂].[92]

(c) An internal document dated 25 January 2024 on VMO2's 'Incremental Investment options over 3YP [three year plan]' states that VMO2's 5G high-band [✂] and that [✂]. The document further states that [✂], with one of its SLAs under the Sky Mobile contract that [✂].[93]

(d) The 'Strategic Plan' dated 21 June 2023 shows that VMO2 considers [✂] and additional [✂] is required [✂].[94] For example:

(i) [✂].

(ii) [✂].

(iii) [✂].

(iv) [✂].

C.34 Overall, we provisionally consider that VMO2's internal documents indicate that:

(a) VMO2 considers its network performance [✂];

(b) VMO2 considers [✂] and [✂] to be the market leaders on 5G, [✂]; and

(c) VMO2 considers that mobile operators have limited incentive to invest in their networks due to inflationary cost pressures and eroding returns on investment in 5G.

## Perceptions of other MNOs' network quality

### Parties' documents

C.35 Evidence from the Parties' internal documents relating to performance on network quality is discussed in Chapter 8, Network quality. The corresponding evidence from third parties' internal documents is discussed in the sections below.

[92] VMO2 internal document
[93] VMO2 internal document
[94] VMO2 internal document

**Third party documents**

*BTEE*

C.36 Internal documents from BTEE show that it considers [✂] to pose the most significant threat to its [✂] in 5G. For example:

(a) A BTEE [✂] states that '[✂] is the market leader [✂]' and has 'the widest coverage of 5G rollout [✂] and lead on 5G speed'.[95]

(b) A [✂] states that while BTEE [✂].[96]

C.37 A BT Group [✂] states that 'UK MNOs pursue different strategies: [for example] [✂].[97]

C.38 Overall, we provisionally consider that BTEE's internal documents show that it considers that MNOs pursue different strategies, and [✂] poses the most significant threat to BTEE's [✂] in 5G.

*VMO2*

C.39 A number of VMO2 internal documents show that it considers that [✂] has the strongest network of MNOs, followed by [✂]. For example:

(a) The VMO2 'Strategic Plan' dated 21 June 2023 states that [✂] is considered to have the strongest network of the four MNOs. The document states that VMO2 considers [✂], and while [✂] are close behind [✂] have a significantly lower percentage [✂].[98]

(b) The VMO2 Executive Committee pre-read dated 12 August 2022 states that [✂] have the strongest network perceptions (based on coverage and speed), while [✂] is trailing them. [✂] is also considered to [✂].[99]

(c) A VMO2 internal document on 'Mobile Network Investment' dated 13 September 2022 shows VMO2 monitoring [✂] as having the strongest network of MNOs based on third party network performance research providers, and [✂] having the second strongest network. The document states that [✂] is a [✂] in most network performance metrics, and that [✂].[100]

[95] BTEE internal document
[96] BTEE internal document
[97] BTEE internal document
[98] VMO2 internal document
[99] VMO2 internal document
[100] VMO2 internal document

C.40 The VMO2 ‘Strategic Plan’ dated 21 June 2023 suggests that VMO2 considers [✂] and [✂] to be market leaders on 5G. The document states that [✂] is significantly ahead on [✂].[101]

C.41 VMO2 internal documents provide an overview of the network strengths of mobile operators. For example:

(a) The VMO2 ‘Consumer Mobile Strategy’ dated 9 September 2021 states that [✂].[102]

(b) A VMO2 internal document dated 25 October 2021 for a Board meeting, [✂] is said to have the [✂], [✂] is considered the [✂] and 3UK a [✂].[103]

C.42 Overall, we provisionally consider that VMO2’s internal documents indicate that it considers [✂] to have the strongest network amongst the MNOs, followed by [✂], and that [✂] and [✂] are market leaders on 5G.

*Sky Mobile*

C.43 In relation to the network quality of the four MNOs, Sky Mobile’s internal documents show that it considers that BTEE is the leading supplier, while 3UK’s network quality has improved. Sky Mobile considers VMO2 to have the poorest network performance.

(a) An internal document from December 2023 notes that BTEE ‘retains leadership in terms of 5G deployment and network performance; O2 continues to lag’ and also shows BTEE has the best network across all network quality measures, followed by VUK in second (except speed which has 3UK second and VUK third) and 3UK in third. VMO2 is fourth on all measures.[104]

(b) Another document notes ‘VMO2 performance isn't keeping up with other MNOs’ and ‘VMO2 network performance is lagging behind MNOs’.[105]

C.44 Sky Mobile also appears to be trying to put pressure on VMO2 to improve its network performance, with one document stating that ‘Network issues still key churn driver; with >60% of these heading to EE – continue to gather evidence and put pressure on VMO2’.[106]

[101] VMO2 internal document
[102] VMO2 internal document
[103] VMO2 internal document
[104] Sky internal document
[105] Sky internal document
[106] Sky internal document

## Post-Merger network investment strategies

### Parties' documents

C.45 Evidence from the Parties' internal documents relating to post-Merger network investment strategies is discussed in section Chapter 10. The corresponding evidence from third parties' internal documents is discussed in the section below.

### Third parties' documents

*BTEE*

C.46 BTEE's internal documents suggests that it considers [✂].

(a) The [✂] the Merger as [✂].[107]

(b) A BTEE [✂] states that 'a merger [between VUK and 3UK] would create a new market leader based on mobile connections / spectrum assets'.[108]

(c) [✂] state that 'potential market consolidation will affect our [BTEE's] competitive position [on spectrum]'. These document state that VUK and 3UK would hold '[✂] of premium low band spectrum' and '[✂] of 3.4-3.8GHz 5G spectrum (vs [✂] BT Group)' and [✂]. [109]

(d) The [✂] sets out BT Group's [✂]. It states that it needs to [✂] between the merged company and others'.[110]

(e) The [✂] states that [✂] and that BTEE's [✂] in a consolidated market scenario', as post-Merger, the Merged Entity would have '[✂]% of usable c-band (3.4-3.8 GHz)' while 'EE would have [✂]%' and '[✂]% of usable low-band' while 'EE would have [✂]%'. The document does state that post-Merger, 'EE maintains current position in mid-band ([✂]% vs VF/3 [✂]%)'.[111]

(f) An internal document dated [✂] states that [✂] BTEE's [✂] if the 3 / Voda[fone] merger goes ahead [✂] and that 'the joined forces could be [✂].'[112]

C.47 BTEE's internal documents show that [✂].

(a) A [✂] states that [✂] the spectrum asymmetry from a potential VF/3 merger'. This is because 'a VF/3 entity would hold c[✂]% of premium usable low

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[107] BTEE internal documents
[108] BTEE internal document
[109] BTEE internal documents
[110] BTEE internal document
[111] BTEE internal document
[112] BTEE internal document

band spectrum (vs [✂]% BT) [and] it would also hold [✂]% of 3.4-3.8GHz 5G spectrum', and 'this will result to a significant competitive advantage for VF/3 [✂]. The document also sets out [✂].[113]

(b) An internal document dated [✂] states that 'For BT, [✂]. The document also states that there is [✂]. The document also sets out BT Group's consideration of other interested parties' perspective, suggesting that [✂] maintain [the] ability to effectively compete'.[114]

(c) [✂] also set out BT Group's [✂].[115]

(d) The [✂] provides a Board update on the Merger. For example:[116]

(i) The document states that 'H3G/VOD would have significantly more network capacity, so [✂]. Additionally, the document states that 'in parallel, BT Group [✂];

(ii) The document states that BTEE's [✂];

(iii) The document also discusses [✂]; and

(iv) The document also states that in response to the Merger, BTEE's [✂].

(e) The 'Minutes of [a] [✂] states that [✂].[117]

C.48 However, some BTEE internal documents [✂].

(a) A [✂] document dated [✂] shows that based on financial modelling, the Merger results in [✂] for BTEE relative to the pre-Merger scenario. BTEE also considered the effect [✂]. Specifically, it considers that [✂] in response to the Merger.[118]

(b) A BTEE internal document [✂] out BT Group's external and CMA engagement plans, which includes its 'public narrative'. The narrative states that 'this merger would tilt the playing field to the benefit of one network, with limited incentive to invest given the size and scale from which it would benefit, and the ability to distort competition. It would result in less, not more, investment in the UK, which to date has seen strong competition driving investment and innovation in networks'. The document sets out four arguments, that the Merger 'will harm investment in infrastructure', that it

[113] BTEE internal document
[114] BTEE internal document
[115] BTEE internal documents
[116] BTEE internal document
[117] BTEE internal document
[118] BTEE internal document. BTEE email

'does nothing to tackle the underlying barriers to investment', that it 'would raise prices' and that 'there's no focus on customer service'.[119]

C.49 Overall, we provisionally consider that most of BTEE's internal documents indicate that BTEE considers that if the Merged Entity were to challenge [✂]. BTEE would consider [✂], but we provisionally consider that the balance of the evidence points to it responding to any such challenge [✂].

*VMO2*

C.50 VMO2's internal documents show [✂]. For example:

(a) An internal document dated 14 November 2022 for the VMO2 Network Strategy Board states that VUK and 3UK will [✂].[120]

(b) An internal document dated 27 November 2023 on '4G / 5G Investment' states that the 'Vodafone Three merger [✂]. VMO2 also quote a VUK press release from June 2023 that, 'The combined business will invest £11bn in the UK over 10 years including the deployment of a 5G standalone network.'[121]

C.51 Internal documents also show that [✂]. For example:

(a) A 'UK M&A Opportunities Update' dated 15 June 2022 states [✂]. The strategy pillar VMO2 identified for the Merged Entity to achieve best network was to [✂]. The document sets out the expected value impact of this strategy pillar both for the Merged Entity and [✂], calculated at up to [✂].[122]

(b) An internal document dated 25 January 2024 on mobile investment options states that the [✂] and that [✂].[123]

(c) An internal document dated 20 February 2024 for the VMO2 CEO on 'Network Performance against key KPIs' includes risks such as [✂] and it also [✂].[124]

C.52 Overall, we provisionally consider that VMO2's internal documents indicate that:

(a) VMO2 considers [✂]; and

(b) It considers that [✂].

[119] BTEE internal document
[120] VMO2 internal document
[121] VMO2 internal document
[122] VMO2 internal document
[123] VMO2 internal document
[124] VMO2 internal document

## Retail

C.53 In this section we consider documents from the Parties and third parties in relation to:

(a) their competitive strategies in the retail market; and

(b) the closeness of competition between the Parties and competitive constraints.

### Competitive strategies

C.54 We first present evidence from the Parties' internal documents and then third parties' internal documents on their competitive strategies.

#### Parties' documents

*3UK's competitive strategy*

##### Pricing strategy

C.55 In a document from January 2022, 3UK sets out the three pillars to its commercial strategy in the consumer retail segment, which include [✂].[125] Further in this presentation, 3UK elaborates on how it intends to [✂] – [✂].[126] [✂].[127] [✂],[128] [✂].[129]

C.56 Further, 3UK's internal documents suggest that its pricing is a key aspect of the competitive role that its two brands play in the supply of retail mobile services, with SMARTY offerings and 3UK's SIM offerings [✂].[130]

C.57 We also found evidence in 3UK's internal documents that its pricing principles are primarily targeted at competing with MNOs, although it also benchmarks its pricing against that of [✂]. For example, in a document dated [✂], the document states that [✂].[131] In the same document, [✂].[132]

C.58 Finally, we found a number of internal documents that [✂].[133] For example:

[125] CK Hutchison internal document
[126] CK Hutchison internal document
[127] CK Hutchison internal document. Also, CK Hutchison internal document.
[128] CK Hutchison internal document
[129] For example, CK Hutchison internal documents
[130] CK Hutchison internal document. Also, CK Hutchison internal documents
[131] CK Hutchison internal document
[132] CK Hutchison internal document
[133] [✂].

(a) [✂].[134] [✂];[135]

(b) [✂];[136] and

(c) [✂].[137]

C.59 The Parties submitted that [✂].[138] We consider that, in the round, 3UK's internal documents show that its pricing strategy is primarily aimed at competing with MNOs, [✂].[139]

C.60 3UK's internal documents considering its response to BTEE introducing a CPI+3.9% price increase in September 2020, show how 3UK considered the pricing behaviour of competitors when setting its own prices.

(a) 3UK initially elected to not match BTEE's price increase but changed its position in 2022. A trading approval document prepared for the 3UK ELT in September 2020 shows that [✂].[140] [✂].[141]

(b) In August 2022, 3UK provided a [✂].[142] Shortly thereafter, 3UK reviewed its initial position and considered moving from a fixed price increase to a variable rate. The slide pack shows that in considering its options 3UK had regard to [✂].[143] [✂].[144]

**Business**

C.61 The Parties explained that 3UK re-introduced a business offering in 2020, initially focusing on SoHo/micro businesses which accounts for approximately [✂]% of its business revenues.[145]

C.62 We found evidence in 3UK's internal documents of ambitious growth plans in the business retail segment, going [✂]. For example:

(a) [✂].[146]

(b) [✂].[147]

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[134] CK Hutchison internal document
[135] CK Hutchison internal document
[136] CK Hutchison internal document
[137] CK Hutchison internal document
[138] Parties' response to the phase 1 Issues Letter
[139] CK Hutchison internal document
[140] CK Hutchison internal document
[141] CK Hutchison internal document
[142] CK Hutchison internal document
[143] CK Hutchison internal document
[144] CK Hutchison internal document
[145] FMN
[146] CK Hutchison internal document
[147] CK Hutchison internal document

(c) [✂].[148] [✂].[149]

C.63 3UK's growth plans in the [✂] subsegment are further evidenced [✂].[150] [✂].[151]

C.64 [✂].[152] [✂].[153]

**SMARTY**

C.65 In August 2017, 3UK launched a digital sub-brand, SMARTY, which offers hybrid pre-paid services and had approximately [✂] subscribers as of September 2023.[154]

C.66 In 3UK's recent internal documents, the SMARTY brand is identified as an area of [✂].[155] [✂].[156]

C.67 Other internal documents are consistent with SMARTY being a brand through which 3UK [✂]. For example:

(a) A business update from February 2022 sets out 3UK's plans to launch a new SMARTY promotion 'to recapture lost market share' and put 3UK 'ahead of the competition'. In this document, [✂].[157]

(b) In a January 2022 document, 3UK identifies establishing and growing the SMARTY brand as one of the 3UK strategies it will implement to [✂].[158] To reach its objective of growing SMARTY, [✂].[159]

C.68 The [✂] role of SMARTY in 3UK's competitive strategy is further [✂][160] [✂].[161]

**FWA**

C.69 The Parties submitted that 3UK's FWA offering is unlikely to be able to compete more strongly with fixed home broadband since [✂] relies on the quality, capacity and coverage of the underlying 5G network, [✂].[162]

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[148] CK Hutchison internal document
[149] CK Hutchison internal document
[150] CK Hutchison internal document
[151] CK Hutchison internal document. Also, CK Hutchison internal document
[152] CK Hutchison internal document
[153] CK Hutchison internal document. Also, CK Hutchison internal document
[154] FMN
[155] For example, CK Hutchison internal document
[156] CK Hutchison internal document. Also, CK Hutchison internal document
[157] CK Hutchison internal document
[158] CK Hutchison internal document
[159] CK Hutchison internal document
[160] FMN.
[161] CK Hutchison internal document
[162] FMN

C.70 In contrast, we identified in internal documents that FWA has been another strong area of growth for 3UK in recent years [✂]. In its internal documents and the public domain, 3UK uses the terms 'Home Broadband' and 'Business Broadband' to refer to its FWA offering to consumers and business customers, respectively.

(a) [✂].[163] [✂].[164]

(b) [✂].[165]

C.71 3UK's internal documents indicate that FWA has continued to be a strong focus throughout [✂]. For example:

(a) [✂],[166] [✂].[167]

(b) [✂][168] [✂].[169]

C.72 [✂].[170]

**Network enhancements (incl. NSA 5G roll-out)**

C.73 3UK's internal documents discussing its network investment strategy are discussed in paragraph A.21 above.

**Customer experience**

C.74 We also found evidence in 3UK's internal documents that improvements to customer experience has been another area of focus [✂].[171]

C.75 [✂].[172]

C.76 In their submissions, [✂].[173]

**Brand reputation**

C.77 The Parties acknowledged in their submissions that all mobile operators compete on branding, undertaking considerable investments to support their brands and

[163] CK Hutchison internal document
[164]CK Hutchison internal document
[165] CK Hutchison internal document
[166] [✂]. See CK Hutchison internal document
[167] CK Hutchison internal document.
[168] The CMA understands this refers to FWA [✂].
[169] CK Hutchison internal document
[170] CK Hutchison internal document
[171] For example, CK Hutchison internal documents ; and CK Hutchison internal document
[172] CK Hutchison internal document
[173] FMN

presence in the supply of retail mobile services, and gave the example of 3UK sponsoring Gogglebox.[174] [✂].[175]

C.78 More generally, 3UK's most recent internal documents support the view that 3UK is committed to improving the perception and reputation of its brand and is making significant progress in this direction. For example:

(a) [✂].[176] [✂].[177]

(b) [✂].[178] [✂].[179]

*VUK's competitive strategy*

**Challenging the converged players**

C.79 [✂].[180]

C.80 [✂].[181] [✂].[182] [✂].[183] [✂].[184] [✂].[185] [✂].[186]

C.81 [✂].[187] [✂].[188]

**Business**

C.82 In their submissions, the Parties acknowledged that VUK has a broad offering to business customers, comprising mobile services, fixed services (including multi-play offers), security functionalities and other specific enterprise add-ons, enabling it to meet the needs of larger business customers (public sector, corporate and medium SMEs).[189]

C.83 [✂].[190] [✂].[191] [✂].[192]

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[174] FMN
[175] CK Hutchison internal document
[176] CK Hutchison internal document
[177] CK Hutchison internal document
[178] CK Hutchison internal document
[179] CK Hutchison internal document
[180] Vodafone internal documents
[181] Vodafone internal document. Also, Vodafone internal documents
[182] Vodafone internal document
[183] Vodafone internal document
[184] Vodafone internal document
[185] Vodafone internal document
[186] Vodafone internal document. Also, Vodafone internal document
[187] Vodafone internal document
[188] Vodafone internal document
[189] FMN
[190] For example, Vodafone internal documents
[191] Vodafone internal document
[192] Vodafone internal document

C.84 [✂],[193] [✂].[194]

### Network ambitions

C.85 VUK's internal documents discussing its network strategy are discussed in paragraphs C.22-C.25 above.

### Pricing strategy

C.86 [✂].[195] [✂].[196] [✂].[197]

C.87 Similarly to 3UK, VUK's internal documents discussing its response to BTEE introducing a CPI+3.9% price increase in September 2020, show VUK considered the pricing behaviours of competitors when setting its own prices. Vodafone's internal documents show that [✂]. A VUK document [✂],[198] while another notes that VUK considered that because BTEE is [✂].[199] VUK considered [✂],[200] but [✂][201] noting it [✂].[202] [✂].[203]

### Third party documents

*BTEE*

C.88 BTEE's internal documents relating to its network strategies are discussed in paragraphs A.26-A.30 above. In this section we discuss its wider competitive strategy in retail.

C.89 Internal documents from BTEE show that it positions itself at a premium to the rest of the market in most subsegments. [✂]. For example:

(a) An internal document dated [✂] states that the [✂].[204]

(b) An internal document dated [✂] states that for [✂], BTEE [✂]. The document [✂].[205]

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[193] [✂] (Vodafone internal documents).
[194] Vodafone internal documents
[195] For example, Vodafone internal documents
[196] For example, Vodafone internal document
[197] Vodafone internal document
[198] Vodafone internal document
[199] Vodafone internal documents
[200] Vodafone internal document
[201] Vodafone internal document
[202] Vodafone internal document
[203] Vodafone internal document
[204] BTEE internal document
[205] BTEE internal document

(c) A [✂] sets out monthly consumer ARPUs (average revenues per user) for different mobile operators from the period Q1 FY21 to Q3 FY23, stating that [✂]. [206]

C.90 Internal documents from BTEE also suggest that [✂]. For example, the implementation and eventual removal of inflation-linked price rises.

(a) A [✂] states that BTEE is [✂]. From 2014 it lists [✂]. For example:[207]

(i) In 2014 [✂];

(ii) In 2020 [✂]; and

(iii) in 2022 [✂].

(iv) The document also states that one of BT Group's key focus areas is [✂].

(b) Several internal documents from July to November 2020 set out BTEE's mid-contract price increase strategy of CPI+3.9% and show that other MNOs followed BTEE's lead on this. For example:

(i) An internal document dated [✂].[208]

(ii) An internal document dated [✂].[209]

(iii) A [✂] states that [✂]. The document states that this [✂]. [210]

(iv) An internal document dated [✂] for the BT Group [✂].[211]

(c) A [✂]. BTEE is doing this by [✂].[212]

C.91 Internal documents also show that BTEE [✂], for example MNOs implementing similar inflation-linked price rises.

(a) A [✂] states that [✂]. The document also states that as this is the [✂] and that BT Group [✂].[213]

(b) The internal document [✂] for the BT Group [✂]. It states that [✂] and that [✂].[214]

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[206] BTEE internal document
[207] BTEE internal document
[208] BTEE internal document
[209] BTEE internal document
[210] BTEE internal document
[211] BTEE internal document
[212] BTEE internal document
[213] BTEE internal document
[214] BTEE internal document

(c) A [✂] acknowledges that [✂].[215]

C.92 BTEE's internal documents also show that it considers [✂] to be a competitive advantage in the retail mobile market, and [✂].

(a) A [✂] outlines BT Group's [✂]. The document states that BT Group's [✂] The document also states that 'BT and VMO2 are integrated telcos, whereas other players specialise or are re-sellers of connectivity', and that [✂].[216]

(b) An internal document [✂] shows different BT Group [✂].[217]

(c) The [✂] states that [✂].[218]

C.93 Overall, we provisionally consider that BTEE's internal documents indicate that:

(a) BTEE considers itself to be at a price premium to most of the market;

(b) BTEE considers that [✂]; and

(c) BTEE considers providing [✂] to be a competitive advantage in the retail mobile market, and this [✂].

*VMO2*

C.94 Internal documents from VMO2 suggest that it operates a [✂] strategy [✂] to win customers [✂], allowing it to compete [✂].

(a) Two internal documents from November 2021 on VMO2's 'Brand Review' state that the three pillars to VMO2's brand strategy are having a [✂], a [✂], and to [✂]. The documents state that a [✂] is needed so that VMO2 can [✂].[219]

(b) A 'Consumer Mobile Strategy' internal document dated 9 September 2021 states that [✂], stating that [✂] strategy is [✂], [✂] strategy is an [✂], and [✂] strategy is to be [✂]. The document further states that [✂] and that since [✂].[220]

(c) A monthly CEO update dated 23 October 2023 states that VMO2's focus in mobile is [✂].[221]

[215] BTEE internal document
[216] BTEE internal document
[217] BTEE internal document
[218] BTEE internal document
[219] VMO2 internal document, VMO2 internal document
[220] VMO2 internal document
[221] VMO2 internal document

(d) A Board Meeting document dated 1 March 2022 states that VMO2's [✂], with [✂].[222]

(e) A VMO2 'Strategic Plan' dated 21 June 2023 outlines VMO2's brand portfolio strategy. This includes wanting to target [✂].[223]

(f) An internal document dated 12 December 2023 on VMO2's 'Key value drivers in Budget & 3YP' outlines the [✂] as a key driver for VMO2, but states that it must consider [✂].[224]

C.95 Quarterly VMO2 Risk Reports from January 2023 to January 2024 state that there is a [✂], and show that VMO2 looks to [✂]. Each report sets out future mitigation plans, including a [✂] strategy which [✂] and [✂]. The Risk Report from January 2024 states that the impact of this risk has increased (from GBP [✂] to GBP [✂] because [✂], and future treatment plans include another [✂] in 2024 which [✂].[225]

C.96 Internal documents from VMO2 also show it monitoring the pricing initiatives of other MNOs and often determining its own pricing initiatives in response to these.

(a) Environmental, social, and governance (**ESG**) updates from May to November 2023 show VMO2 monitoring other operators and assessing their mobile social tariff offerings, stating that [✂], and [✂]. The documents then show [✂].[226]

(b) A monthly CEO update dated 22 February 2023 shows VMO2 monitoring announcements in the mobile sector, such as '[✂], that [✂], and that [✂].[227]

(c) A VMO2 'Strategic Plan' dated 28 May 2023 states [✂].[228]

C.97 Internal documents from VMO2 show that it monitored the introduction of CPI+3.9% mid-contract price rises from other MNOs (first BTEE and then VUK) before deciding on its own inflation-linked mid-contract price rise strategy of RPI+3.9%.

(a) A paper on 'EE['s] annual price increase change' dated 17 September 2020 sets out an overview of BTEE's move to CPI+3.9% mid-contract price rises and what a similar move might be worth to VMO2. The document suggests

[222] VMO2 internal document
[223] VMO2 internal document
[224] VMO2 internal document
[225] VMO2 internal document, VMO2 internal document, VMO2 internal document, VMO2 internal document, VMO2 internal document
[226] VMO2 internal document, VMO2 internal document, VMO2 internal document
[227] VMO2 internal document
[228] VMO2 internal document

that EE had a revenue gain over GBP [✂] by 2023. The document states that [✂].[229]

(b) A [✂] 'Pricing Strategy […] pre-read' from 3 November 2020 shows [✂] monitoring EE's change to CPI+3.9% mid-contract price rises. The document also sets out options available to VMO2 [✂], citing that this could [✂].[230]

(c) An [✂] paper on its 'annual price increase change' dated 16 December 2020 sets out its proposal and rationale for [✂]. The document sets out the recommendation of [✂].[231]

(d) A monthly CEO update dated 20 January 2022 sets out VMO2's mobile price change approach compared to the other MNOs, showing that BTEE and VUK moved to a CPI+3.9% price rise, 3UK moved to a 4.5% increase, and VMO2 moved to RPI+3.9%. BTEE was the first MNO to implement this change, with VMO2 being the latest (at that time). The document also sets out the impact of this price rise on revenues following [✂], stating that there is a [✂] but that [✂].[232]

C.98 Internal documents from VMO2 show that it continued to implement its RPI+3.9% strategy [✂].

(a) An internal document dated 4 October 2022 on 'Fixed [and mobile] price rise[s] 2023' shows VMO2's proposal to [✂]. The document outlines considerations for price rise, stating that [✂].[233]

(b) An internal document dated 12 December 2022 on [✂].[234]

(c) A monthly CEO update dated 19 January 2024 sets out VMO2's [✂].[235]

(d) An internal document dated 2 February 2024 on 'customer issues that impact corporate stakeholders & reputation' [✂].[236]

C.99 A 'Price Rise Review' dated 6 February 2024 sets out VMO2's [✂].[237]

C.100 A VMO2 [✂] dated 23 April 2024 shows. [✂].[238]

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[229] VMO2 internal document
[230] VMO2 internal document
[231] VMO2 internal document
[232] VMO2 internal document
[233] VMO2 internal document
[234] VMO2 internal document
[235] VMO2 internal document
[236] VMO2 internal document
[237] VMO2 internal document
[238] VMO2 internal document

C.101 VMO2's internal documents relating to its network strategies are discussed in paragraphs C.31-C.34 above. In this section we discuss its wider competitive strategy in retail.

C.102 VMO2's internal documents also suggest that it considers that [✂]. VMO2's documents suggest that [✂].

(a) An internal document dated 11 February 2024 on 'Strategic Priorities [for] 2024' states that VMO2's [✂].[239]

(b) A Board Meeting document dated 1 March 2022 states that [✂].[240]

(c) The 'Strategic Plan' dated 21 June 2023 states that [✂].[241]

C.103 Overall, we provisionally consider that VMO2's internal documents indicate that:

(a) VMO2 operates a [✂] strategy [✂] to compete [✂] most internal documents state has premium brand positioning and competes at mid-high price points;

(b) VMO2 actively monitors pricing initiatives of its competitors, and often implements its own price initiatives and adjusts its own prices based on this; and

(c) VMO2 considers that [✂], and sees this as an important strategy to help it grow.

*Sky Mobile*

C.104 Sky Mobile's internal documents show that its competitive strategy is to drive sustainable growth through balancing price competitiveness with its cost structure. It also aims to drive cross selling of its pay-TV and broadband offerings as well as growing its tariffs to offer larger data packages.

(a) One internal document notes that its trading strategy is for 'sustainable growth' which aims to 'deliver profitable subs growth by balancing pricing competitiveness with our economic model'. In 2023 it did this by having an 'aggressive' mid-range tariff strategy, a simple tariff structure to drive cross selling and upselling customers to higher tariffs through tiered pricing and extra data offers. [✂].[242]

(b) Another internal document notes that it aims to grow its subscriber base by balancing pricing competitiveness with its costs, which are based on

[239] VMO2 internal document
[240] VMO2 internal document
[241] VMO2 internal document
[242] Sky internal document, Annex to s109

customer data usage, such that its profitability varies by tariff due to the average customer utilisation of the data allowance.[243]

(c) Another internal document notes that Sky Mobile sees 'clear benefit in upsell & cross-sell to minimise churn in the long term' and that 'competitive pricing & value are the predominant reasons to join Sky'.[244]

(d) Another internal document which discusses Sky Mobile's pricing strategy for introducing a new [✂] that it considered four different pricing plans based on its competitors' current pricing. [✂].[245]

C.105 Sky Mobile also uses its 'Piggybank' offering as a competitive differentiator, where it allows customers to roll over unused data allowances.[246] Sky Mobile announced the reduction of the time period customers could roll the data over from 3 years to 1 year in April 2024.[247]

C.106 Sky Mobile internal documents also show that it considers that [✂].

(a) A document from November 2022 which sets out a review of mobile profitability notes that 'SIMO market for premium tariff sizes is growing as the market reduces prices at the top end, with [✂].[248]

(b) A market research document from Q1 2022 notes that 'Increased data bundle sizes (including growth of unlimited) [✂].[249]

(c) While another document from January 2023 which sets out Sky Mobile's review of its mobile strategy notes that 'Sky share at entry level is strong, and we have headroom to grow mid-tier [✂]'.[250]

C.107 We provisionally consider that Sky Mobile's documents show that its competitive strategy is to drive sustainable growth through balancing price competitiveness with its cost structure [✂].

**Closeness of competition and competitive constraints**

C.108 We first present evidence from the Parties' internal documents and then third parties' internal documents on the closeness of competition and competitive constraints.

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[243] Sky internal document, Annex to s109
[244] Sky internal document, Annex to s109
[245] Sky internal document, Annex to s109
[246] Sky internal document, Annex to s109
[247] Sky internal document, Annex to s109
[248] Sky internal documents, Annexes to s109
[249] Sky internal document, Annex to s109
[250] Sky internal document, Annex to s109

### Parties' internal documents

*Evidence from 3UK's internal documents*

C.109 We carried out a systematic review of 3UK's [✂],[251] [✂].[252] We also observed this in another category of competitive monitoring documents produced by 3UK, [✂].[253]

C.110 3UK consistently benchmarks itself against the performance of other MNOs having regard to a wide range of metrics ([✂]).[254]

#### Pricing

C.111 The evidence from 3UK's internal documents shows that the price positioning of the other MNOs plays a critical role in terms of [✂].[255]

C.112 In section above on 3UK's Pricing strategy, we identified several instances of 3UK [✂] through its pricing strategy. We consider that this constitutes important evidence of 3UK exerting a competitive constraint on VUK, and by extension of the Parties being close competitors. Conversely, we also found evidence in 3UK's internal documents [✂].[256] Further:

(a) [✂].[257]

(b) [✂].[258]

C.113 In its most recent cross-brand pricing principle update from January 2024, 3UK sets out its [✂].[259] The same document notes that the [✂] to include [✂] due to its [✂], which we understand refers to [✂].[260]

C.114 This was followed in March 2024 by an update to SMARTY-specific [✂].[261] [✂].[262] [✂].[263]

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[251] [✂] (FMN).
[252] For example, CK Hutchison internal documents
[253] For example, CK Hutchison internal documents
[254] For example, CK Hutchison internal documents
[255] For example, CK Hutchison internal documents
[256] For example, CK Hutchison internal documents
[257] CK Hutchison internal document
[258] CK Hutchison internal document
[259] CK Hutchison internal document
[260] CK Hutchison internal document
[261] CK Hutchison internal document
[262] CK Hutchison internal document
[263] CK Hutchison internal document

### Market initiatives

C.115 We found some evidence of 3UK having particular regard to the competitive impact of its new market initiatives, [✂]. For example, [✂].[264] [✂].[265] [✂].[266]

C.116 In terms of promotional activity and spend, the CMA's view is that 3UK primarily monitors campaigns initiated by [✂].[267] For the purposes of tracking [✂].[268]

### Business segment

C.117 In relation to how closely the Parties compete in the business retail segment, we found limited evidence of 3UK targeting specific competitors, [✂]. However, there is consistent evidence that 3UK only monitors the performance and activities of the other three MNOs in this segment and we found no mention of MVNOs in this context.[269]

C.118 Internal documents suggest that gaining ground in the business retail segment [✂] (as discussed in the above section on VUK's Business strategies). Internal documents also suggest that 3UK [✂]. Notably, in its 2024 budget presentation [✂]:

(a) [✂].[270]

(b) [✂].[271]

(c) [✂].[272] [✂].

C.119 3UK's internal documents relating to the business retail segment do not feature MVNOs as part of the competitive landscape.

### MVNOs

C.120 We have found in some categories of 3UK internal documents references to a [✂].[273] [✂].[274]

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[264] FMN. And CK Hutchison, annex.
[265] CK Hutchison internal document
[266] CK Hutchison Internal document
[267] CK Hutchison internal documents
[268] CK Hutchison internal documents
[269] For example, CK Hutchison internal documents. The CMA acknowledges that some SoHo customers choose consumer tariffs and are therefore classified as in the consumer retail segment, where MVNOs are present, rather than the business retail segment.
[270] CK Hutchison internal document
[271] CK Hutchison internal document
[272] CK Hutchison internal document
[273] CK Hutchison internal documents
[274] CK Hutchison internal document

C.121 In an August 2022 presentation entitled [✂] are listed as 'key competitors' to [✂] (ie not independent MVNOs).[275] The same document shows that in terms of [✂] offers none of those listed on the slide and [✂].[276]

C.122 In an October 2022 [✂], 3UK discusses in response to [✂].[277]

C.123 In response to the Parties' submission [✂],[278] we note that:

(a) [✂].

(b) In the context of the [✂], there are [✂].

*Evidence from VUK's internal documents*

C.124 We carried out a systematic review of [✂]. [✂].[279] [✂],[280] [✂].[281]

C.125 Similarly to 3UK, VUK consistently benchmarks itself against the performance of other MNOs having regard to a wide range of metrics ([✂]).[282]

C.126 We [✂]. In the same slide [✂] include [✂]. [✂] is shown on the slide as [✂].[283]

**Pricing**

C.127 The evidence from VUK's internal documents shows that the price positioning of the other MNOs plays a critical role in terms of [✂].[284]

C.128 We carried out a systematic review of all [✂]:

(a) [✂].[285]

(b) [✂].[286]

(c) [✂].[287]

C.129 The extent of the competitive constraint exercised by 3UK [✂]. For example:

[275] CK Hutchison internal document
[276] CK Hutchison internal document
[277] CK Hutchison internal document
[278] Annex 1 to the Parties' response to the AIS and working papers
[279] [✂].
[280] Vodafone internal documents
[281] Vodafone internal documents
[282] For example, Vodafone internal documents
[283] Vodafone, internal documents
[284] For example, Vodafone internal documents
[285] For example, Vodafone internal documents
[286] For example, Vodafone internal documents
[287] Vodafone internal document

(a) [✂];[288]

(b) [✂];[289]

(c) [✂];[290]

(d) [✂],[291] [✂];[292] and

(e) [✂].[293]

### Market initiatives

C.130 As part of their documentary evidence, [✂]:[294]

(a) [✂];

(b) [✂]; and

(c) [✂].

C.131 [✂].[295] [✂].[296]

C.132 [✂].[297]

C.133 [✂].[298]

C.134 [✂].[299]

### Business segment

C.135 With regard to current competition, we have found several references in VUK's internal documents [✂].[300] [✂].[301] [✂].[302]

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[288] For example, Vodafone internal documents
[289] Vodafone internal document
[290] Vodafone internal document
[291] Vodafone internal document
[292] Vodafone internal document
[293] For example, Vodafone internal documents
[294] FMN; Vodafone Annex; Annex 1 to the Parties' response to the AIS and working papers. The CMA has not sought to confirm or reproduce this analysis.
[295] Vodafone internal document
[296] Vodafone internal document
[297] Vodafone internal document
[298] Vodafone internal document
[299] Vodafone internal document
[300] Vodafone internal documents
[301] Vodafone internal document
[302] Vodafone internal document. In response to the phase 1 Issues Letter, the Parties submitted that any [✂] on the part of 3UK would not necessarily translate into a higher share as there are other key factors that influence competitiveness in the business retail segment, including the credibility of a mobile operator through its network quality (Parties' response to the phase 1 Issues Letter. The CMA notes that 3UK's share of supply, in particular in the SoHo subsegment has grown materially Chapter 8, Customer bases suggesting that 3UK's strategy is bearing fruit. Regarding the Parties' point relating to 3UK's network quality, this is discussed in Chapter 8, Network quality.

C.136 Internal documents also suggest that [✂]. For example, [✂].[303] [✂].[304] [✂].[305] [✂].[306]

C.137 More recent internal documents do not suggest that the intensity of the competitive pressure from 3UK in the business retail segment is diminishing, and in fact may suggest the contrary. For example, [✂].[307] [✂].[308]

C.138 We found some infrequent references in VUK's internal documents to 3UK entering the corporate and public sector subsegments. [✂].[309] [✂].[310]

C.139 VUK's internal documents contain references to BTEE being [✂] important competitor in the business retail segment. For example, [✂].[311] [✂].[312] [✂].[313] [✂].[314]

C.140 VUK's internal documents relating to the business retail segment do not feature MVNOs as part of the competitive landscape.

**MVNOs**

C.141 First, we note that the analysis carried out by Vodafone's economic advisors of these VUK's consumer trading reports [✂] shows that VUK does not target [✂] and [✂]. For example, the analysis shows [✂].[315]

C.142 Regarding the internal VUK [✂] documents highlighted by the Parties to [✂],[316] we note that:

(a) With the exception of [✂].

(b) In relation to [✂].

C.143 Further, the internally commissioned research, [✂] of January 2024, [✂].[317] [✂].[318] The Parties submitted that [✂].[319] However, we observe [✂].

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[303] Vodafone internal document
[304] Vodafone Internal Document
[305] Vodafone Internal Document
[306] Vodafone Internal Document
[307] Vodafone internal document
[308] Vodafone internal document
[309] Vodafone internal document
[310] Vodafone internal document
[311] Vodafone internal document
[312] Vodafone internal document
[313] For example, Vodafone internal documents
[314] Vodafone internal document
[315] Vodafone Annex
[316] Annex to Parties' initial submission; and Vodafone internal documents
[317] Vodafone internal document
[318] Vodafone internal document
[319] Annex 1 to the Parties' response to the AIS and working papers

C.144 The same document contains [✂] which highlights that [✂].[320] Finally, we observe that [✂].[321] We note that Tesco Mobile cannot be treated as a fully independent competitor given VMO2's 50% shareholding in Tesco Mobile and associated rights, as discussed in Chapter 5 in the MVNO section.

C.145 As also set out in Chapter 8 in the evidence from the Parties' internal documents section, we provisionally consider that the Parties' internal documents show that:

(a) the Parties compete closely with each other and also with the other MNOs, including in terms of their price and brand positioning. This also holds true in relation to the business retail segment. The price positioning of other MNOs plays a critical role in terms of how the Parties set their own pricing strategy; and

(b) with the exception of Sky Mobile and Tesco Mobile – although the latter cannot be treated as a fully independent competitor from VMO2 - which are emphasised in the Parties' internal documents, the overall competitive performance or strength of other MVNOs (including [✂]) is not monitored or commented on with the same intensity. Further, the Parties' internal documents also contain evidence that MVNOs are differentiated and underrepresented in some sub-segments in contrast with most of the MNOs which use their sub-brands, in conjunction with their primary offer, to achieve presence across the board. As an overarching point, the Parties rely on [✂], which we consider overstates the constraint exercised by MVNOs, individually and in aggregate. Finally, the Parties' internal documents relating to the business retail segment do not feature MVNOs (as part of the competitive landscape).

**Third parties' documents**

*Competitive positioning*

C.146 Documents discussing the different competitive position of mobile operators in relation to network quality are discussed in paragraphs C.36-C.44.

C.147 BTEE internal documents show that it considers different mobile operators have different retail strategies. For example:

(a) A BTEE internal document dated [✂] shows that different mobile operators have different value propositions. It states that 'Players have historically pursued [✂]. The document states that there are challenging fundamental economics in the UK telecommunications market, with a 'highly capital

[320] Vodafone internal document.
[321] The Parties submitted that [✂].

intensive industry' with 'low marginal costs', and that there are 'players with different value chain positions'. The document also states that [✂].[322]

(b) The BTEE [✂] dated [✂] states that 'UK MNOs pursue different strategies: [✂]. The document also states that [✂].[323]

C.148 BTEE internal documents suggest that BTEE considers that MVNOs compete on lower data allowances, and to consumers with different characteristics than MNOs. For example:

(a) A BTEE [✂] states that 'MVNO operators currently do not compete on [✂]. For example, stating that [✂] 'currently do[es] not have an [✂] in [the] market for mobile'.[324]

(b) The [✂] states that MVNOs are [✂].[325]

(c) A BT Group internal document [✂] shows that [✂]. Despite this, the document still shows that BT Group [✂].[326]

(d) The [✂] states that 'customers who purchase from MVNO brands are inherently younger [18-24] or older [55-64] demographics', are 'more likely [than the customers of MNOs] to purchase from Digital channels' and 'value and price are the biggest drivers for MVNO brands, with MNO drivers more focused on network quality'.[327]

C.149 Another BTEE internal document also shows that [✂]. [✂] shows BTEE monitoring [✂], the [✂]. The document states that [✂].[328]

C.150 VMO2 internal documents show that it historically considers itself and [✂] (and more recently just [✂]) to have positioned at a premium in the market, while [✂], [✂], and [✂] have used discounting to drive scale. For example:

(a) A VMO2 'Consumer Mobile Strategy' dated 9 September 2021 states that the [✂]. For example: [329]

(i) [✂];

(ii) [✂];

(iii) [✂]; [✂]

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[322] BTEE internal document
[323] BTEE internal document
[324] BTEE internal document
[325] BTEE internal document
[326] BTEE internal document
[327] BTEE internal document
[328] BTEE internal document
[329] VMO2 internal document

(b) A VMO2 Executive Committee pre-read dated 12 August 2022 states that [✂].[330]

C.151 VMO2 internal documents also show that [✂] is [✂]. For example:

(a) The VMO2 'Consumer Mobile Strategy' dated 9 September 2021 describes [✂] as a [✂].[331]

(b) The VMO2 'Strategic Plan' dated 21 June 2023 states that [✂].[332]

C.152 Sky Mobile also considers that different mobile operators have different competitive strategies. It considers that MNOs look to 'maximise profitability – pushing all customers to higher ARPU/GB tariffs', MNO sub-brands and Tesco Mobile look to 'Maximise growth – attracting price seekers with tariffs likely to be unprofitable', ID Mobile's strategy is to 'support hardware upsell' while Sky Mobile looks to drive sustainable growth through balancing price competitiveness with its cost structure.[333]

C.153 Overall, we provisionally consider that third party internal documents relating to the competitive positioning of mobile operators indicate that third parties consider that:

(a) MVNOs compete on lower data allowances than MNOs;

(b) MNO sub-brands use discounting to drive scale; and

(c) [✂] is [✂] and [✂].

*Price competition*

C.154 BTEE's internal document [✂], sets out monthly consumer ARPUs (average revenues per user) for different mobile operators, and shows that [✂].[334]

C.155 Internal documents from BTEE show that in setting its prices BTEE reviews other mobile operators' prices. For PAYM handset contracts BTEE assesses [✂], while for SIMO contracts and value segments it [✂].

(a) A [✂] shows that BTEE benchmarks its handset vs SIMO pricing differential against other MNOs and that [✂]. The document states [✂].[335]

[330] VMO2 internal document
[331] VMO2 internal document
[332] VMO2 internal document
[333] Sky Mobile internal documents, Annexes to s109
[334] BTEE internal document
[335] BTEE internal document

(b) An internal document dated [✂] for the BT Group [✂] sets out a [✂]. The document explains that BTEE [✂]. However, it also noted that [✂].[336]

(c) An [✂] states that [✂]. The document also states that [✂].[337]

(d) A BT Group [✂].[338]

C.156 A VMO2 monthly CEO update dated 19 April 2024 sets out a comparison of [✂]. The document shows that:[339]

(a) [✂];

(b) [✂]; [✂]

(c) [✂].

C.157 A VMO2 monthly CEO update dated 19 April 2024 shows VMO2 [✂] its [✂]. For example:[340]

(a) [✂];

(b) [✂]; [✂]

(c) [✂].

C.158 A VMO2 'Price Rise Review' dated 6 February 2024 states that VMO2 implemented [✂].[341]

C.159 BTEE's internal documents state that MVNOs and MNO sub-brands price aggressively, particularly in value segments. For example:

(a) A [✂] states that 'MVNOs continue to price aggressively leading to price deflation'. For example, it shows that [✂] and that average market prices per GB have fallen from 2019/20 to 2022/23 across most price ranges, eg by 52% in the <GBP 10 price range, by 45% in the GBP 15-20 price range, and by 80% in the >GBP 20 price range. The document also states that the 'PAYG [ie pre-paid] market [is] growing with low MVNO pricing'.[342]

(b) The [✂] states that MVNOs are 'hyper competitive at low end SIMO price points' because they have 'no ROI [return on investment] requirement[s]'.[343]

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[336] BTEE internal document
[337] BTEE internal document
[338] BTEE internal document
[339] VMO2 internal document
[340] VMO2 internal document
[341] VMO2 internal document
[342] BTEE internal document
[343] BTEE internal document

(c) The BTEE [✂] states that the value segment is a growing share of the consumer retail segment, and that [✂] for example because [✂].[344]

(d) A BTEE internal document dated [✂] assesses the external context for mobile dynamics, and states that the [✂].[345]

(e) A [✂] states that [✂]. The document also states that 'for most customers [✂] is enough data to operate with per month, [and] the appeal of MVNOs and sub brands has come with driving abundant data at the [✂] price point with super low cost brands ([✂]) offering deals at [✂] and committing to holding prices.'[346]

C.160 A VMO2 monthly CEO update dated 19 April 2024 shows VMO2 [✂]. It shows that [✂]. Specifically, the document shows that:[347]

(a) [✂];

(b) [✂]; [✂]

(c) [✂].

C.161 Sky Mobile's documents also show it monitors the prices of, and its performance against, both MNOs and MVNOs (most notably Tesco Mobile).

(a) One internal document notes that [✂]. Sky Mobile also monitored its performance against all four MNOs (including some of their sub-brands) and Tesco Mobile but noted that [✂].[348]

(b) Another document includes Sky Mobile monitoring all four MNOs (including some of their sub-brands) and Tesco Mobile expected 2024 price increases.[349]

(c) Another document assessing the differences between MNO and MVNOs, notes that 'MVNO customers are much more price-sensitive when joining than MNO customers, who put more value on signal coverage and CS' however 'MNO customers are more likely to leave over pricing-related issues than MVNO customers'.[350]

C.162 Overall, we provisionally consider that third party internal documents relating to price competition indicate that third parties consider that:

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[344] BTEE internal document
[345] BTEE internal document
[346] BTEE internal document
[347] VMO2 internal document
[348] Sky Mobile internal document, Annex to s109
[349] Sky Mobile internal document, Annex to s109
[350] Sky Mobile internal document, Annex to s109

(a) MVNOs are less expensive than MNO's main brands (ie EE, O2, Three and Vodafone). MVNOs and MNO sub-brands price aggressively, particularly in value segments; and

(b) Tesco Mobile, whilst not a wholly independent competitor to VMO2, is cheaper than the MNOs' main brands (except the Three brand which is similarly priced) but more expensive than most MVNOs and competes across a wider range of tariffs than other MVNOs.

## Views on the impact of the Merger

### [✂]

C.163 [✂]'s internal documents suggest that consolidation in the telecommunications industry may bring about synergies [✂]. For example:

(a) A [✂] outlines [✂]'s views on market consolidation, [✂]. The document states that [✂].[351]

(b) A [✂] states that [✂], citing VUK and 3UK as an example of in-market consolidation, [✂].[352]

(c) [✂] states that [✂].[353]

C.164 Some [✂] internal documents show that [✂].

(a) [✂] reports [✂], stating that it [✂].[354]

(b) A [✂] and sets out [✂].[355]

(c) [✂] both state in regard to the 'Vodafone internal restructure & merger [with respect to] Three' that [✂].[356]

C.165 [✂] one [✂] states that [✂].[357]

C.166 Overall, we provisionally consider that [✂]'s internal documents indicate that it believes the Merger may [✂] for the Merged Entity, and there are some documents which suggest it may lead [✂].

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[351] [✂] internal document
[352] [✂] internal document
[353] [✂] internal document
[354] [✂] internal document [✂] internal document
[355] [✂] internal document
[356] [✂] internal document [✂] internal document
[357] [✂] internal document

**[✂]**

C.167 [✂] internal documents show [✂].

(a) An internal document dated [✂] for the [✂].[358]

(b) An internal document dated [✂] for [✂].[359]

(c) A 'UK M&A Opportunities Update' dated [✂] states [✂].[360]

(d) A [✂] dated [✂] sets out [✂].[361]

(e) A monthly CEO update dated [✂] states [✂].[362]

C.168 An internal document dated [✂] assesses 'Mobile Market Opportunities' open to the [✂].[363]

C.169 Overall, we provisionally consider that [✂]'s internal documents indicate that it considers that the Merger may create synergies for the Merged Entity but that it considers that its own competitive position [✂].

[358] [✂] internal document
[359] [✂] internal document
[360] [✂] internal document
[361] [✂] internal document
[362] [✂] internal document
[363] [✂] internal document

# APPENDIX D: CMA econometric analysis of the UK market for mobile services

## Overview

D.1 This appendix sets out the CMA's estimation of demand for mobile services in the UK and the impact of the Merger on prices (merger simulation). The CMA's modelling uses an estimated demand model to flexibly capture subscriber preferences for mobile services and simulates the price effects of the Merger absent efficiencies based on the model.

D.2 The main results of the CMA's exercise are the following:

(a) Consumers valuations vary across individuals. Consumers value 4G download speed and 4G network coverage - key aspects of current network quality. However, the results of the model predict that subscribers do not value aspects of 5G network quality (speed and network coverage). One potential reason for the low willingness to pay for 5G is that 5G speeds may be less commonly observed by consumers than 4G speeds (eg because some consumers do not have a 5G-enabled phone or because it is still being rolled out in some areas).

(b) Diversion ratios implied by the CMA's econometric model are similar to those implied by the CMA's survey. These indicate that the Parties impose a competitive constraint on one another.

(c) Absent efficiencies, prices would rise for both the Parties and their rivals. Specifically, prices would rise by 7.0% for 3UK and 3.8% for VUK with smaller rises for rivals. The overall harm to UK consumers implied by these price rises is approximately £328 million annually (2023 prices). As described in more detail below, we consider that this is likely to be an underestimate of the true price effects resulting from the Merger.

(d) The CMA's merger simulation results imply that lower income subscribers would lose more welfare as a result of the Merger.

(e) Finally, we explore the sensitivity of our estimate of consumer harm to alternative assumptions on the shape of the demand curve, the size of the market and the existing level of market power pre-Merger.

D.3 This rest of this annex sets out:

(a) The datasets used;

(b) The demand estimation and its results;

(c) Our merger simulation and sensitivity analysis; and

(d) Summary of our provisional conclusions.

## Data

D.4 To estimate a model of subscriber demand in the UK retail market the CMA uses four datasets:

(a) **Ofcom Provider Data:** Provided by Ofcom, this is an annual pseudo-panel constructed by taking a five percent sample from the subscriber base of BTEE, Plusnet, Vodafone, VOXI, VMO2, Three, Smarty, Sky Mobile, Giffgaff, Tesco Mobile, iD Mobile and Talk Mobile in January 2023. For sampled subscribers the data contains their records with the provider back to January 2022. The Provider Data contains detailed information on the tariffs used by subscribers in that period.

(b) **Pure Pricing Data**: This is a commercial dataset that provides a list of tariffs that are publicly available for purchase online around the 10th of each month from January 2019.[364] This is used in the model to construct the choice sets subscribers face when making purchases.

(c) **Connected Nations**: This dataset provided by Ofcom contains tri-annual predictions of signal strength at the 100x100m pixel level for each network in the UK. We have this data for 2022 and May and September 2023.[365] This data is used to compute the 4G and 5G coverage associated with each network.

(d) **Open Signal**: This dataset contains monthly estimates of download and upload speed tests for each network for 2023. We use this to construct a measure of network quality associated to each tariff a subscriber chooses from.

D.5 These four datasets are used to create the estimation data for our demand model. In the following subsections we describe each in more detail.

### Ofcom Provider Data

D.6 Ofcom's Provider Data (**PD**) is an individual subscriber choice database containing the tariffs subscribers purchased and used in the period January 2022 to June

[364] More information can be found at the providers website Mobile & Broadband Pricing Consultants | Pure Pricing, accessed by the CMA on 3 September 2024.
[365] In particular we have five sets of estimates: January 2022, May 2022, September 2022, May 2023 and September 2023. Although Ofcom collected January 2023 estimates due to a data storage issue, they were unable to provide these estimates.

2023. [366] The data also includes individual information on the subscribers who purchased them (for example their age and location). It is constructed from a random sample of approximately 5% of the active subscriber bases of BTEE, Plusnet, Vodafone, VOXI, VMO2, Three, Smarty, Sky Mobile, Giffgaff, Tesco Mobile, iD Mobile and Talk Mobile.

D.7 The Provider Data is the primary dataset we use to estimate the demand model. It consists of revealed preference data, offering insight into individual preferences by observing, for each sampled subscriber, the history of tariffs the subscriber has had with that provider.[367] The key variables of interest include tariff characteristics (price, contract length, contract type and allowances on data, voice and text messaging) and the socio-demographic details (age and location) of the subscribers.

D.8 In cleaning the data, we took the following steps:

(a) We generate one row for each month that tariffs are in use. For example, if we observe a 6-month contract with a start date of January 2022 and an end date of June 2022, we generate six rows which correspond to the duration of the tariff. The result is that each row in the PD corresponds to a tariff-in-use in a month within our observation period, allowing us to calculate the total number of tariffs being used on any given month.

(b) We excluded rows with missing information on key tariff variables (monthly price, contract length and data allowance), and information related to subscribers' personal details (age and location).[368] Where there are duplicates in the data, we drop them, so each subscriber only has one contract in a given month. In cases where the data reports two contracts overlapping in a month, we keep the most recent one.

(c) We exclude the top and bottom one percent of the age distribution due to the presence of implausible birth years at either end of the range.

D.9 While we lack individual income data, we impute income using the subscriber's age and location:

(a) In the data we observe subscribers' location in terms of output area/small area. We use ONS geography lookups to aggregate these into lower super output areas (England and Wales), data zones (Scotland) or super output

[366] Excludes business/SOHO consumers. For the purposes of the econometrics, we focus on January 2023 to June 2023 to be able to combine with Opensignal data that was only available from January 2023.
[367] This includes the ability to see if they have had more than one tariff or if the characteristics of their tariffs have change over time, for example due to a mid-contract price increase.
[368] This particularly impacted data from Giffgaff and due to too limited data remaining after the removal of rows with missing values we drop Giffgaff from our estimation.

areas (Northern Ireland).[369] Then, we give the subscriber the 2021 median gross disposable household income estimate for the corresponding geography.

(b) We then adjust this imputed income by subscriber age using the ONS 2021/2022 income-age correction.

(c) This provides a reasonable estimate given that the geographies on which we base the estimated incomes are small and that we adjust for age.[370]

D.10 Finally, we restrict the PD to focus only on subscribers who purchase PAYM SIMO tariffs. This is due to data quality and modelling concerns:[371]

(a) We excluded PAYM handset contracts because for these contracts the service is bundled. Thus to use these tariffs we would have to account for the effect of bundling of the handset on consumer demand for the airtime component of the contract.

(b) We excluded PAYG contracts because of insufficient subscriber information. Providers do not collect additional details, such as age and location, for PAYG contract subscribers due to the simpler nature of these contracts. Additionally for data reasons we were unable to utilise information relating to BTEE's PAYG contracts.

**Pure Pricing Data**

D.11 The PD gives information on the tariffs subscribers have chosen, however to model the demand for tariffs it is important to have information on the set of options that were available to the subscriber in the month when they chose the tariff.

D.12 The Pure Pricing dataset contains monthly information on all tariffs that were publicly available for purchase in each month.[372] For each available tariff the

[369] Scotland and Northern Ireland do not have LSOAs. Instead, we aggregate Scotland's output areas to Data Zones (**DZ**), and Northern Ireland's output areas to Small Output Areas (**SOA**), which are of similar size to LSOAs in England and Wales.
[370] An alternative interpretation is that by using this measure we are using the choice of a representative subscriber of a specific age and location. We note that while we believe this provides a reasonable estimate of income, if in fact the estimate is inaccurate for specific types of subscribers it could introduce bias in the model estimates.
[371] For estimation we use the definitions of contract types as reported in the PD data. In limited cases these differ from the definitions in Pure Pricing.
[372] While Pure Pricing (PP) is a comprehensive list of tariffs available in our time period it does not include all possible tariffs. The main tariffs excluded in PP are 'below the line' offers, which typically involve discounts negotiated over the phone. By missing these discounted deals in the choice sets we potentially overestimate price sensitivity in the model.

dataset provides information on tariff characteristics such as price, contract length, contract type, allowances for data, voice and messaging, extras and discounts.[373]

D.13 To combine with the PD, we dropped tariffs with missing information on key variables (price, contract type, contract length, data allowance). Further, where we observed many of the same tariffs in a given month, we set the price to be the median of the prices of the available tariffs.[374]

**Connected Nations Data**

D.14 An important aspect of service in telecoms is the quality of the mobile network. As such it is important that any econometric analysis of demand captures aspects of network quality. To capture measures of 4G and 5G coverage we use Ofcom connected nations data.

D.15 This data contains coverage predictions submitted to Ofcom by each network between May 2022 and September 2023 for the purpose of producing Ofcom's Connected Nations Reports.[375] In particular, the data comprises tri-annual submissions of network level predictions of signal strength in the UK. Each network provides an estimated signal strength in each 100x100m pixel in the UK for each technology and frequency band in a given area.[376] Ofcom told us that these signal strength predictions 'represent a reasonable basis for estimating signal strength (and coverage) in aggregate' and we note they are used by Ofcom to analyse coverage in its Connected Nations Reports. [377]

D.16 In order to construct a coverage measure, we calculate for each network in each pixel a signal strength for each technology using the maximum signal strength of the frequency in the technology available in the pixel. We then apply technology-specific thresholds to each of 100m x 100m pixels to determine whether there is at least a 95% probability of there being sufficient coverage in the area to use basic

[373] Pure Pricing has a number of columns that describe extras included with the tariff. In order to match the Pure Pricing data to the PD it is necessary to combine the these into one variable. To do this we define an extra as including at least one extra from content extras, vouchers: and other extras: (for example free picture messaging). Importantly we exclude any extras that are not extras or only apply for specific groups eg fair use policy applies or only available online'. We cannot guarantee this definition of extras is the same as the definition of 'extra' in the PD. To the extent they differ it would add measurement error to the estimated value of extras in our model.
[374] For our purposes we define a tariff as a unique combination of brand, contract length, extra, data allowance, and ownership (eg VOXI would be considered as having the same ownership as Vodafone).
[375] These network predictions are collected by Ofcom for the purpose of producing its Connected Nations Reports. Ofcom's methodology annex which explains its approach to obtaining and analysing the information from the operators to generate the Connected Nations data can be found at Ofcom's Connected nations UK report 2023, 19 December 2023.
[376] Formally signal strength measures the power of a given signal. This can be associated to coverage by reference to specific thresholds as is done in Ofcom's connected nations reports. We note that, as it is a prediction, the data on signal strength may differ from coverage actually experienced which would introduce measurement error in our estimate of coverage.
[377] In particular, Ofcom noted that coverage data is useful in the aggregate, noting predictions of signal strength and therefore coverage at a particular location may be affected by other local factors such as in-building signal attenuation or positioning of external buildings affecting signal propagation. Consequently, in some areas, the actual on-the-ground experience may differ from the predicted outcomes. Ofcom response to the CMA's 19 April 2024 letter.

services. Finally, we compute the percentage of pixels within a geographical area to construct a coverage measure for that area for each technology and network.

D.17 For the purposes of defining coverage, we apply the thresholds used by Ofcom in its connected nations reports. In particular, for 4G we consider there to be coverage if the signal strength is above -105dBm. This is the threshold Ofcom considers as meaning there is a 95% probability a user can make an uninterrupted voice call or get 2 Mbps of download speed. For 5G we use a threshold of -100dBm which corresponds to a very high confidence (over 95% probability) of accessing 5G outdoors.

D.18 When defining the coverage area, we use the 2011 definitions of Travel to Work Areas (**TTWA**s).[378] TTWAs approximate a self-contained labour market area. These are areas where most people both live and work and therefore relatively few commuters cross a TTWA boundary on their way to work. As such we believe this is a good basis for considering the likely area in which a subscriber needs coverage.

D.19 Although Ofcom receives submissions in January, May and September of each year it was unable to provide us with the January 2023 set of predictions. Therefore, in order to cover the period of estimation (January-June 2023) we use the September 2022, May 2023 and September 2023 results and then linearly interpolate to give monthly predictions of the coverage in each TTWA. This approach assumes that network coverage increases linearly between each submission which we believe is a reasonable approach absent additional data or information about network changes.

D.20 Descriptive results of the CMA's analysis of connected nations data can be found in Chapter 8. For the purposes of the econometric analysis, it is important to note that there is variation between networks in measures of coverage at the TTWA level. The average (mean) difference between the best and worst network in a TTWA in a month is 8 percentage points for 4G coverage and 24 percentage points for 5G coverage.

### Open Signal Data

D.21 To include further aspects of network quality we use speed data from Opensignal. Opensignal is a third party analytics provider which gathers network speed data based on network performance tests using mobile devices across the UK.[379] In particular, we use 4G and 5G average download and upload speed results in each

[378] TTWAs are produced by the ONS as based on a statistical analysis of census data.
[379] Opensignal collects measurements of network experience quality and speed based on regularly scheduled periodic tests, executed independently and at random intervals to capture what users are experiencing at a typical moment in time. Our Approach | Opensignal, accessed by the CMA on 3 September 2024.

TTWA from open signal file size tests for each network from January 2023 to June 2023.[380]

D.22 In our analysis we only considered download speed results in TTWAs where there was over 25% coverage and over 50 conducted tests.[381] This is to ensure the estimates provide an appropriate snapshot of the speeds in the area and, for example, were not biased by a single test result. Due to this there are some TTWAs that are missing observations in a given month. For such cases, as in the connected nations data above, where the missing information is between months with known values we use a linear interpolation.[382]

D.23 Chapter 8 contains a description of the CMA's analysis of the speed data. This shows there is variation between networks in TTWAs.

## Demand Model for UK Mobile

D.24 This section describes the CMA's econometric model, the key characteristics of the data used to estimate it, and the estimation methodology. Noting that the estimation output is difficult to directly interpret, we present the results of the model by describing its findings on the distribution of subscribers' willingness to pay for tariff and network characteristics.

D.25 We then use the results of the model to calculate price and quality diversion ratios capturing subscriber substitution patterns between the operators. Finally, we conduct robustness checks on the demand model and compare its outputs to the results of recent, comparable academic studies.

### Demand Model and estimation approach

D.26 When choosing a tariff, subscribers choose which network to use, the type of contract they want, and how much mobile data to use in each month. Recognising this, M(V)NOs post a menu of tariffs that – to a first approximation – specify a monthly fee that gives the subscriber access to a maximum monthly data allowance.

D.27 Tariffs are often purchased on long contracts. These typically commit the subscriber to 12, 18 or 24 months of payments to the M(V)NO.

[380] Throughput file tests are a test used by Opensignal that measures for a specific file size the time taken to download or upload the file. By dividing the average file size by the average time taken across tests in a given month in an area we are able to construct a measure of average download and upload speed.
[381] Due to this filtering of results it is possible there is noisiness in our speed measure. For example, tests may all happen in one part of the TTWA meaning the average may fail to capture the true experience of speed in the TTWA
[382] In cases where data is missing up until a month, we assume all of these missing values are due to no coverage in the area. We also check this with the coverage measure and as such exclude two Northern Irish TTWAs as they have no measurements despite coverage being present.

D.28 For our econometric model of UK mobile demand, we use the standard discrete choice model.[383] In this model subscribers choose a tariff paid for out of disposable monthly income. Therefore, all individuals have the same set of posted tariffs to choose from in a given month. However, their expected experience using them will vary by subscriber location due to geographical variation in network quality.

D.29 For each M(V)NO in each month, we model "contestable subscribers". These are subscribers that either:

(a) Have just chosen a new contract; or,

(b) Are out of contract (ie have 0 months remaining on their contracts)

D.30 This modelling approach allows us to focus on consumers that can switch to one of the available tariffs without buying out the remainder of their contract. As such the model captures consumer valuations at the point subscribers make an active choice. These choices are based on their expectations at the time of purchase. For those subscribers who are out of contract but keep rolling over their contract with their existing provider we assume, in each month, that they actively choose to stay on the contract given the other options available to them.[384]

D.31 Furthermore, we estimate the demand model for PAYM SIMO subscribers in the first 6 months of 2023.[385]

D.32 We model individual choices at the monthly-tariff level (month $t$, tariff $j$). Subscriber $i$'s utility is individual specific and is given by:

$$U_{ijt} = \underbrace{-\alpha \frac{price_{jt}}{income_i} + x_{ijt}{}'(\beta + \sigma \cdot \log(age_i))}_{=V_{ijt}} + \varepsilon_{ijt}$$

where $x_{ijt}$ are the characteristics of tariff $j$ in period $t$ and include:

(a) Contract length

[383] To capture the interaction of all demand determinants (for example, the forward-looking nature of subscriber decisions), we would ideally estimate a dynamic discrete-continuous demand model for mobile services. However, although intuitively appealing, this richer dynamic choice framework sits at the frontier of economic research and has been yet to be fully developed into a tested framework that can be used for merger investigation in practice. As such, we consider a dynamic discrete-continuous choice framework is unsuitable for use in the context of this merger investigation. In contrast the standard discrete choice model simplifies several features of a dynamic discrete-continuous framework to reduce the technical complexity and computational burden of estimating demand without materially reducing how well a model approximates subscriber demand for tariffs in the UK.

[384] We discuss the limitations of this assumption in the discussion section below.

[385] We only have data from January 2023 from Opensignal which limited the overall sample to January-June 2023. This period may capture a slightly higher willingness to switch to providers which either did not implement in-contract price rises, or implemented lower in-contract price rises. Consequently, it may be that diversion ratios between the MNOs may be slightly lower compared to other time periods.

(b) (Finite) Data allowance in GB

(c) A dummy for unlimited data

(d) A dummy for whether the tariff has an extra (eg a free period of Netflix, BT Sport, etc)

(e) Brand dummies for the brand (ie EE, O2, Three, Vodafone, Sky Mobile, Tesco) or the outside good. There is also a dummy for if the brand is not in the list (Other)

(f) Network quality measures that depend on the location where subscriber $i$ lives

(g) $\varepsilon_{ijt}$ is an (IID) error term which is assumed to follow a Type-1 Generalised Extreme Value distribution

D.33 In the equation $\alpha, \beta$ and $\sigma$ are estimated coefficients. Note $\beta$ and $\sigma$ are vectors of coefficients. $V_{ijt}$ is the non-random component of the individual's utility.

D.34 For the purposes of the model, we consider network quality at the level of the 2011 definition of Travel to Work Areas (TTWA). As noted, above we believe this captures the area where a subscriber is most likely to spend their time in and out of work and thus is a good basis for the area in which they experience network quality.

D.35 In the model there are six network quality measures for each network in each month and TTWA:[386]

(a) Percentage of 4G coverage in the TTWA

(b) Percentage of 5G coverage in the TTWA

(c) Mean 4G download speed in the TTWA (Mbps)

(d) Mean 4G upload speed in the TTWA (Mbps)

(e) Mean 5G download speed in the TTWA (Mbps)

(f) Mean 5G upload speed in the TTWA (Mbps)

D.36 A subscriber's decision to opt out of using mobile services or using a tariff that is not a PAYM SIMO tariff is encoded by them choosing the 'outside good', $j = 0$. In

[386] As noted in Chapter 8 there are many aspects of network quality. There is no systemic way to capture all aspects of network quality and as such a limitation of our approach is that we have only focused on three aspects: coverage, download speed and upload speed.

this case, $V_{ijt} = 0$ for all markets $t = 1, \ldots, T$, and the utility obtained from the outside good is $u_{i0t} = \varepsilon_{i0t}$.

D.37 In our model we capture heterogeneity in customer preferences by letting parameters vary by observed individual characteristics (income and age). In some settings, notably where aggregate data is used, it might be appropriate to also allow for 'unobserved heterogeneity' in preferences (ie heterogeneity that is not associated with observable consumer characteristics) by using a mixed or nested logit model.[387] Here due to the availability of individual-level data, observed consumer characteristics and detailed geographical data, we have chosen not to estimate a model allowing for unobserved heterogeneity.

D.38 Our model assumes that the unobserved determinants of utility are uncorrelated with the observed characteristics of products, notably price.[388] This choice is motivated, in the context of this case, by the fact that the Pure Pricing data used for this study contains very rich information on product characteristics and we have detailed, high quality data on key aspects of local network quality experienced by consumers. In other words, it is unlikely in this context that customers' decisions were driven to a significant extent by product and network characteristics that are not observed.[389]

D.39 For estimation we base our results on a sample of 10,000 subscriber choices from the PD.[390] Sampled choices reflect the market shares in pay-monthly SIMO.[391] Table D.1 shows the market shares used to construct the sample.

[387] For example this was the approach taken by the CMA in the Arçelik / Whirlpool EMEA merger inquiry.
[388] This is similar to the approach taken by Goldberg, P. K. (1995). Product Differentiation and Oligopoly in International Markets: The Case of the U.S. Automobile Industry. In Econometrica (Vol. 63, Issue 4, p. 891) and Griffith, R., Nesheim, L., & O'Connell, M. (2018). Income effects and the welfare consequences of tax in differentiated product oligopoly. In Quantitative Economics (Vol. 9, Issue 1, pp. 305–341) who also explore demand estimation with rich individual data
[389] In principle, a correlation between observed and unobserved determinants of utility may arise due to factors other than unobserved product characteristics, for example advertising. While we cannot rule out this possibility, this risk is mitigated in our context by the fact that a large share of advertising happens at brand rather than product level, and our model includes a brand fixed effect.
[390] This represents about 0.5% of the data and is done for computational efficiency. We have also checked robustness to a larger sample of 50,000 subscriber choices and obtain similar results.
[391] Some providers submitted data representing significantly more or less than five percent of their active subscriber base. As such it is necessary to stratify the sampling to be in line with market shares in PAYM SIMO.

**Table D.1: Market shares by brand used to sample rows of the provider data[392]**

| *Brand* | *Share* |
|---|---|
| EE | [20-30%] |
| BT | [<5%] |
| Plusnet | [<5%] |
| O2 | [20-30%] |
| Virgin Media | [5-10%] |
| Tesco | [5-10%] |
| Vodafone | [10-20%] |
| Three | [10-20%] |
| Sky Mobile | [5-10%] |
| iD Mobile | [<5%] |
| Total | 100.0% |

*Source: CMA calculation of subscriber market shares based on Ofcom Quarterly Telcoms Data and analysis of Parties' and third parties' revenue and subscriber data.*

D.40 In addition to the chosen option and an option not to use a mobile phone, we construct a choice set in each month. The choice set comprises the set of tariffs from the Pure Pricing data that were available for purchase in each month. We define a tariff as a unique combination of brand, contract length, extra (for example 6 months of a streaming service included with the tariff), data allowance, and ownership. Where there are multiple instances of the same tariff, we use the median price of the corresponding tariffs.

D.41 Finally, to capture the substitution of subscribers to options outside of PAYM SIMO, a random 5% of the sample is assumed to have chosen the outside good.[393] We use an outside good to recognise amongst other things, that some consumers may not use a UK mobile tariff or do not purchase an additional tariff (eg not having a second phone). The assumption that 5% chose the outside good is in line with the CMA's survey results showing that diversion to "no purchase" is 1-4%. As a sensitivity in paragraph D.73, we discuss the implication of assuming an outside good share of 1% or 10% for the results.

D.42 The final data used for estimation contains a sample of 10,000 choices. Table D.2 provides an overview of the average value for key variables in the estimation sample for each provider. It highlights that there is variation in the tariffs chosen by subscribers of different brands in the sample.

[392] The market shares are based on those in Chapter 8 and market share estimates submitted by Ofcom.
[393] In particular, this means that we sample 9,500 choices and use a random 500 subscribers demographics to be the demographics of subscribers who chose the outside good.

**Table D.2: Means of key variables of the chosen choices of subscribers in the estimation sample**

| *Brand* | *Number sampled* | *Price (£'s)* | *Data allowance if it is limited (GB)* | *If the tariff has an unlimited data allowance (0 or 1)** | *If the tariff contains an extra (0 or 1)* | *Contract length (months)* | *Age of subscriber (Years)* | *Estimated gross disposable monthly income (£'s)* |
|---|---|---|---|---|---|---|---|---|
| EE | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| O2 | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| Other (includes BT, PlusNet, iD mobile and Talk Mobile) | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| Sky Mobile | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| Tesco | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| Three | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| Vodafone | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |

*Source: CMA analysis of PD data.*

** We define an unlimited contract as a contract with an allowance of at least 500 GB*

D.43 To estimate the model, we use maximum likelihood based on the choice probability implied by the utility specification. We note that this model itself is relatively standard and is similar to the one used by the Parties in their quality merger simulation model – however, in our case, we estimate it from data on actual choices. The methodology is also similar to that used in recent academic work on telecommunications such as Bourreau et al (2021), and to a lesser extent Elliott et al (2024).[394] [395]

## Estimation results

D.44 In this section we discuss the results of the CMA's demand model. We discuss:

(a) The estimated coefficients

(b) Willingness to pay estimates

(c) Diversion ratio estimates

### Coefficients

D.45 Table D.3 shows the estimated coefficients of the model. In the first column we list the variable in the model, the second and third columns list the value the coefficient takes and the standard error of the variable respectively. In the final column we present the T-statistic associated with each coefficient.

D.46 We present the table of coefficients as it gives an insight into the statistical importance of each variable. However, in isolation the table of coefficients is difficult to interpret in terms of the relative value subscribers place on different aspects of a tariff offering. To help interpret the results and to further understand

[394] Bourreau, M., Sun, Y., & Verboven, F. (2021). Market Entry, Fighting Brands, and Tacit Collusion: Evidence from the French Mobile Telecommunications Market. In American Economic Review (Vol. 111, Issue 11, pp. 3459–3499).
[395] Elliott, J., Houngbonon, G.,Ivaldi, M., & Scott, P. (2024). Market Structure, Investment, and Technical Efficiencies in Mobile Telecommunications. Forthcoming Journal of Political Economy.

the importance consumers place on different aspects we estimate subscribers' willingness to pay for tariff characteristics (such as data allowance) and multiple aspects of network quality.

**Table D.3: Table of coefficients from the CMA's estimation of the demand model**

| *Coefficient* | *Value* | *Standard Error†* | *TStatistic* |
|---|---|---|---|
| Price over income | -354.69 | 2.48 | -142.83 |
| brand: EE | 1.92 | 0.48 | 3.98 |
| brand: O2 | 1.32 | 0.46 | 2.87 |
| brand: Other± | -1.94 | 0.47 | -4.16 |
| brand: Sky Mobile | -0.33 | 0.46 | -0.72 |
| brand: Tesco | 0.64 | 0.46 | 1.40 |
| brand: Three | 0.72 | 0.47 | 1.55 |
| brand: Vodafone | 1.66 | 0.48 | 3.49 |
| Percentage of 4G coverage | 2.07 | 1.46 | 1.42 |
| Percentage of 5G coverage | 0.20 | 1.29 | 0.16 |
| Extra | -1.04 | 0.38 | -2.70 |
| Unlimited | 8.56 | 0.42 | 20.33 |
| Contract length | -0.17 | 0.02 | -10.07 |
| Data allowance given the contract is limited | 0.06 | 0.00 | 18.97 |
| Download speed 4G (For areas with more than 25% 4G coverage) | -0.27 | 0.04 | -7.17 |
| Download speed 5G (For areas with more than 25% 5G coverage) | -0.01 | 0.01 | -0.99 |
| Upload speed 4G (For areas with more than 25% 4G coverage) | 0.54 | 0.12 | 4.46 |
| Upload speed 5G (For areas with more than 25% 5G coverage) | 0.00 | 0.06 | 0.03 |
| Log(age) * perc_4G_coverage | -0.21 | 0.36 | -0.60 |
| Log(age) * perc_5G_coverage | -0.10 | 0.34 | -0.30 |
| Log(age) * extra | 0.59 | 0.10 | 6.12 |
| Log(age) * unlimited | -1.78 | 0.11 | -16.01 |
| Log(age) * contract length | 0.02 | 0.00 | 4.67 |
| Log(age) * limited * data | -0.02 | 0.00 | -18.20 |
| Log(age) * download speed 4G (For areas with more than 25% 4G coverage) | 0.08 | 0.01 | 8.09 |
| Log(age) * download speed 5G (For areas with more than 25% 5G coverage) | 0.01 | 0.00 | 1.33 |
| Log(age) * upload speed 4G (For areas with more than 25% 4G coverage) | -0.14 | 0.03 | -4.65 |
| Log(age) * upload speed 5G (For areas with more than 25% 5G coverage) | -0.01 | 0.01 | -0.41 |

*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*
*± Other includes all other brands.*
*† Asymptotic standard errors.*

### Willingness to pay

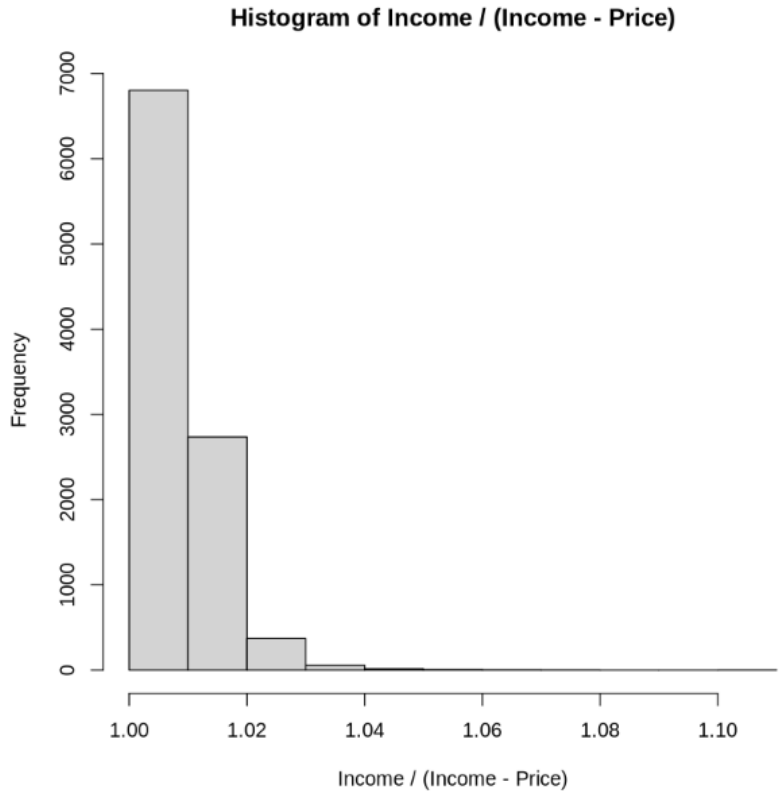
D.47 Willingness to pay (**WTP**) is the amount of income a consumer would forgo for a specified improvement in a tariff feature or an aspect of network quality. For example, it measures how much extra would a subscriber pay on top of the tariff price for an additional 5 Mbps of download speed.

D.48 To simplify our calculation of willingness to pay we use an approximation to it at the subscriber level. Namely, we divide the coefficient on the tariff feature or network quality measure we would like to compute the willingness to pay for by the price coefficient. That is for characteristic $X$:

$$WTP_i(X) = \frac{(\beta_x + \log(age_i) \cdot \sigma_x)}{\alpha_i} \text{ where } \alpha_i = \frac{\alpha}{income_i}$$

D.49 We note that formally the above calculation for WTP is only a good approximation where price is a small share of income ($\frac{y_i}{y_i - p} \cong 1$).[396] In the context of the sample this is a reasonable assumption as seen in Figure D.1 below showing a histogram of $\frac{y_i}{y_i - p}$:

**Figure D.1: A histogram of showing the price/income share assumption in the sample**

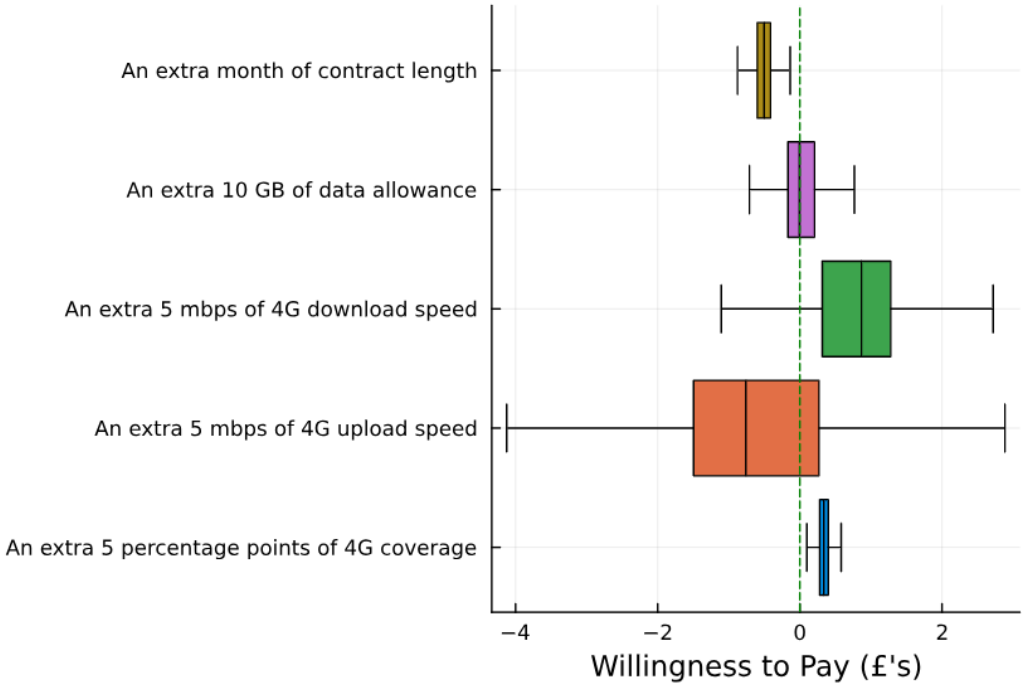



*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*

D.50 Figures D.2 and D.3 below show boxplots of estimated distribution in our sample of subscriber willingness to pay in GBP's per month for different tariff and network characteristics. The box shows the 25th percentile (start of the box), the median and 75th percentiles (end of the box) of willingness to pay in the sample used for estimation.

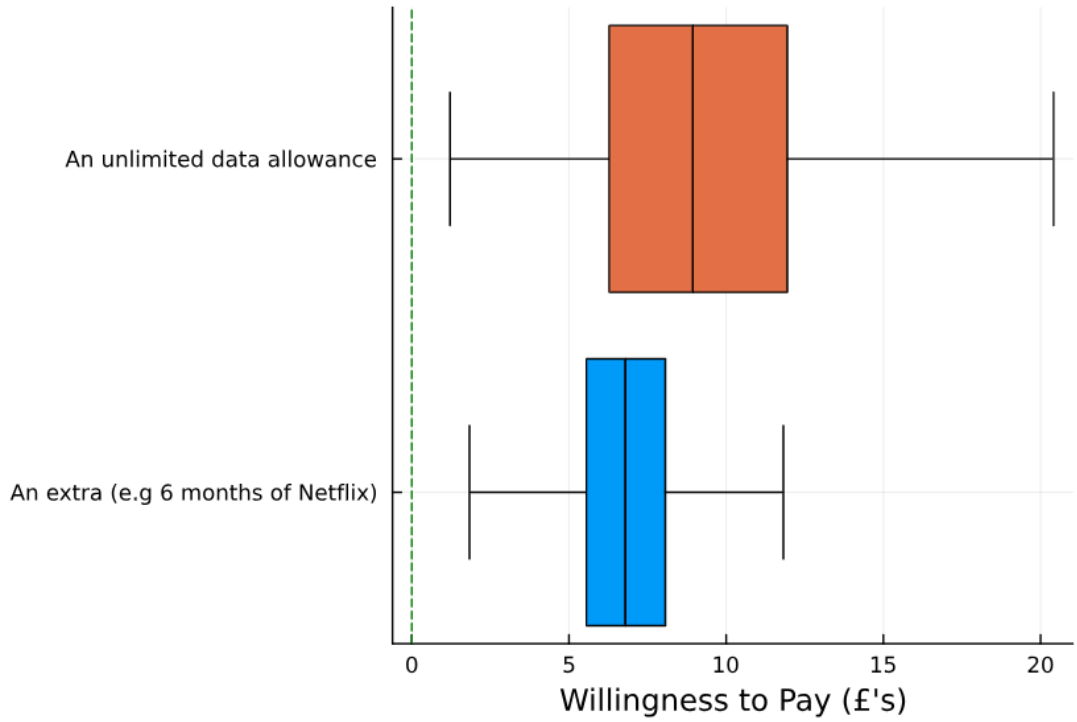
[396] See Train, K. E. (2009). *Discrete choice methods with simulation* for a discussion of the estimation of willingness to pay in logit models.

**Figure D.2: CMA econometric estimates of willingness to pay (GBP's per month)**




*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*

**Figure D.3: CMA econometric estimates of willingness to pay (GBP's per month)**



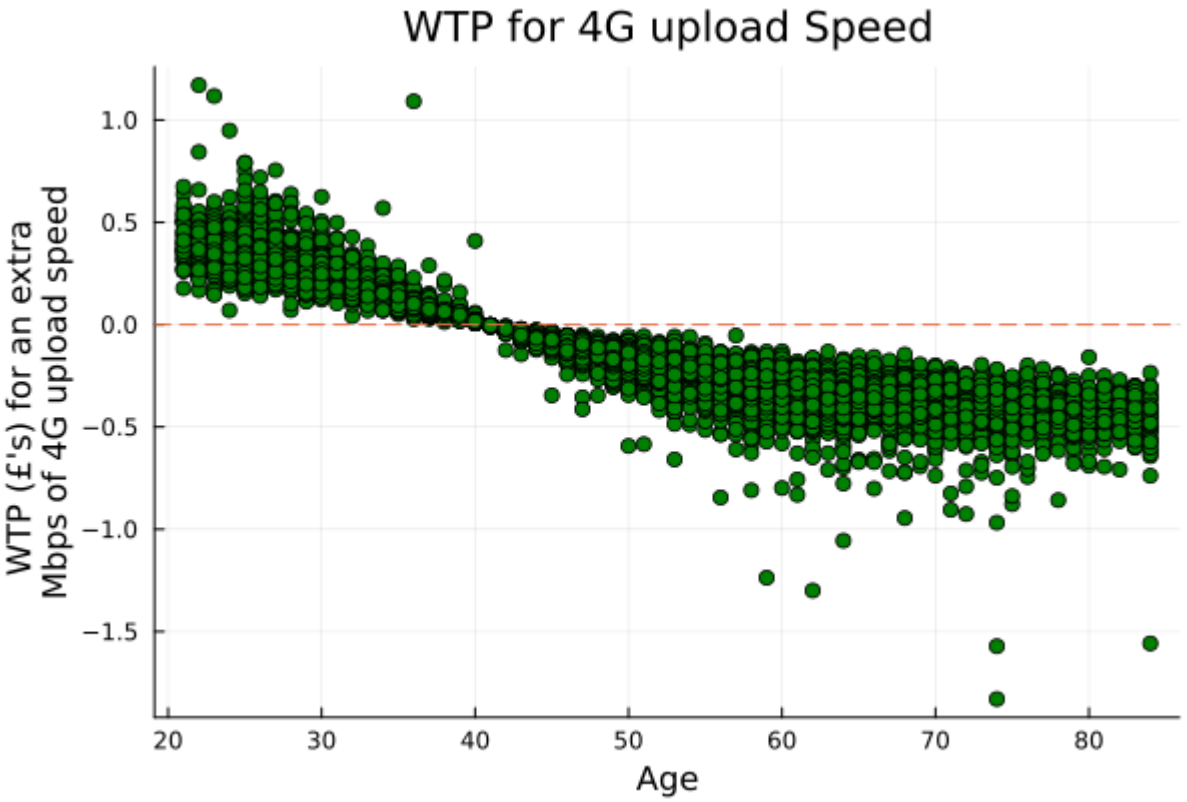

*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*

D.51 The estimates show that there is willingness to pay for aspects of network quality and in particular for 4G download speed. 5 extra Mbps of 4G download speed has a median valuation of GBP 0.86, while an extra 5% of 4G coverage in the travel to

work area around where a consumer lives is valued by the median subscriber in the sample as GBP 0.33.

D.52 In contrast we estimate a more varied valuation for 4G upload speed (important for posting to social media or making calls over 4G) with valuations being zero or negative for large parts of the distribution. Our sample has a large fraction of subscribers over the age 40 and, as can be seen in Figure D.4 below, willingness to pay estimates of 4G upload speeds are highly age dependant with estimates showing a positive willingness to pay for subscribers under the age of 40 but a negative or zero valuation for those over the age of 40.

**Figure D.4: CMA econometric estimates of willingness to pay for 4G upload speed by age**




*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*

D.53 Notably, compared to 4G measures we do not estimate a positive valuation for any 5G network quality variables. Specifically, we find that 5G network quality willingness to pay is close to GBP 0 and cannot be statistically distinguished from GBP 0 for any subscribers in the sample.

D.54 It is unclear why consumers value 4G more than 5G. One potential reason for the low willingness to pay for 5G is that 5G speeds may be less commonly observed by consumers than 4G speeds (eg because some consumers do not have a 5G-enabled phone or because it is still being rolled out in some areas).

D.55 Data allowance (for limited contracts) is valued at a median of 0 however, as can be seen from the graph below, there a positive valuation amongst younger subscribers. This is consistent with higher internet usage by younger audiences.[397]

**Figure D.5: CMA econometric estimates of willingness to pay for an extra GB of data by age**


*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*

D.56 Other willingness to pay estimates are as follows:

(a) Willingness to pay for an additional month of contract length is negative, consistent with the logic that all else equal, subscribers value the option to be able to change or cancel contracts.

(b) Unlimited data is highly valued with a median willingness to pay of GBP 8.94.

(c) Extras are also valued positively with a median valuation of GBP 6.79 which seems plausible given extras typically include a period of free access to a streaming service.[398]

D.57 More generally the results show that there is variation in the willingness to pay for different characteristics across consumers included in our sample.

D.58 It is difficult to directly compare our willingness to pay estimates for network quality to those produced by the Parties' demand model estimated from survey data as

[397] See Global internet users age distribution 2024 | Statista, accessed by the CMA on 3 September 2024.
[398] Streaming services may cost above this figure however subscribers may not receive the extra for the full contract period and economic theory predicts that consumers have a lower valuation for in-kind transfers compared to cash.

part of their quality-focused merger simulation model. This is because the Parties use different and less clear definitions of network speed and coverage compared to those we use in our demand model (See Appendix F).[399] As such we do not consider that the WTP estimates presented here can be directly compared to the Parties' WTP estimates.

D.59 Additionally, our demand model willingness to pay estimates are linear in aspects such as speed and are estimated on data on the first half of 2023. This means that our estimates are not well suited to be used to comment on the consumer valuation for very large changes in network quality.[400] Instead, the CMA's WTP estimates are informative for understanding the relative importance consumers placed on different aspects of their tariffs in the period before the Merger.

**Diversion ratios**

D.60 Next, we show what our econometric results imply for closeness of competition. To do so, we calculate operator-level price diversion ratios.[401] The operator diversion ratio asks: if we change a specific characteristic (eg price or network quality) of all tariffs owned by operator $j$, what fraction of the subscribers who substitute away from operator $j$ switch to tariffs owned by operator $k$?

D.61 Formally the diversion ratio from tariff *j* to *k* in the case of price being the characteristic of interest is given by: [402]

$$DR_{jk}(\boldsymbol{p}) = -\frac{\frac{\partial q_k}{\partial p_j}(\boldsymbol{p})}{\frac{\partial q_j}{\partial p_j}(\boldsymbol{p})}$$

D.62 The operator diversion ratio is then constructed by aggregating the diversions for each product as shown below.[403] In that sense it differs from the firm level

[399] For example, one measure of coverage the Parties refer to is the percentage of coverage 'in your area' which is an ambiguous definition that may be interpreted differently by different respondents.
[400] Willingness to pay estimates are calculated in the range of the sample. Therefore, they cannot be reliably extrapolated to predict the aggregate welfare effect that may associated with large changes in tariff characteristics eg a large change in the available network quality. Additionally, our model assumes linearity in WTP for data. Over large changes the assumption of linearity is less likely to hold. For example, a 1mbps increase from a base of 10mbps is possibly valued more than a 1mbps increase when the base is 500mbps.
[401] An operator diversion ratio is different to a brand level diversion ratio as considers switching following a price rise for all tariffs owned by the operator not just tariffs in a given brand.
[402] The diversion ratios used in the econometrics are conceptually different to the diversion ratios calculated from the survey. Formally the diversion ratios calculated from the econometrics is a LATE estimate while forced diversion ratios such as those calculated from the CMA's survey provide an ATUT (average treatment on the untreated) estimate. For more information on the difference see Conlon, C. and Mortimer, J.H. (2021), Empirical properties of diversion ratios. The RAND Journal of Economics, 52: 693-726.
[403] The cross-own firm derivative accounts for the firms recapture with its other tariffs when it raises the price of one of its tariffs. The operator diversion ratio should in the denominator capture the total loss of sales from the firm when all its products raise price. This denominator in the formula is therefore too large when including the cross-own firm derivatives as they do not account for the rise in in the price of the products that recapture the sale. At the same time, it would be incorrect to not include some recapture. In practice under simulation, we find that as we are considering an infinitesimal change in price, the cross-own firm derivatives under a single or joint change are approximately the same. As such we use the formula presented but note that formally it is an approximation for the reasons described in this footnote.

diversion by assuming all the tariffs owned by the firm raise prices.

$$Operator\ DR_{jk}(\boldsymbol{p}) = -\frac{Sales\ captured\ by\ firm\ K}{Total\ sales\ lost\ by\ firm\ J} \approx -\frac{\sum_{k\in K_f}\ \sum_{j\in J_f}\frac{\partial q_k}{\partial p_j}(\boldsymbol{p})}{\sum_{x\in J_f}\ \sum_{j\in J_f}\frac{\partial q_x}{\partial p_j}(\boldsymbol{p})}$$

D.63 Table D.4 shows the results with values on the diagonal reporting the diversion to the outside good. We see that there the Parties provide a constraint on each other, and the diversion is 17% from 3UK to VUK and 15% from VUK to 3UK.

D.64 Diversion to MVNOs shows that they pose a more limited competitive constraint on the Parties - the diversion ratio from 3UK to Sky Mobile is 8%, 9% to Tesco Mobile and 7% to Other. Tariffs offered by BTEE and VMO2 brands pose a strong competitive constraint with diversion ratios close to 30%.

**Table D.4: CMA's econometrics operator price diversion ratios**

| *FROM/TO* | *BTEE* | *SKY* | *VM02* | *TESCO* | *OTHER* | *THREE* | *VODAFONE* |
|---|---|---|---|---|---|---|---|
| BTEE | 6% | 9% | 32% | 10% | 6% | 17% | 20% |
| SKY | 23% | 8% | 26% | 9% | 5% | 14% | 15% |
| VMO2 | 30% | 9% | 8% | 10% | 6% | 17% | 20% |
| TESCO | 23% | 8% | 26% | 8% | 6% | 15% | 15% |
| OTHER | 21% | 8% | 25% | 9% | 9% | 15% | 14% |
| THREE | 26% | 8% | 27% | 9% | 6% | 7% | 17% |
| VODAFONE | 28% | 8% | 29% | 9% | 5% | 15% | 6% |

*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*

D.65 In addition to price diversion, Table D.5 and Table D.6 show diversion ratios based on two most highly valued network quality measures, 4G download speed and 4G coverage. Compared to price diversion ratios these show the diversion following a reduction in the quality measure. As such they capture the closeness of the Parties in terms of aspects of their quality offerings. Compared to the price diversion ratios we see broadly similar diversion between the Parties.

**Table D.5: CMA's econometrics operator diversion ratios (4G download speed conditional on over 25% coverage)**

| *FROM_TO* | *BTEE* | *SKY* | *VM02* | *TESCO* | *OTHER* | *THREE* | *VODAFONE* |
|---|---|---|---|---|---|---|---|
| BTEE | - | 9% | 33% | 9% | 5% | 16% | 22% |
| SKY | 27% | - | 26% | 8% | 4% | 12% | 16% |
| VM02 | 35% | 10% | - | 9% | 4% | 15% | 21% |
| TESCO | 28% | 8% | 26% | - | 4% | 13% | 16% |
| OTHER | 27% | 8% | 25% | 7% | - | 12% | 15% |
| THREE | 30% | 8% | 27% | 8% | 4% | - | 18% |
| VODAFONE | 33% | 8% | 29% | 8% | 4% | 14% | - |

*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*

**Table D.6: CMA's econometrics operator diversion ratios (4G coverage)**

| *FROM_TO* | *BTEE* | *SKY* | *VM02* | *TESCO* | *OTHER* | *THREE* | *VODAFONE* |
|---|---|---|---|---|---|---|---|
| BTEE | 0% | 8% | 32% | 10% | 5% | 17% | 22% |
| SKY | 25% | 0% | 26% | 8% | 5% | 14% | 16% |
| VM02 | 31% | 9% | 0% | 10% | 6% | 17% | 21% |
| TESCO | 25% | 7% | 26% | 0% | 5% | 15% | 16% |
| OTHER | 23% | 7% | 25% | 9% | 0% | 15% | 15% |
| THREE | 27% | 7% | 27% | 9% | 6% | 0% | 18% |
| VODAFONE | 30% | 7% | 29% | 9% | 5% | 15% | 0% |

*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*

## Robustness

D.66 To test the robustness of our results, we carried out several sensitivity checks. We check robustness to our sample size, outside good size, potential omitted variable bias concerns, and compare the results to those in recent academic work. Across sensitivities, the results remain stable.

D.67 Firstly, we checked robustness to the sample sized used. In the baseline estimation for computational speed, we used a small sample of 10,000 sampled choices. Although the sample is drawn in proportion with market shares, there could be concern that it may contain choices of consumers that are unrepresentative of demographics of the overall population. If so, this could bias results. To check robustness to this potential concern, we checked how results differed in a sample of 50,000 choices. In this case, the coefficients of the 10,000 sample cannot be statically rejected to be different from 50,00 sample coefficients at the 5% level.[404]

D.68 Additionally, to test the representativeness of the demographic of the subscribers sampled we carried out a Kolmogorov–Smirnov test of the distribution of ages and income in the sample vs the overall data.[405] The tests could not statistically reject the hypothesis that the distributions are the same as in the overall population with p-values of greater than 0.25 in the two-sided asymptotic test.

D.69 Secondly, we have checked robustness to the assumed size of the outside good. The size of the outside good is an important assumption. In general, a higher outside good tends to lead to a more elastic estimated demand system. To check the robustness of our assumption on the size of the outside good, we increased the size of the outside good to 10%. The estimated coefficients and willingness to pay estimates are comparable with merger simulation results within one percentage point. Additionally, we compute results with an outside good of only 1% and obtain quantitatively close results.

[404] We also find that the margins implied by the combination of the demand and supply model discussed below are similar whether a sample of 10,000 or 50,000 choices are used to estimate the model.
[405] Formally the Kolmogorov–Smirnov tests whether two samples come from the same underlying distribution

D.70 We have also checked robustness to potential concerns omitted variable bias by adding a month fixed effect. The idea is that a time fixed effect captures unobservable components of demand correlated with the time dimension. Again, the results are similar in terms of the implied diversion ratios and willingness to pay.

D.71 Finally, our willingness to pay estimates are comparable to those in a recent study of the 2015 French market.[406] For 4G data we find a 10 Mbps speed increase has a median WTP of GBP 1.72, in comparison Elliott et al (2024) find a value of EUR 2.84 (approximately GBP 2.64) for a 10 Mbps speed increase.[407] We view these as comparable given the different contexts of the studies. For example, because the baseline speed was lower in 2015 a 10 Mbps speed increase was likely more valued then than today and because French consumers may behave differently and have different preferences than UK consumers.

## Merger Simulation

D.72 The CMA has conducted a merger simulation to assess the impact of the Merger on prices. The merger simulation captures the combined effect of the pricing pressure that results from the Merger, the ability for the Merged Entity to pass through this pricing pressure, and the reaction of rivals to any price change by the Merged Entity.

D.73 In line with the CMA's analysis of REE's (Chapter 14) that finds no link between the incremental cost of capacity and retail pricing, we do not consider marginal costs efficiencies in our simulation. Additionally, we do not consider a model where each firm makes decisions about its price and investment in quality simultaneously or any quality changes that happen as a result of the Merger.[408] In that sense our results provide a short term view of the impact of the Merger on price.

D.74 In this section we discuss the CMA's merger simulation and the robustness of its results.

### Supply Model

D.75 We have undertaken a merger simulation based on our econometric demand model to analyse the impact of the Merger on prices. Merger simulation can provide a tool to understand the potential price impacts of a merger – especially when based on an econometric model that has used real world choices and a

[406] Elliott, J., Houngbonon, G.,Ivaldi, M., & Scott, P. (2024). Market Structure, Investment, and Technical Efficiencies in Mobile Telecommunications. Forthcoming Journal of Political Economy.
[407] To calculate the approximate figure, we use the 2015 exchange rate and then adjust for inflation between 2015 and 2023.
[408] We consider that trying to model the impact of a Merger on both price and quality presents significant challenges. These include, but are not limited to, mapping firms' investment to realised changes in network quality and modelling the impact of quality changes on consumers' behaviour

flexible demand system. It has previously been used by other competition authorities and in academia to study mergers in telecoms.[409] Additionally, the supply-side model used is the standard supply-side model which is also used by the Parties in their quality-focused merger simulation.

D.76 Having estimated the choice model, we use the results to predict the impact of the Merger on prices holding network quality fixed. We do not allow for marginal cost efficiencies in the simulation.

D.77 In our merger simulation, operators simultaneously choose the price of each of their tariffs to maximise profits:

$$\max_{p \in J_f} \pi_f(\boldsymbol{p}) = \sum_{\boldsymbol{j \in J_f}} (p_j - c_j) \cdot q_j(\boldsymbol{p})$$

where $J_f$ denotes the set of tariffs owned by operator $f$.

D.78 The multi-product Bertrand first-order condition (FOC) for tariff $j$ is then:

$$q_j(\boldsymbol{p}) + \sum_{\boldsymbol{j \in J_f}} (\boldsymbol{p_j} - \boldsymbol{c_j}) \frac{\partial q_k}{\partial p_j}(\boldsymbol{p}) = 0$$

D.79 In matrix terms, the system of FOC's is:

$$q(\boldsymbol{p}) + \boldsymbol{\Delta}(\mathbf{p}) \cdot (\boldsymbol{p} - \boldsymbol{mc}) = \mathbf{0}$$

where:

$$\Delta_{(j,k)}(\boldsymbol{p}) = \begin{cases} -\dfrac{\partial q_j}{\partial p_k}(\boldsymbol{p}) & for\ (j,k) \in J_f \\ 0 & for\ (j,k) \notin J_f \end{cases}$$

D.80 We simulate the Merger in three steps:

(a) Use the estimated model and the FOC of the supply-side model to recover marginal costs as:

$$\widehat{\boldsymbol{mc}} = \boldsymbol{p} + \boldsymbol{\Delta}^{\mathbf{pre}}(\mathbf{p})^{-1} q(\boldsymbol{p})$$

(b) Adjust the ownership matrix by giving control of all VUK and 3UK tariff's price to the Merged Entity:

$$\boldsymbol{\Delta}^{\mathbf{pre}}(\mathbf{p}) \rightarrow \boldsymbol{\Delta}^{\mathbf{post}}(\mathbf{p})$$

[409] For a review see for example: Valletti, T., Zenger, H. Mergers with Differentiated Products: Where Do We Stand?. *Rev Ind Organ* **58**, 179–212 (2021).

(c) Solve for the vector of post-Merger tariff prices $\boldsymbol{p}^*$ :

$$q(\boldsymbol{p}^*) + \boldsymbol{\Delta}^{\boldsymbol{post}}(\mathbf{p}^*) \cdot (\boldsymbol{p}^* - \widehat{\boldsymbol{mc}}) = \mathbf{0}$$

D.81 To solve the pricing equation in step 3 for post-Merger prices $\boldsymbol{p}^*$ we use a fixed-point iteration based on the Morrow and Skerlos (2011) decomposition:[410]

$$(\boldsymbol{p}^* - \widehat{\boldsymbol{mc}}) \leftarrow \boldsymbol{\Lambda}^{-\mathbf{1}}(\boldsymbol{p}^*) \cdot \boldsymbol{\Gamma}(\boldsymbol{p}^*)' \cdot (\boldsymbol{p}^* - \widehat{\boldsymbol{mc}}) - \boldsymbol{\Lambda}^{-\mathbf{1}}(\boldsymbol{p}^*) \cdot s(\boldsymbol{p}^*)$$

where $\Lambda(\boldsymbol{p}) = Diag[\alpha s(\boldsymbol{p})]$ and $\Gamma(\boldsymbol{p}) = \alpha \cdot \boldsymbol{\mathcal{H}} \odot s(\boldsymbol{p}) s(\boldsymbol{p})'$ with $\mathcal{H}$ being the ownership matrix associated with firm changes following the Merger.

D.82 In addition to computing the price change implied by the Merger we also compute

(a) The implied pre-Merger margins of each firm

(b) The implied changes in market shares

(c) The aggregate consumer welfare change

D.83 For margins we calculate this using the recovered marginal costs $\widehat{mc}$ as:

$$Implied\ margin\ = \frac{p\ -\ \widehat{mc}}{p}$$

D.84 It is important to note that the margins computed here are economic margins which typically differ from accounting margins due to the inclusion of implicit costs such as the opportunity cost to the firm.

D.85 For consumer welfare changes, we consider the change in consumer surplus which we calculate as the change in:[411]

$$CW_{it} \coloneqq E(CS_{it}) = \frac{1}{\alpha_i} E_\varepsilon \left[ \max_j \left( U_{ijt}\ \forall j \right) \right] \approx \frac{1}{\alpha_i} \ln \sum_j e^{V_{ijt}}$$

**Merger simulation results**

D.86 Before presenting the merger simulation results, we check what the model implies in terms of operator-level margins and implied market shares.[412] Table D.7 shows the margins and market shares implied by the model.

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[410] Morrow, W. R., & Skerlos, S. J. (2011). Fixed-Point Approaches to Computing Bertrand-Nash Equilibrium Prices Under Mixed-Logit Demand. Operations Research, 59(2), 328–345.

[411] Because the marginal utility of income is not independent of income in our model, the formula used to compute consumer welfare changes is an approximation to its true value. However, as noted by Train (2009), when the change in consumer surplus due to a policy change (here a merger) is small relative to income – as is the case here – then this approximate formula may be used.

[412] The fact that the market shares are broadly in line with the market shares in the sample is driven by both the fact that they are an input to the model and that the model predicts market shares well.

**Table D.7: Merger simulation results from the CMA's subscriber demand model for MNOs**

| *Operator* | *Market Shares (excl. Outside Good)* | |
|---|---|---|
| | *Implied Economic Margin* | *Econometric Model Shares*[413] |
| BTEE | [✂] | [20-30%] |
| SKY Mobile | [✂] | [5-10%] |
| VM02 | [✂] | [10-20%] |
| TESCO Mobile | [✂] | [10-20%] |
| OTHER | [✂] | [<5%] |
| THREE | [✂] | [10-20%] |
| VODAFONE | [✂] | [20-30%] |

*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*

D.87 The table shows that the margins across firms are around [✂]% with the margins for 3UK and VUK being [✂]% and [✂]% respectively. Compared to the margin estimates in Appendix E we note these are most [✂] which intuitively makes sense given the sample and estimation assumptions.[414]

D.88 Given the margins implied by the supply side model and the diversion ratios from the demand model we can compute a measure of upwards pricing pressure. In particular in line with our approach in the Appendix E we compute a GUPPI estimate. These estimates are [5-10%] for 3UK and [<5%] for VUK. As discussed in Chapter 8 these estimates are similar to the lower range of the survey-based GUPPI estimates.

D.89 GUPPI estimates only describe the impact of the Merger on pricing pressure and as such do not provide an estimate of the impact of the Merger on prices. To be able to provide evidence on the price effect as described in the above section the CMA has conducted a merger simulation.

D.90 Table X shows the results of this simulation. Given the assumptions made, the model predicts that the Merged Entity would raise the prices of 3UK's tariffs by 7.0% on average and VUK's tariffs by 3.8%. This translates into an annual price increase of GBP 13.04 for the average 3UK customer and GBP 9.76 for the average VUK customer. Rivals would respond to the Merged Entity raising prices by also raising prices. BTEE and VMO2 would increase prices by 0.6% and 0.5% respectively. Other providers such as Tesco Mobile and Sky Mobile would also raise prices.[415]

[413] Market shares are close to those in the sample. In an aggregate logit model market shares are matched to input shares as part of the estimation. In our model shares can differ from the imputed shares however it is expected that they are close since the sample is a key input to the model and the estimation uses maximum likelihood.
[414] In particular the sample is based on contestable consumers and we do not model switching costs. As such we possibly understate the long run value that maybe associated with acquiring a new customer. This means our margins more closely reflect acquisition margins as opposed to contribution margins that would capture the long run value of having a subscriber.
[415] We find that the 'Other' brand would slightly decrease its price by <0.01%.

D.91 The price increases predicted by our merger simulation are similar to our GUPPI estimates. The reasons for this are as follows:

(a) Unlike GUPPI, merger simulation takes account of second round effects. Where, as is the case of our industry model, the prices of tariffs tend to be strategic complements (ie tariff prices tend to move in the same direction), the inclusion of second round effects leads to higher prices.[416]

(b) However, the pass-through of pricing pressure into prices in our demand model is typically less than 1. In contrast, because GUPPI does not assume a particular functional form for demand, pass-through defaults to 1. Thus, all else being equal, GUPPI estimates of pricing pressure will tend to exceed the predicted price effect of a merger simulation whose demand system has less than unit pass-through (ie moderately convex demand systems).

D.92 In this case, the under prediction by GUPPI of merger price rises due to the omission of second round effects is approximately offset by its over-prediction due to its higher assumed pass-through of pricing pressure into final prices. When accounting for these second round effects we see that overall, the price rises in the industry are more than in the GUPPI even though the Parties have lower price changes.

**Table D.8: Merger simulation results from the CMA's subscriber demand model for MNOs**

| | *Price change post-merger (%)* | *Estimated change in market share (percentage points)** |
|---|---|---|
| 3UK | 7.0% | -1.8pp |
| VFUK | 3.8% | -1.4pp |
| BTEE | 0.6% | +0.9pp |
| VMO2 | 0.5% | +1pp |
| Change in consumer welfare | | -1.5% |

*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*
*Note:*
** Even though their shares fall profit overall rises for the merging firms*

D.93 In addition to considering the price impacts of the Merger we have estimated the impact of the Merger on consumer welfare. Table D.8 reports that the Merger would lead to a 1.5% decrease in consumer welfare.

D.94 If we assume that the model's results hold for the whole consumer retail market (not just the SIMO segment on which the model is estimated) we have calculated that this translates into an average annual reduction in the welfare of each subscriber of GBP 3.66 (in 2023 £'s). If we assume that the model's results hold for the whole consumer retail market (not just the SIMO segment on which the model is estimated) this would imply an annual cost to UK consumers of approximately GBP 328 million a year (in 2023 £'s) resulting from the Merger

[416] See Appendix E for a discussion of other evidence suggesting the likelihood of second round effects.

excluding consideration of any cost efficiencies, product repositioning or network quality changes.[417]

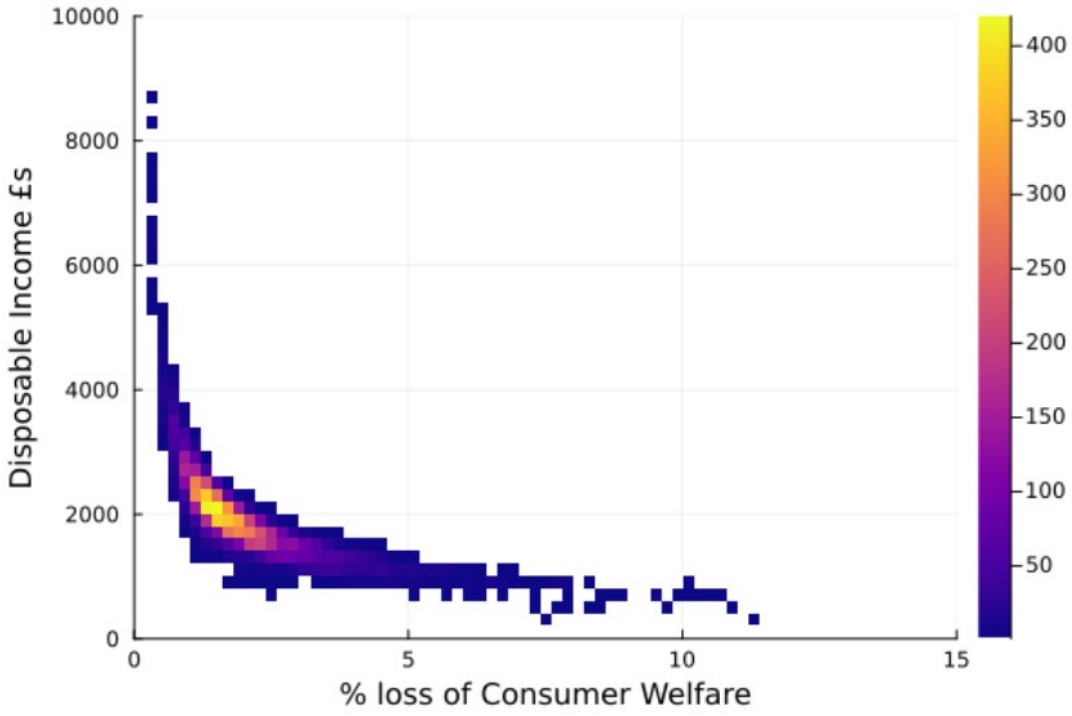
D.95 An important input to the merger simulation is our estimated model of subscriber demand. As this model flexibly allows for variation in subscribers' valuations of tariffs by location, income and age we have also been able to consider how the change in welfare impacts different types of subscribers.

D.96 Figure D.6 shows the estimated consumer welfare changes for different income groups. The Figure is a 2D histogram where the lighter colours indicate a higher number of consumers at a given point. The Figure shows a larger impact on the welfare of subscribers with lower incomes. This is driven by the fact that:

(a) in the estimated model lower income consumers are more price sensitive so are both more likely to switch to less desirable products post-Merger and dislike higher prices more; and

(b) in the sample there is a higher proportion of low-income consumers who subscribe to 3UK and thus are subject to price rises.[418]

**Figure D.6: Impact on consumer welfare by subscribers' monthly disposable incomes**




*Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.*

[417] This number multiplies the per subscriber consumer welfare change in the model by the number of subscribers in the UK retail market.
[418] In the 10,000 sample of subscribers used in these results subscribers of tariffs under the Three brand have a median monthly income of GBP [✂] which is lower than most brands in the sample.

D.97 We note that we consider that the modelling is a likely lower bound on the pricing impacts of the Merger. This is for a number of reasons, including:

(a) We may underestimate price impacts as we do not account for vertical relationships between firms (such as through wholesale interaction).

(b) The demand model is based on the assumption that everyone in the sample has made an active choice based on the options available. A different modelling assumption may consider that these consumers are not engaged with the market or actively considering their options which, if true for a large portion in the sample, would imply more inelastic demand and higher price effects resulting from the Merger.[419]

(c) The model only considers "contestable subscribers". As such not only is point b) relevant but we do not account for those that may search but do not make a choice due to switching costs. This may lead to a more elastic demand in our model than is likely to be the case in practice.

D.98 It is also important to note the model does not consider any long run effects. In particular, we do not allow for a firm to make decisions about both price and quality simultaneously, nor do we allow for marginal cost efficiencies in the simulation (for the reasons outlined in Chapter 14).

**Robustness**

D.99 To ensure the robustness of our merger simulation results, we have carried out a number of sensitivity checks.

D.100 When a merger simulation produces multiple plausible equilibria, this can reduce the utility of the exercise. As such we have checked robustness of our results to different starting values in the merger simulation. For starting values +/- GBP 2.5 of pre-merger prices we have found no additional (pure strategy) equilibria.

D.101 To further check the robustness of our result we also considered the extent to which the implied marginal costs are less than zero. Negative costs are usually implausible and therefore when present can suggest misspecification in the model. We have considered the extent to which the model predicts marginal costs that are less than zero by considering the distribution of the implied marginal costs. Most tariffs have positive marginal costs however 10.8% of tariffs were estimated to have marginal costs less than zero[420]. We consider possible explanations for these below zero estimates to include:

[419] The impact of this assumption can be seen in the difference between the contribution margins and the acquisition margins presented in Appendix E

[420] Tariffs with negative marginal costs were often low-priced tariffs, ie less than a £5 monthly charge.

(i) The presence of loss leading tariffs; and/or,

(ii) specific factors affecting this segment not captured (eg not accounting for operators believing that new customers are more likely to stay with them at the end of the contract)

D.102 Finally, we have compared our elasticities to those in recent studies.[421]

(a) In Bourreau et al's 2021 study of the French telecoms market in 2013 they find an own elasticity in post-paid for each firm of between -2.89 and- 3.51.[422] We find firm level own-price elasticates in the market for MNOs to be between -2.35 and -3.13. These are closely comparable.

(b) Cullen, Schutz and Shcherbakov 2020 studying the US wireless industry 2005 to 2012 find an elasticity of -3.31 in their static and -2.97 in their dynamic model. These are comparable to the estimates in our model.

**Sensitivity of harm estimates**

D.103 As noted above we consider that the consumer harm estimate from the econometrics merger simulation is likely an underestimate (see paragraph D.97). Next, we explore the sensitivity of our estimate of consumer harm to alternative assumptions regarding demand responsiveness (ie the shape of the demand curve), the size of the market (ie outside good) and the existing level of market power pre-merger (as captured by margins).

D.104 To do this we use a calibration approach similar to that used in the Parties' capacity model. Compared to the detailed estimation exercise described in the rest of the annex a calibration approach is more approximate and has a number of limitations (see Appendix F). As such we place limited evidentiary weight on specific harm estimates and instead consider how the scale and direction of the harm estimates change under different assumptions.

D.105 For the calibration, we aggregate up from the tariff level to the operator level. As a result, in this alternative model, we assume there are seven firms (BTEE, VMO2, 3UK, VUK, Sky Mobile, Tesco Mobile and Other) each producing a single product. In each case, the price of the operator's product is set equal to the average price predicted by the econometric analysis and used as an input into our merger

[421] As there is a high degree of overlap between the range of estimated own price elasticities in our model with recent, studies that control for potential endogeneity between prices and unobserved tariff characteristics. This further supports our view that conditional on the inclusion of a rich set of tariff characteristics and important local network quality features, prices are uncorrelated with any omitted tariff characteristics.
[422] Table A.4 of the online appendix to Bourreau, M., Sun, Y., & Verboven, F. (2021). Market Entry, Fighting Brands, and Tacit Collusion: Evidence from the French Mobile Telecommunications Market. In American Economic Review (Vol. 111, Issue 11, pp. 3459–3499).

simulation. The operator shares are calculated as the sum of the pre-Merger individual tariff shares.

D.106 Finally, to complete the set of data inputs needed to calibrate the model, we use the margins implied by our econometric modelling. To check the robustness of our provisional conclusions to alternative input margins, we compute a version of the model that is calibrated using the contribution margins submitted to the CMA by BTEE, VMO2 and the Parties.[423] The price, share and margin inputs into the calibrated sensitivity exercise are shown in Table D.9 below:

**Table D.9: Inputs for the calibrated models**

| *Firm* | *Margin (%)* | *Price (£)* | *Share (%)* |
|---|---|---|---|
| BTEE | [✂] or [✂] | [✂] | [20-30%] or [20-30%] |
| VM02 | [✂] or [✂] | [✂] | [20-30%] or [20-30%] |
| Vodafone | [✂] or [✂] | [✂] | [10-20%] or [10-20%] |
| Three | [✂] or [✂] | [✂] | [10-10%] or [10-20%] |
| Sky Mobile | NA or [✂] | [✂] | [5-10%] or [5-10%] |
| Tesco Mobile | NA or [✂] | [✂] | [5-10%] or [5-10%] |
| Other | NA or [✂] | [✂] | [<5%] or [<5%] |

*Source: CMA analysis of Ofcom provider data also CK Hutchison response to the CMA's s109 notice; Vodafone response to the CMA's s109 notice; BTEE response to the CMA's s109 notice; and VMO2 response to the CMA's s109 notice.*
*Note: Where an "or" is in the table, it shows the values used depending on different input choices.*

D.107 In calibrating the model, we assume diversion by market share as a base case. As an alternative specification for a linear demand model, we allow diversion to be matched to the price diversion matrix estimated in the econometric model (see Table D.4).

D.108 To then calibrate the models (logit or linear) we use the methodology of Taragin and Sandford (2022) as presented in the R package "antitrust".[424] For example for the logit case choice probabilities of product $i \in n$ are given by:

$$s_i = \frac{exp(V_i)}{\sum_{k \in n} exp(V_k)}$$

D.109 Where $V_i = \delta_i + \alpha p_i$ (ie a mean utility plus a price term and price coefficient). In turn this then implies the standard own and cross price elasticities. Together this means there are $n + 1$ parameters (the set of $\delta_i$'s and $\alpha$) and $2n$ equations (the $n$ choice probabilities and n first order conditions). To calibrate the model the antitrust package first finds the $\alpha$ that minimises the FOC before then using the choice probabilities to recover $\delta_i$'s.

D.110 Having then calibrated the demand system, we simulate the impact of the merger in a similar manner as described in the above section on post-estimation methodology.

[423] CK Hutchison response to the CMA's s109 notice; Vodafone response to the CMA's s109 notice; BTEE response to the CMA's s109 notice; and VMO2 response to the CMA's s109 notice.
[424] For details, see antitrust Reference Manual, accessed by the CMA on 3 September 2024.

D.111 The results for different input assumptions are shown in Table D.10 below:

**Table D.10: Results of the CMA's calibration**

| *Case* | *Outside good size* | *Diversion ratio used* | *Margins used* | *Demand Model* | *Price change* | *Estimated annual consumer harm (£'s)* | *% Change* |
|---|---|---|---|---|---|---|---|
| Base | *5%* | *Assumed to be by share* | *Econometrics margins* | *Logit* | *6.9% (3UK), 4.0% (VUK)* | *£362m* | *-* |
| Functional form - linear symmetric | *5%* | *Assumed to be by share* | *Econometrics margins* | *Linear* | *5.3% (3UK), 3.4% (VUK)* | *£384m* | *106%* |
| Functional form - linear non-symmetric | *5%* | *Using econometrics diversion ratios* | *Econometrics margins* | *Linear* | *4.9% (3UK), 3.2% (VUK)* | *£343m* | *95%* |
| Lower outside good | *1%* | *Assumed to be by share* | *Econometrics margins* | *Logit* | *7.1% (3UK), 4.1% (VUK)* | *£384m* | *106%* |
| Contribution margins -1 | *5%* | *Assumed to be by share* | *Contribution-A margins (no calibration of MVNO margins)* | *Logit* | *13.0% (3UK), 6.3% (VUK)* | *£640m* | *177%* |
| Contribution margins -2 | *5%* | *Assumed to be by share* | *Contribution-A margins (MVNO margins calibrated to the econometric margins)* | *Logit* | *13.4% (3UK), 8.4% (VUK)* | *£1,123m* | *310%* |

*Source: CMA analysis of Ofcom provider data also CK Hutchison response to the CMA's s109 notice; Vodafone response to the CMA's s109; BTEE response to the CMA's s109 notice; and VMO2 response to the CMA's s109 notice.*

D.112 In the first row we show a baseline result. This is a homogeneous logit model calibrated with the shares and prices from data the CMA has used for its econometrics. It is the closest comparator to our baseline merger simulation. However, it is important to note that, unlike the CMA's econometric model which is estimated using actual choice data in a more flexible and sophisticated approach, the calibrated logit model does not allow for consumer heterogeneity or for the multiproduct nature of the firms.

D.113 As expected, due to the stylised nature we find a calibrated harm estimate that is slightly higher than we find in the CMA's merger simulation. The calibrated annual harm is GBP 368 million as opposed to GBP 328 million.

D.114 In the remaining rows we recompute the harm under different inputs and model assumptions. In particular, we check how the harm estimates change when in the calibration we change:

(a) the curvature of demand;

(b) the size of the market; and,

(c) the existing level of market power pre-merger

D.115 Rows 2 and 3 compare the result to a linear model with and without symmetric diversion which assumes different curvature of demand to the logit model. [425] Linear models imply an even lower pass-through than logit. The results here show that, despite the lower curvature, the harm is larger than in the logit in the symmetric case. This is due to the fact that there is a larger quantity response from rivals. That is, under the linear demand at the calibrated parameters, rivals are more incentivised (than in the logit case) to raise prices. This leads to lower prices for the merging parties, higher prices for the rivals, overall higher industry prices and lower total consumption. This results in a larger loss in consumer welfare.

D.116 Row 4 compares the results to one where the outside good is lower (ie 1%). Changing the outside good size in effect changes the size of the overall market. Typically, with a lower outside good there is less constraint on the firms within the market and thus there is higher harm from a merger, which we find to be the case here.

D.117 Finally, rows 5 and 6 show the results when we use contribution -A margins (See Appendix E). By changing the margins targeted in the calibration we capture the impact of a higher level of a pre-merger market power. We consider these contribution margins to be a better proxy of the longer-term value of winning a customer to an operator.

D.118 Row 5 does not target any specific margins for non-MNOs as we do not have available estimates for their contribution margins and calibration only requires margins estimates for some of the firms. Row 6 targets non-MNOs margins to match those in the econometric margins and shows the highest harm estimate reflecting that the high margins used in the calibration. [426]

D.119 Overall, the table shows that the range of harm based on these simple calibrations is GBP 343 million to GBP 1.123 billion annually in the UK. As discussed in the merger simulation results section, we consider that these are still likely to be underestimates as the model does not capture important aspects of the market such as the long run impact (expect possibly in the case of the margin sensitivity), and wholesale interactions (in the case of all sensitivities).

[425] Not shown in the table but we additionally calibrate to a CES (more curved) demand function, and this results in higher industry prices than in a linear or logit demand in the case of the baseline inputs. This is consistent with greater curvature of a CES demand system see Miravete et al (2024) *Elasticity and Curvature of Discrete Choice Demand Models.* Mimeo

[426] When not targeting non-MNO margins in row 5 the calibration estimates low margins for non-MNOs. In contrast, row 6 uses the econometric margins for non-MNOs which allows for a more realistic calibration to test the impact of pre-merger market power.

## Provisional conclusions on the CMA's econometric analysis

D.120 We have conducted an econometric analysis on subscriber demand for mobile tariffs in the UK and used the results to complete a merger simulation to estimate the impact of the Merger on prices (not accounting for efficiencies).

D.121 The main results are:

(a) Willingness to pay varies across individuals. On average, subscribers value 4G aspects of network quality (download speed and network coverage). However, the results of the model predict that subscribers do not value aspects of 5G network quality (speed and network coverage). One potential reason for the low willingness to pay for 5G is that 5G speeds may be less commonly observed by consumers than 4G speeds (eg because some consumers do not have a 5G-enabled phone or because it is still being rolled out in some areas).

(b) The diversion ratios implied by the CMA's econometric model are similar to estimates from a range of sources including the CMA's survey. These indicate that the Parties impose a competitive constraint on one another.

(c) The results from the CMA's merger simulation show that, absent efficiencies, prices would rise for both the Parties and their rivals. Specifically, prices rise by 7.0% for 3UK and 3.8% for VUK with smaller rises for rivals. The overall harm to UK consumers implied by these price rises is approximately GBP 328 million annually (2023 prices). As described in more detail in paragraph D.118, we consider that this is likely to be an underestimate of the true price effects resulting from the Merger because amongst other things, it does not account for the impact on wholesale.

(d) The CMA's merger simulation results imply that lower income subscribers' welfare is particularly adversely affected by the Merger.

D.122 Overall, we consider the econometric analysis provides a useful insight into how consumers value different aspects of tariff offerings, and the potential short-run price effects of the merger absent efficiencies. We consider these results in the round and note that results support and are consistent with other evidence such as that presented in the Chapter 8.

# APPENDIX E: Gross Upwards Pricing Pressure Index

## Introduction

E.1 One of the theories of harm that we are assessing is horizontal unilateral effects in the supply of retail mobile services in the UK. Horizontal unilateral effects may arise in a horizontal merger when one firm merges with a competitor that would otherwise provide a competitive constraint. Unilateral effects may arise in differentiated product markets because a price increase becomes less costly when the products of the two firms are brought under common ownership or control.

(a) Absent the merger, firms face a trade-off when considering whether to raise prices. On the one hand, the firm will incur a cost because some customers will switch away, and the firm will lose the profits they would have earned on those customers. On the other hand, the firm also gains, because it makes a bigger profit on the customers that remain (because of the higher price).

(b) After the merger, it would no longer be as costly for the merged entity to raise prices or reduce quality: it would recoup the profit on recaptured sales from those customers who would switch to the products of the other merger firm.[427]

E.2 In this chapter we present our survey-based estimates for the Gross Upwards Pricing Pressure Index (**GUPPI**). The GUPPI is a simple quantitative indicator which gives an approximate measure of the incentives for parties to raise their price as a result of a merger (in the absence of efficiencies). It does this by combining information on diversion ratios (to measure the closeness of competition between the merging parties) and margins (to measure the additional profit the merging parties would gain from sales diverting between them). The GUPPI does not attempt to predict the exact extent of post-merger price rises, rather it measures the extent of the upward price pressure.[428] We note that quantitative assessments of price effects have previously been undertaken in a range of previous telecoms mergers.[429]

E.3 In response to our Working Paper, the Parties submitted that the GUPPI approach is inadequate in this case as it assumes that post-Merger capacity and quality remain unchanged.[430] Further, they submitted that it is important that the scope for REEs is considered as an inherent part of our assessment of whether or not any SLC arises.[431] We consider that the GUPPI is a useful measure which can provide

[427] Mergers remedies guidance (CMA87), December 2018, paragraphs 4.6-4.7.
[428] Retail merger commentary (CMA62), April 2017, paragraph 5.12.
[429] These include Case M.7612 – *Hutchison 3G UK/Telefónica UK*, Case M. 8792 – *T-Mobile NL/Tele2 NL*, and Case M. 7018 – *Telefónica Deutschland/E-Plus*.
[430] Parties' response to the GUPPI working paper
[431] Parties' response to the GUPPI working paper

an indication of pricing pressure arising from a merger and has previously been applied in cases by the CMA and other authorities. We note that the GUPPI forms just one part of our evidence base on the impact of the Merger on competition in the supply of retail mobile services in the UK. We further note that we have undertaken a detailed assessment of efficiencies as set out in Chapter 14.

E.4 We consider each of the following areas in turn in this chapter:

(a) diversion ratios;

(b) margins; and

(c) the GUPPI.

## Diversion ratios

E.5 Diversion ratios attempt to capture what customers would do in response to an increase in prices. Where the parties have high diversion between them, this implies that were either of them to increase prices, a significant proportion of sales would be recaptured by the other party, increasing the risk that the merged entity would have the incentive to unilaterally raise prices.

E.6 As outlined in the Chapter 8, we commissioned the market research agency DJS to undertake two separate surveys: a UK general population survey and a survey of the Parties' customers (**CMA customer survey**).

E.7 As part of the CMA customer survey, we asked new subscribers to the Parties what they would have done if there was a 10% increase in the price of their chosen tariff. The options available included selecting the same tariff with the same provider, choosing a different deal with that provider, choosing a different provider, or not choosing a new phone package.

E.8 From these responses, we calculated the proportion of subscribers from each Party that would divert to the other in the event of a price rise (as reported in Chapter 8, Diversion ratios). To estimate these diversion ratios we weighted the CMA customer survey responses to be representative of the number of subscribers on each of the Parties' brands and segment (ie pre-paid and post-paid).[432]

E.9 We recognise that the importance of subscribers likely differs across segments. For example, our analysis of the Parties' customer bases shows that, in the consumer segment, whilst pre-paid customers make up about [✂]% of the Parties' subscribers, they account for only about [✂]% of revenues. Whilst there are

[432] Vodafone response to the CMA's s109 notice. [✂]. To be consistent with the survey sample frame we used figures relating to the consumer segment (ie excluding business customers) and excluded Superdrug customers.

several potential ways to adjust diversion ratios to reflect the relative importance of different segments, one relatively simple method is to weight the CMA customer survey results by the revenue-share of each brand and segment. We therefore also calculated revenue-weighted diversion ratios.

E.10 Table 1 and Table 2 show that in the event of a 10% price increase:

(a) 19% of subscribers that would leave 3UK would go to VUK on both a subscriber-weighted and revenue-weight basis; and

(b) 16% of subscribers that would leave VUK would go to 3UK on both a subscriber-weighted and revenue-weighted basis.

**Table 1: Price diversion destinations of 3UK's subscribers**

| | *Revenue weighted* | | *Subscriber weighted* | |
|---|---|---|---|---|
| Diversion destination | Percentage | Percentage (out of all those who would leave 3UK) | Percentage | Percentage (out of all those who would leave 3UK) |
| VUK | 5 | 19 | 5 | 19 |
| Other 3UK brand | <1 | | <1 | |
| BTEE | 7 | 28 | 7 | 26 |
| VMO2/GiffGaff | 6 | 21 | 6 | 22 |
| ID Mobile | 2 | 7 | 2 | 7 |
| Lebara | 2 | 8 | 3 | 10 |
| Sky Mobile | <1 | 1 | <1 | 1 |
| Tesco Mobile | 1 | 3 | 1 | 2 |
| Other | 1 | 4 | 1 | 4 |
| Not chosen a new package | 2 | 9 | 2 | 9 |
| Remain with same 3UK brand | 73 | | 74 | |

*Source: CMA analysis of CMA customer survey.*
*Base size: n = 636*

**Table 2: Price diversion destinations of VUK's subscribers**

| | *Revenue weighted* | | *Subscriber weighted* | |
|---|---|---|---|---|
| Diversion destination | Percentage | Percentage (out of all those who would leave VUK) | Percentage | Percentage (out of all those who would leave VUK) |
| 3UK | 4 | 16 | 4 | 16 |
| Other VUK brand | 2 | | 2 | |
| BTEE | 8 | 32 | 8 | 31 |
| VMO2/GiffGaff | 6 | 25 | 6 | 24 |
| ID Mobile | 3 | 11 | 2 | 10 |
| Lebara | 1 | 3 | 1 | 4 |
| Tesco Mobile | 1 | 2 | 1 | 3 |
| Sky Mobile | 1 | 3 | 1 | 3 |
| Other | 1 | 2 | 1 | 3 |
| Not chosen a new package | 1 | 6 | 1 | 6 |
| Remain with same VUK brand | 74 | | 74 | |

*Source: CMA analysis of CMA customer survey.*
*Base size: n = 575*

E.11 These diversion ratios were calculated based on the answers to two questions:

(a) The price diversion question: this asked respondents what they would have done if, at the time they chose the package, all of the provider's prices had been 10% more expensive but the prices of other providers had remained unchanged.[433]

(b) The forced diversion question: this asked respondents what they would have done if, at the time they chose the package, the provider had ceased providing mobile phone services.[434]

E.12 In calculating price diversion ratios from these questions, we made the following assumptions:

(a) Where respondents answered the price diversion question by saying they would choose a different provider, if they were able to name a different provider in their answer to the forced diversion question we assumed that they would divert to this provider in the event of a 10% price rise.

(b) Where respondents answered the price diversion question by saying they did not know how they would react to an increase in price, we assumed they would divert or stay with their provider in the same proportions as given by other respondents from the same brand and segment.

(c) Where respondents answered the price diversion question by saying that they would choose a different provider but answered 'Don't Know' to the forced diversion question, we also used the approach outlined in (b).

(d) Some respondents answered the price diversion question by indicating that they would not have chosen a new package in the event of a price increase. These responses are difficult to interpret as some respondents, those who had switched to the party's brand rather than making a first-time purchase, may have meant that they would have stayed with their previous mobile operator. We cannot identify these customers or identify their previous operator. We therefore adopted the following approach:

(i) Those that also responded that they would not have bought a package in response to the forced diversion question have been included in the denominator of the diversion ratio (as a non-purchaser).

(ii) Those that gave any other response to the forced diversion question, including those that responded that they would have diverted to one of the merger party's brands, have been removed from the diversion

[433] The answer categories were 'Choose the same package', 'Choose a different package with the same provider', 'Choose a different provider', 'Not choose a package', 'None of these', and 'Don't know'.
[434] The answer categories were a list of 18 brands, plus 'Other (please specify)', 'None (I wouldn't have bought a package)', and 'Don't know'.

calculation on the basis that we do not have sufficient information to interpret their responses.

(e) A small number of respondents answered the price diversion question by saying they would divert in the event of a price rise but gave the answer 'None' to the forced diversion question. We are unable to say which provider they would divert to in the event of a price rise. We therefore treated them as people who would divert but not to any of the named alternatives.[435]

E.13 In response to our Working Paper, the Parties submitted that the CMA customer survey is likely unrepresentative and skewed towards customers that are more price sensitive as a result of over-indexing pre-paid customers.[436] As explained above, in analysing the CMA customer survey we weighted the data to be representative of the Parties' customers both by subscribers and revenue. We therefore do not consider that the survey is unrepresentative or skewed.

## Margins

E.14 In this section we firstly outline the role of the margin in the calculation of the GUPPI. We then present the margins which we have used as a proxy for the economic profits earned on each recaptured sale.

E.15 For a given diversion ratio, a higher margin increases the value of sales 'recaptured'. The higher the economic profit earned on recaptured sales, the greater the incentive of a merged entity to increase the price of its existing products above the pre-merger level (knowing that the merger makes it less costly to do so). Therefore, the higher the margin earned on recaptured sales, the greater the upwards pricing pressure that arises from the merger.

E.16 The margin figures used in the value of recaptured sales should reflect the economic profit earned on each unit sold, but in practice – and depending on the industry – this may be difficult to assess.[437] In past cases, the economic margin has been proxied by a variable margin calculated from the merging firms' internal accounting records, and on the basis of data provided by parties at the CMA's request.[438]

E.17 The CMA's 'Retail mergers commentary' states that variable margins are made up of the sales of the relevant products which both parties supply less their variable

[435] These represented <1% of respondents for each of 3UK and VUK.
[436] Parties' response to the GUPPI working paper
[437] Economic profit is defined as revenue less the opportunity costs of inputs used. One practical challenge encountered when measuring economic profit is that accounting costs and opportunity costs do not necessarily coincide (ie. when the 'market price' of the input differs from its recorded cost in the firm's accounts).
[438] For an example, see J Sainsbury PLC / Asda Group Ltd merger inquiry, Appendix F: Margin Calculations.

costs.[439] The CMA has considered that cost variability depends on the period over which the parties could change their retail offer, and decisions on how to derive variable margins have therefore been made on a case-by-case basis and have required an element of judgement.[440]

E.18 We note that margins are an area where we have a clear information asymmetry with parties with respect to the definition and use of variable margins in the ordinary course of operating their businesses. Accordingly, we are reliant on the information provided by parties in calculating these margins.

E.19 As part of submissions relating to their merger simulations, the Parties have estimated margins using three definitions. We have therefore considered these three definitions as potential inputs into our price pressure calculations, namely:

(a) Contribution margins;

(b) Congestion-adjusted contribution margins (**CACM**); and

(c) Acquisitions margins.

E.20 Below we describe what each of these margins measure and discuss both the CMA's and Parties' estimates for them.

**Contribution margins**

E.21 Contribution margins capture revenues less all variable costs related to sales volumes and provide the 'contribution' to fixed costs.

E.22 We requested quarterly contribution margin data for the period 1 January 2022 to 31 March 2024 from all MNOs active in the UK. This included requesting contribution data for each operator's overall UK mobile-only business, by segment (ie consumer retail, business retail, and wholesale), and by brand.

E.23 As part of submissions relating to their merger simulations, the Parties also provided estimates of contribution margins for pre-paid and post-paid retail consumers, and for their 'Total Consumer' businesses for the year ended 31 March 2023 (ie Vodafone's reporting year-end, **V_FY23**).[441]

E.24 We have used both sources of data to compute contribution margins.

[439] Costs can be classified as 'variable', 'semi-fixed' or 'fixed' depending on the extent to which they vary with sales volumes or revenues in the short run (ie completely, partially or not at all). In addition to challenges approximating opportunity cost, it can be difficult to assess variable costs on a true 'per unit' basis, even if such costs are ordinarily assessed as variable in the short run by market participants.
[440] CMA62, Technical Box 1: Calculating variable profit margins, page 33.
[441] Parties submission, Capacity-focused merger simulation model.

### The Parties' contribution margin estimates ('subscriber margins')

E.25 The Parties' estimates of contribution margins were based on work conducted as part of the development of the joint business plan (**JBP**), updated for 'actual' performance, with 3UK's reporting year-end and certain of its accounting treatments being adjusted for alignment with VUK.[442]

E.26 The following revenues and costs, earned and incurred over V_FY23 for each Party, were included in the Parties' contribution margin estimates:[443]

(a) 'Mobile direct revenue' broadly included all [✂];

(b) [✂];[444]

(c) [✂]; and

(d) [✂].

### CMA's contribution margin estimates based on accounting data requested from the Parties

E.27 As noted at E.22, we requested quarterly contribution margin data for the period 1 January 2022 to 31 March 2024 from all MNOs active in the UK.

E.28 As part of this, we requested the following categories of revenues and variable costs for each operator's overall UK mobile telecommunications business, by segment and by brand:[445]

(a) Service Revenue;

(b) Non-service revenue (including handset and equipment revenue);

(c) Interconnection costs;

(d) Outbound roaming costs;

(e) Bad debt expense;

(f) Commissions paid relating to customer acquisition and retention;[446] and

[442] Parties response to the CMA's RFI.
[443] Parties response to the CMA's RFI; Parties submission, Capacity-focused merger simulation model.
[444] [✂], see Parties response to the CMA's RFI.
[445] Vodafone response to the CMA's s109 notice; CK Hutchison response to the CMA's s109; Parties response to the CMA's RFI.
[446] [✂].

(g) Handset and equipment costs.[447]

E.29 We also asked all MNOs to identify any further variable cost categories to be considered as part of our analysis.

E.30 Each Party identified several further cost categories.[448] We considered the additional cost categories carefully, having regard to:

(a) whether each cost item was ordinarily considered as a variable cost within internal management reporting (ie in each Party's assessment of its own performance);

(b) the detail and sufficiency of the Parties' explanations as to why and how each cost category should be considered variable; and

(c) where possible, and mindful of our limitations with respect to information asymmetry and a lack of access to granular cost data, seeking to align accounting treatments between the Parties.

E.31 We also tested the Parties' requests for additional cost categories by considering responses provided by other MNOs. BTEE identified no further variable cost categories to be considered (in addition to those listed at E.28), noting that many further cost categories may include a mixture of fixed and variable elements. VMO2 included some further cost categories identified as part of its internal measurement of 'cost of sales'.[449]

E.32 We present contribution margin estimates below for each Party's 'overall' consumer retail performance for the calendar year 2023 (**CY23**), setting out:

(a) Contribution margins including only the revenue and cost categories identified at E.28 (**Contribution A**); and

(b) Contribution margins incorporating only the additional cost categories submitted by the Parties assessed to be variable with subscriber volumes, based on the principles discussed at E.30 (**Contribution B**).[450]

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[447] Our initial request asked for 'handset subsidies' which resulted in difficulties in interpretation given differences in accounting treatment between MNOs. All MNOs subsequently provided a measure of 'handset (or equipment) revenue' and 'handset (or equipment) cost' as part of their response. [✂].

[448] CK Hutchison identified several cost categories ordinarily incorporated in its definition of 'direct costs' and of 'customer acquisition and retention costs' (**CARCs**), see Parties response to the CMA's RFI and CK Hutchison response to the CMA's s109 notice. For its consumer retail performance, the most material of these included [✂]. Conservatively, given the information asymmetry described between us and CK Hutchison [✂], we accepted [✂] additional costs submitted for the purposes of our calculation of Contribution B, with the exception of [✂].
Vodafone identified several cost categories ordinarily incorporated within its internal definition of 'contribution', see Vodafone response to the CMA's s109 notice and Parties response to the CMA's RFI. For its consumer retail performance, the most material of these costs included: [✂].

[449] BTEE response to the CMA's s109 notice; VMO2 response to the CMA's s109 notice; BTEE email.

[450] With respect to the cost categories excluded from Contribution B: considering VUK, [✂]. For 3UK, [✂], to aid consistency [✂].

E.33 In response to our Working Paper, the Parties told us that they consider that Contribution A should be excluded from the GUPPI analysis, given that we have allowed for - based on the principles outlined at A.30 - the inclusion of certain additional cost categories in Contribution B that are considered to be variable with subscriber volumes.[451] We consider Contribution A to be useful for our analysis because it has required each MNO in the UK to submit the same categories of revenues and costs, which aids comparability across different operators and minimises inconsistencies in definitions and accounting treatments. Further, one MNO (BTEE) told us that it does not meaningfully consider any further costs to be 'totally' variable in nature, and that other cost categories are likely to have fixed and variable elements.[452] As a result of these considerations, we find Contribution A to be a useful upper bound to the contribution margin.

### Congestion-Adjusted Contribution Margins (CACM)

E.34 As part of their 'pro-competitive effects paper' (**PCEP1**) and merger simulations submissions, the Parties provided contribution margins adjusted for congestion.[453] The respective congestion adjustments were [✂] percentage points (**pp**) for 3UK and [✂] pp for VUK.

E.35 The congestion adjustment for each of VUK and 3UK is calculated on a standalone basis. [✂].[454]

E.36 As discussed at Chapter 14, we consider that a reduction in the 'incremental' cost of expanding capacity experienced by the Merged Entity may incentivise it to increase capacity. However, having reviewed the Parties' typical approach to retail pricing decisions, we have not found sufficient evidence to provisionally conclude that capacity considerations are ordinarily considered in retail pricing decisions. For completeness, we also had some reservations about the methodology used to produce this adjustment, which uses estimates of capex and opex (costs which are usually considered to be 'fixed' in nature over the short run) projected over a significant time period, in order to theoretically measure observed margins 'today'.

E.37 We have therefore excluded margins with the CACM adjustment from our analysis.

### Acquisition margins

E.38 The acquisition margin incorporates only the revenues and costs associated with new ('gross adds') customers acquired over the course of V_FY23. The acquisition

[451] Parties' response to the GUPPI working paper.
[452] BTEE, email.
[453] Parties submission, Quality-focused merger simulation model; Parties submission, Quality-focused merger simulation model.
[454] Parties submission, The pro-competitive effects of the Vodafone/Three merger.

margins submitted by the Parties were lower than other margin estimates, reflecting that (i) prices to attract new customers are usually significantly discounted compared to 'back book' or 'total subscriber base' prices and (ii) onboarding customers gives rise to acquisition costs, such as sales commissions (part of acquisition and retention, **A&R**, costs), in the short run.[455]

E.39 The Parties' methodology for calculating the acquisition margin for each Party is largely as follows. Each month, the profitability of new 'gross add' 'post-paid' customers is assessed:

(a) Based on a combination of (i) observable contracted revenues and (ii) estimates using past performance of other customer cohorts, the **revenues** expected to be generated from these customers over the duration of their contract (assessed to be [✂] on average for VUK and [✂] on average for 3UK); and

(b) based on a combination of (i) observable paid costs at the time of customer acquisition (for example, commissions paid to salespeople, handset costs, logistics) and (ii) projected costs based on past performance of other customer cohorts, the variable **costs** expected to be generated from these customers over the duration of their contract (as above, assessed to be [✂] on average for VUK and [✂] on average for 3UK).[456]

E.40 [✂].[457] [✂].

E.41 The Parties' estimates of acquisition margin are shown as **Acquisition**.

### Input margin estimates

E.42 At Table E.1, we set out the results of the margin estimation undertaken for each of the categories of potential margin inputs discussed above.

[455] Parties submission, Capacity-focused merger simulation model.
[456] Parties response to the CMA's RFI.
[457] [✂]. See Parties response to the CMA's RFI.

**Table E.1: Margin estimates for each Party's consumer retail performance**

| *Margin Type* | *Period* | *Unit* | *3UK* | *VUK* |
|---|---|---|---|---|
| Contribution - Parties' submission | V_FY23 | % | [✂] | [✂] |
| Contribution A | CY23 | % | [✂] | [✂] |
| Contribution B | CY23 | % | [✂] | [✂] |
| Acquisition | V_FY23 | % | [✂] | [✂] |

*Source: CMA analysis of the Parties responses to information requests (Vodafone response to the CMA's s109 notice; CK Hutchison response to the CMA's s109 notice; Parties response to the CMA's RFI, and of the Parties' margin estimates as set out at (i) Parties submission, Quality-focused merger simulation model, and (ii) Capacity-focused merger simulation model.*

E.43 We have considered the relevance of these margins to our assessment.

E.44 We firstly note that we consider that acquisition margins provide a useful indication of the value of customers during their initial contracts, and the margins that the Parties currently make on 'contestable' customers. We consider that acquisition margins are lower than contribution margins for several reasons, including:

(a) [✂];[458] and

(b) [✂].[459]

E.45 However, we consider that not all customers will switch after their initial contracts, and the margins on subsequent contracts are likely to be higher. In particular, we note that the [✂].[460] [✂].[461]

E.46 We therefore consider that to the extent that operators expect a proportion of their customers to remain with them beyond their initial contract term, we would expect acquisition margins to understate the longer-run value of winning a customer. We consider that contribution margins are an appropriate proxy for the upper-bound of this longer-run value. In this regard we note that:

(a) Key performance indicator (**KPI**) tracking of both Parties suggests that [✂]. 3UK [✂], and VUK [✂].[462]

(b) the standard profitability metrics that both Parties ordinarily track and measure in [✂],[463] [✂].

[458] Parties response to the CMA's RFI.
[459] Vodafone internal documents show[✂]
[460] Parties response to CMA email.
[461]See Vodafone internal documents.
[462] [✂]). [✂], for example, see Vodafone internal documents. [✂] see – for example – CK Hutchison internal documents.
[463] For example, VUK [✂]. 3UK [✂].

E.47 Therefore, our provisional view is that both acquisition and contribution margins are useful to our assessment, and respectively represent an upper and lower bound to the economic margin.

## GUPPI

E.48 In this section we calculate a range for the GUPPI for VUK and 3UK using the diversion ratios and range of margins described above.

E.49 GUPPI measures the fraction of revenues lost due to a price increase by one of the merging parties that are recaptured as profits by the other merging party.[464] The higher the fraction of lost revenues recovered by the other merging party, the stronger the competitive constraint on pricing power that is being relaxed by a merger.

E.50 Recaptured profits are higher when:

(a) the volume of sales recaptured by the other merging party is larger (ie a higher diversion ratio); and/or

(b) the profit earned on each consumer switching to the other merging party is higher (ie a larger mark-up of its price over marginal costs).

E.51 Diversion ratios and margins are the key inputs in the calculation of GUPPI. Formally, GUPPI is calculated as product of the diversion ratio between the merging firms ($DR_{jk}$), an estimate of the pre-merger economic profits earned as a percentage of the revenues of the firm who is recapturing sales ($M_k$), and the ratio of pre-merger prices ($p_k/p_j$).

$$GUPPI_j = \frac{Recaptured\ profits\ on\ sales\ of\ product\ k}{Lost\ revenues\ for\ product\ j\ when\ p_j \uparrow} = DR_{jk} M_k \frac{p_k}{p_j}$$

E.52 Even though GUPPI is expressed as percentage of the pre-merger price, it is not a direct prediction of the price effect of a merger. Rather it measures the increment in the percentage margin due to the partial internalisation of the removal of the competitive constraint between the merging parties.[465]

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[464] The other merging party's price and all rivals' prices are held fixed at pre-merger values. Similarly, diversion ratios are evaluated at pre-merger price and quantities.

[465] Whether or not GUPPI provides a conservative proxy to price increases from a merger depends on two factors. The first is the rate at which changes in marginal costs are passed through to equilibrium prices. Through this channel, depending on the curvature of demand, GUPPI can over-predict price rises from a merger. On the other hand, GUPPI is only a partial response to the internalisation of a competitive constraint insofar as only the price of one merging party can change while all others are held fixed. For a more detailed discussion of how these two factors affect the interpretation of GUPPI as a proxy for the price effects of a merger, see Valletti, T., & Zenger, H. (2021). Mergers with differentiated products: Where do we stand?. *Review of Industrial Organization*, *58*, 179-212.

E.53 We used the CMA customer survey diversion ratios and the range of accounting proxies for the economic margin from the previous sections to compute lower and upper bounds of GUPPI. Table 4 reports the GUPPI evaluated using the diversion ratios from the CMA survey discussed at 1.19 (19% from 3UK to VUK and 16% from VUK to 3UK) and each of the margins discussed above. Using the same data as was provided for our margin estimates, the average monthly revenue per retail subscriber for VUK in 2023 is GBP [✂] and the corresponding figure for 3UK is GBP [✂].[466]

E.54 The lower and upper bounds for the GUPPI with respect to a change of 3UK's price are [5-10]% and[10-20]% percent, respectively. The same bounds on GUPPI with respect to a change of VUK's price are [5-10]% and [5-10]%.

**Table 3: GUPPI for 3UK and VUK for overall consumer retail in 2023**

| *Margin Type* | *Period* | *Unit* | $GUPPI_{3UK}$ | $GUPPI_{VUK}$ |
|---|---|---|---|---|
| Contribution - Parties' submission | V_FY23 | % | [✂] | [✂] |
| Contribution A | CY23 | % | [✂] | [✂] |
| Contribution B | CY23 | % | [✂] | [✂] |
| Acquisition | V_FY23 | % | [✂] | [✂] |
| Range | | | [5-10], [10-20] | [5-10], [5-10] |

*Source: CMA analysis.*

E.55 The GUPPI figures in Table 4 are likely to underestimate the pricing pressure created by the Merger for two reasons:

(a) They do not take into account MVNO sales which will be recaptured post-Merger. Pre-Merger, if one Party raised prices some sales would be diverted to MVNOs hosted by the other – eg if VUK raised prices some sales would be lost to iD Mobile (an MVNO hosted by 3UK). Post-Merger, these sales would be – to an extent – recaptured;

(b) They do not capture how constraints may change post-Merger. For example:

(i) we have provisionally concluded that the Merger is likely to substantially reduce wholesale competition (as discussed in Chapter 9), which means that the competitiveness of MVNOs is likely to be reduced; and/or

(ii) rival MNOs may have incentives to respond to price increases by the Merged Entity by increasing their own prices. As set out in the Retail Chapter, this in turn could have some positive feedback on the Merged

[466] Average revenue per subscriber is calculated dividing overall consumer retail revenue for 2023 by the number of subscribers in the final quarter of 2023. See Parties response to the CMA's RFI and CK Hutchison response to the CMA's s109 notice.

Entity's own prices and therefore magnify the effect of the Merger on prices.

E.56 In response to our Working Paper, the Parties submitted that they disagree that the GUPPI estimates may underestimate the potential price effects arising from the Merger. In particular:

(a) our view that the 'feedback effects' between Merged Entity and their rivals' prices not accounted for in a GUPPI calculation necessarily lead to even higher prices is not supported by market-specific analysis or evidence. Further, they state that feedback effects from rival MNOs have been modelled in the merger simulations submitted by the Parties, and the results indicate that not all prices move in the same direction;[467]

(b) there will be no reduction in the intensity of competition in the wholesale market as 3UK is currently not an effective wholesale supplier and has not won a single significant wholesale customer in any competitive tender since 2018. They further stated that competition in the wholesale market would be improved as a result of the Merger as the Merged Entity would have significantly more capacity than the Parties on a standalone basis and VMO2 would become a more effective competitor due to Beacon 4.1;[468] and

(c) the Parties disagree that the impact of taking account of switching to MVNOs hosted by the other is material. They submitted analysis which they state shows that including switching to iD Mobile and Lebara increases the GUPPI by [✂] percentage points for 3UK and by [✂] percentage points for VUK.[469] They further state that they consider these effects are 'insignificant compared with the effect of incorporating efficiencies'.

E.57 In relation to E.56(a) we do not consider that, in the absence of efficiencies, rivals would likely have incentives to respond to a price increase by the Merged Entity by decreasing their prices. We note that, as outlined in Chapter 8, Post-Merger competitive incentives of MNOs, our provisional view based on our analysis of the MNOs' strategies, our review of internal documents relating to previous price interactions and the views of third parties is that, if the Merged Entity raised its prices, its rivals may follow. As outlined in Appendix F, we consider that the Parties' quality-focused merger simulation contains multiple methodological flaws and irregularities which means we are unable to place any weight on its results.

E.58 In relation to E.56(b), as set out in Chapter 9, our provisional view is that before consideration of any potential efficiencies, there is scope for an SLC in the wholesale market. In relation to E.56(c), we do not agree that the estimates

[467] Parties' response to the GUPPI working paper.
[468] Parties' response to the GUPPI working paper.
[469] Parties' response to the GUPPI working paper.

provided by the Parties of the increase in GUPPI due to recaptured MVNO sales are immaterial. We therefore consider that both of these reasons mean that, absent efficiencies, our GUPPI estimates are likely to underestimate the pricing pressure.

E.59 In response to our Working Paper, the Parties also submitted that our analysis has not reflected important commercial factors which, in practice, would further limit the likelihood and magnitude of any incentive to raise prices, even without taking into account the efficiencies. In particular:

(a) rivals will seek to respond to a price increase by becoming more competitive it is likely that the Merged Entity's rivals would respond to a price increase by re-positioning their offerings to attract more subscribers. The Parties cited a number of examples of operators launching new products or sub-brands as evidence of this.[470] They further submitted that further increased prices may create opportunities for new players to enter the UK retail mobile market, especially those that may already have a desire to do so.[471]

(b) the profit uplift to the Parties from implementing such a price increase would be very low (around 0.5% to 1% of the Parties' total gross profits) which means that such a strategy would not be commercially attractive in reality.[472] They further submit that implementing a price increase is also likely to entail longer-term reputational risks.

E.60 In relation to E.59(a), we note that the examples the Parties provided of operators launching new products or sub-brands were in the context of a purported increase in competitive pressure, rather than a decrease. Further, as set out in Chapter 13, we provisionally consider that entry and expansion is unlikely to mitigate a reduction in competition. Finally, as outlined in Appendix F, due to methodological concerns we place no weight on Parties' quality focused merger simulation model and, by extension, its claim that rivals will necessarily cut price in response to a price increase by the Merged Entity. Overall, we therefore do not consider that rivals will seek to respond to a price increase by becoming more competitive.

E.61 In relation to E.59(b), as a starting point we consider that the Parties' analysis suggests that the Merged Entity would increase its profit by raising prices, and we would therefore expect it to act in line with these incentives. Notwithstanding this:

(a) We have not seen evidence that commercial factors cited by the Parties have prevented them from making price rises in practice. We note that the Parties have submitted that 3UK has been increasing its price in recent years and that all MNOs have introduced inflation-linked price rises. We therefore do

[470] Parties' response to the GUPPI working paper.
[471] Parties' response to the GUPPI working paper.
[472] Parties' response to the GUPPI working paper.

not consider that reputational considerations have, in practice, prevented price rises in this market. As set out in Chapter 8, we have also observed the Parties closely and regularly monitoring and responding to their competitors' price changes which suggests that they are actively seeking opportunities to commercially benefit from incremental price changes.

(b) We also consider that the commercial benefits to raising prices are likely to be greater than suggested by the Parties' analysis in practice - for example as the analysis did not account for the factors listed in E.55. We also note that a key technical assumption underpinning the Parties' analysis is that demand is linear, and to the extent to which this was not the case in practice, the commercial benefit from price rises is likely to be higher.

E.62 The Parties further submitted an extension to the standard GUPPI approach which they state takes account of quality-adjusted prices and marginal cost reductions in line with Willig's extended model. They state that these results show that there would be no upward pricing pressure, but substantial pro-competitive effects.[473] We consider that these results are directly related to the size of the expected cost and quality improvements. We set out our provisional views on these in Chapter 14.

[473] Parties' response to the GUPPI working paper.

# APPENDIX F: The Parties' Merger Simulations

## Introduction

F.1 The Parties submitted two merger simulation models which they state show that the REEs are more than sufficient to eliminate any prospect of an SLC and confirm that the Merger is strongly pro-competitive. The two merger simulation models are:

(a) The 'Quality-Focused Model' prepared by Compass Lexecon (3UK's advisers);[474] and,

(b) The 'Capacity-Focused Model' prepared by Frontier Economics (VUK's advisers).[475]

F.2 The Parties submit that in combination the models show that:

(a) the Merger is strongly pro-competitive, increasing value for money by 15% market wide, once REEs are fully taken into account;

(b) the impact of the Merged Entity's higher capacity is sufficient by itself to outweigh the upward pricing pressure effect of the Merger and even produces a small price reduction of -0.3% to -0.4%, eliminating any prospect of an SLC arising from the Merger; and

(c) even if the Merger is assumed to generate no efficiencies, which is not a valid assumption, the standard modelling effect on prices is very low (on average less than 2% market wide).[476]

F.3 We note that the Parties provided these detailed and technical models to us part way through phase 2 – on June 4 2024 - with less than a month before the Main Party Hearings. We have assessed the Parties' models within the time constraints, including through detailed meetings with the Parties and a follow-up RFI. In this appendix we set out our provisional assessment of both models.

## Quality-Focused Model

### Parties' submissions

F.4 The Parties submitted that the quality-focused model takes the following approach:

(a) it uses the results of a discrete choice customer survey of 5,561 respondents in which respondents were given a range of tariff choices involving different

[474] Parties' submission, Quality-focused model.
[475] Parties' submission, Capacity-focused model.
[476] Parties' submission, Overview of modelling approaches and results.

prices and aspects of network quality and were asked to select their preferred option. Each respondent was invited to repeat this exercise but with different choices five times;

(b) an econometric model was then used to derive the value that customers attached to different aspects of network quality from their survey responses;

(c) that data was then used to calibrate a model to closely match pre-Merger market shares, prices and customers' current choice of tariffs; and

(d) that model was then used to predict how customers' tariff choices and firms' prices would respond to the Merger, including with respect to the Parties' stated cost and quality efficiencies.[477]

**Our assessment**

F.5 Next, we provide our provisional assessment of each component of the quality-focussed model described above.

**The Parties' customer choice survey**

F.6 We have assessed the robustness of the Parties' survey by considering how far it meets the requirements set out in the CMA's survey good practice guide.[478]

F.7 The Parties commissioned GfK to conduct their customer survey using Cint, a software platform that provides access to multiple online panels for hosting the survey and sourcing sample. The constituent panels do not employ a random recruitment methodology. The CMA's survey good practice guide states that, 'The CMA tends to place less evidential weight on surveys involving customer recruitment from panels, though each case is treated on its individual merits. If panel sources are used, transparency and rigour of panel recruitment and data weighting methods will be factors in the CMA's evaluation of the survey results'.[479]

F.8 The Parties have not provided information on which recruitment methodologies have been used for the panels and we are therefore unable to assess their fitness for purpose, particularly regarding:

(a) their representativeness of the customer population; and

(b) the extent to which bias may have been introduced (for example, if panellists were recruited through telecoms channels).

[477] Parties' submission, Overview of modelling approaches and results.
[478] Good practice in the design and presentation of customer survey evidence in merger cases (CMA78), May 2018.
[479] CMA78, paragraphs 2.29-2.30.

F.9 We further consider that the cognitive demands on respondents from the choice experiments are high and may limit the extent to which their stated preferences reflect their true preferences. Respondents were presented with five choice experiments. In each experiment, respondents were asked to select between three hypothetical tariffs described by eight attributes. Respondents were able to click on information buttons to access further detailed explanation for each tariff attribute. For example, the explanation for speed contained a detailed table setting out what consumers would be able to expect at three different speed levels when they wanted to perform seven types of activities on their phones. We consider that the number of attributes provided to respondents, and the extent of information on these, exceeds what consumers would be presented with in real-life settings, for example, on price comparison websites.

F.10 We further consider that some of the tariff attributes would likely have been difficult for respondents to understand. For example, we are concerned that participants may not have understood the 'High Speed 5G' attribute where the definition related to 'the percentage of residential areas where an incredible fast and reliable new type of 5G connection can be accessed', or the 'Reliable fast paced gaming' attribute where the definition concerned 'the capability to play advanced mobile games where speed is everything (eg Valorant, Fortnite) at least 90% of the time in the UK. Without this attribute, consumers can still play fast-paced games at least 50% of the time in the UK, but less than 90% of the time'.

F.11 We understand that the survey questionnaire was not cognitively tested with customers in line with good practice.[480] This is particularly problematic with this survey given the cognitive demands it places on respondents and the scope for respondents not understanding tariff attributes.

F.12 We also consider that there is a risk that there was overemphasis given to network quality in the choice experiment design. Four of the eight attributes describing the hypothetical tariffs related to different aspects of network quality giving them far more prominence than a customer would normally see on, for example, a price comparison site. Moreover, we consider that the information provided when clicking on the information buttons was generally more comprehensive for the network quality attributes than the other attributes (for example, data allowances).

F.13 Finally, when respondents are asked to complete five cognitively demanding choice experiments, there is danger that the quality of their responses to each choice experiment may be linked to the order in which they attempted them. On the one hand, it is possible that respondents' understanding of unfamiliar attributes may improve as they repeated choice experiments. If so, their answers to the final choice experiment may be better informed than the answers to the earlier ones (ie a 'learning effect'). On the other hand, given the cognitive challenges associated

[480] CMA78.

with the experiment, it is possible that respondents may have been less attentive in their responses to later experiments than earlier ones (ie 'fatigue' effects).

F.14 Consistent with these possibilities, we see relatively large changes in the willingness to pay coefficients for the 'no signal', 'minimum speed', 'minimum speed above 10 Mbps', 'reliable fast-paced gaming', and 'access to high-speed 5G' attributes depending on whether the full sample of the choice set, the first choice, last choice or a random choice is used. For example, the coefficient on the 'no signal' attribute varies considerably when estimated on responses from participants' first choice experiment (-0.82) relative to the baseline that includes all respondents' choice experiments (-0.35).[481]

F.15 Our provisional assessment is therefore that we have a number of concerns with the Parties' customer choice survey and do not consider that it meets a number of requirements set out in the CMA's Survey Good Practice.[482] We note that the Parties engaged with us in advance of conducting their survey (as is recommended in the good practice guide).[483] As part of this we provided them with our views on, and concerns around, their proposed approach. These included concerns about their proposed survey vehicle and the risk that participants may not understand some of the attributes. We also reminded them that it is good practice to undertake cognitive testing. We do not consider that these considerations were sufficiently addressed by the Parties.

**Demand Model Estimation and Calibration**

F.16 The Parties used the responses from the Parties' customer choice survey to estimate consumer demand for SIM-only contracts. However, our provisional view is that the combination of the survey design and demand estimation methodology is not able to capture current consumer preferences well. When applied to the current choice set, both the predicted margins and market shares implied by the estimated stated preference demand model differ substantially from observed counterparts. As we discuss in more detail below, the overall fit is poor.

F.17 For example, the predicted share for all O2 tariffs in the stated preference demand model is only 5.4%, much less than its observed share of 23%. Conversely, the predicted shares of MVNOs in the stated preference demand model are substantially overstated by the stated preference model (these are predicted to be 31% compared to a 9% observed share).[484]

F.18 Further, the diversion ratios derived from the demand model estimated using the survey data (pre-calibration) differ substantially from corresponding estimates from

[481] Parties' response to the CMA's request for information (**RFI**).
[482] CMA78.
[483] CMA78. paragraph 1.23.
[484] Parties' response to the CMA's RFI.

the CMA survey, the CMA econometric model, and the GfK survey (used in the capacity-focused model). In particular, the price diversion ratio from VUK to 3UK is [✂]%, [✂] the diversion ratio from 3UK to VUK of [✂]%.[485] All other diversion ratio estimates between the Parties imply that VUK is a [✂] substitute to 3UK than vice-versa.

F.19 Finally, when combined with the Parties' chosen supply model, the demand model's price elasticity estimates predict margins that are close to, or over 100%.[486] These are [✂] as the margins the Parties choose to calibrate their demand model to.[487] This suggests that survey respondents are, in the Parties own view, insufficiently price sensitive.

F.20 To help mitigate this concern, the Parties augment their demand model to allow for unobserved tariff characteristics to affect consumers' decisions and rescale the non-random component of subscriber's utility from using the tariff.[488] In principle, these changes enable the Parties to calibrate their demand model to closely match observed operator margins and market shares.

F.21 However, we have serious reservations about the procedure used to calibrate the demand model and the effect it may have on the demand model's properties.

F.22 First, this ad-hoc 'estimate-then-calibrate' algorithm used by the Parties is novel and its properties are unknown. Even though it contains algorithmic elements of the workhorse Berry-Levinsohn-Pakes (**BLP**) estimator of the same mixed logit model of consumer demand with unobserved products characteristics, it is not clear how, if it at all, its output is related to it.[489] The Parties have not been able to show an equivalence nor establish to what, in theory, their algorithm converges.[490]

F.23 A key practical feature of the BLP estimator is that it can be implemented using an iterative procedure that alternates between estimating model parameters and then calibrating the mean utility parameters to equate observed and predicted shares given the updated parameter estimates. The 'estimate-then-calibrate' procedure continues until the chosen loss function is numerically optimised. Crucially, this

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[485] Specifically, the operator-level price diversion ratio from 3UK to VUK in the stated preference model is only [✂]%. However, from VUK to 3UK it is [✂]%. Parties' response to CMA's RFI.
[486] Parties' response to the CMA's RFI.
[487] The Parties target a margin of [✂]% for 3UK and [✂]% for VUK. Parties' submission, Quality-focused merger simulation model.
[488] These unobserved tariff-specific characteristics are observed by all consumers, but not the econometrician. The Parties refer to these as a source of 'unobserved heterogeneity'. However, they are common to all consumers and their valuation is normalised to 1 for all consumers. By construction, because there are no tariff unobservables in the Parties' customer choice survey, these parameters are appropriately constrained to zero in the stated preference model.
[489] The BLP estimator, developed by Berry *et al* (1995) is used to estimate mixed logit demand model with unobserved product characteristics only using market-level data on volumes and prices. See Berry, S., Levinsohn, J., & Pakes, A. (1995). Automobile Prices in Market Equilibrium. In Econometrica (Vol. 63, Issue 4, p. 841).
[490] The BLP model can be estimated using a nested fixed-point algorithm. This alternates between fitting parameters affecting only the idiosyncratic part of utility and the mean utilities that are adjusted to equate observed product-level shares and predicted product-level shares. The procedure continues until the chosen loss function is numerically optimised. In contrast, in the Parties' algorithm the model is only estimated once. Then, ex-post, their algorithm only iterates between rescaling estimated parameters to match margins and the step fitting tariff level unobservables.

procedure is known to converge to the optimal set of parameters that maximise the model's objective function subject to the constraint that the predicted and observed market shares match.

F.24 In contrast, in the Parties' algorithm the model is only estimated once. Post-estimation, their algorithm iterates between a step rescaling estimated parameters to match margins and a fitting step attempting to approximate tariff level unobservables. Unlike the BLP estimator of the same model, it is unclear how, if at all, the demand model parameters that result from this numerical procedure relate to the optimal set of parameters that maximise the model's (penalised) objective function subject to the constraint that the aggregate predicted and (targeted) observed aggregate market shares match.[491]

F.25 Without any formal results establishing the link between the outcome of the Parties' ad-hoc algorithm and the solution to the constrained optimisation problem it purports to solve, we are unable to place any evidentiary weight on the calibrated demand model that results from it.

F.26 Second, because only eight operator-level observed aggregate market shares are used to calibrate 150 unobserved tariff characteristics, the system of inverse demand equations used to compute product unobservables is under-identified for a given scale-parameter.[492] To address this, the Parties use penalised least squares regression.

F.27 This minimises the sum of squared deviations between the aggregate observed market shares and the sum of the predicted tariff shares produced by the stated preference model needed to match to them. Therefore, given the chosen value of the scale parameter, any 'correction' to any 'poor' share predictions from the stated preference model is purely statistical and is not driven by observed differences within operator tariff shares.[493] As a result, any omitted variable bias affecting the distribution of within operator tariff shares in the stated preference model is unlikely to be addressed and will be inherited by the calibrated demand model.[494]

F.28 Moreover, because the scaling parameters are only applied to the non-random part of a subscriber's utility from using the tariff, the calibrated demand model may

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[491] The penalised objective function referred to here notionally would include the ad-hoc least squares procedure the Parties use to resolve the under-identification of the tariff specific unobservables. As discussed in paragraph F.26, we have strong reservations over the use the penalised least squares used by the Parties for this purpose. Here, we only refer to it as part of constrained optimisation problem that the Parties' algorithm is purporting to solve.
[492] The system of inverse demand equations is under-identified because it contains more unknown unobserved tariff characteristics than it does equations. There are an infinite number of combinations of values for the unobserved tariff characteristics that are consistent with the demand model.
[493] Only by chance would any adjustments coincide with observed within-operator tariff shares.
[494] For example, the within operator predicted tariff shares by data allowance grouping are nearly identical in the stated preference model and both calibrated models for VUK and 3UK. However, neither are a close match the observed tariff share splits (Chapter 8, Market shares by data allowances discusses differences in market shares by data allowance across operators in more depth).

fundamentally change the core properties of the demand model estimated from the stated preference data.[495] Specifically, there is no guarantee that the (partially) rescaled calibration of the stated preference demand respect the same order of choices for any given individual. In this case, it is unclear what connection remains in the calibrated demand model to the preferences elicited using the stated choice experiment. The result is an ad-hoc mixed logit classifier disconnected from economic theory and the preference data used to create it.

F.29 Furthermore, the diversion ratios between the Parties in the calibrated demand models appear implausibly low. For the acquisition margin calibration, the diversion ratios between the Parties are [✂]%.[496] These are [✂] of the magnitude of the range of 15% to 19% diversion ratios estimated by the CMA's survey, the CMA's econometric model and the GfK survey used to calibrate the capacity-focused model.

F.30 Since diversion ratios are not targeted directly in the calibration, we are concerned that their significant deviation from the same diversion ratios collected from other sources is symptomatic of severe misspecification and/or an unsuitable calibration method. Either way, given this and the other concerns outlined above, our provisional view is that we are unable to place any evidentiary weight on demand models developed in the quality-focused model.

**Merger simulations in the quality-focused model**

F.31 In the final step of the model, the Parties use the calibrated demand model together with choice set data drawn from Pure Pricing data to conduct merger simulations. The Parties implement four merger simulations:

(a) Without cost or quality efficiencies on 'Day 0' of the Merged Entity's formation (Scenario 1);

(b) Without cost or quality efficiencies in 2030 (Scenario 1);

(c) With only cost efficiencies in 2030 (Scenario 2); and

(d) With both cost and quality efficiencies in 2030 (Scenario 3).

F.32 In all cases, the calibrated demand model is combined with a static Nash Bertrand pricing model. This is combined with the demand model to back out marginal costs at 'Day 0'. We understand that the resulting marginal costs are held fixed across all simulations.

[495] Parties' submission, Quality-focused merger simulation model.
[496] Parties' response to the CMA's RFI.

F.33 Prior to calibration, the contribution margins used to calibrate the 'Day 0' model have been adjusted to reflect the incremental cost incurred to hold the congestion level fixed. Implicitly, the deduction of these costs from the margin earned on each subscriber assumes that these costs are entirely variable. As such, it is assumed that costs associated with managing network congestion influence pricing decisions.

F.34 Our provisional view, as set out in more detail in Chapter 14, is that this is not an appropriate treatment of the investment used to hold congestion fixed.[497] Specifically, we have not seen convincing evidence at this stage that congestion costs directly affect retail pricing decisions. Without the congestion cost deduction from contribution margins, the input margin consistent with the Parties' assumptions would be higher. In line with the standard GUPPI effect, we expect that a higher input margin will result in even higher headline price increases in the Parties' merger simulations. As such, we find it likely that the reported price increases and resulting welfare effects are overly conservative.

F.35 Another key component of the quality-focused model's calibration are the external measures of network quality (**KPIs**). For the Day 0 simulation the KPIs are chosen to reflect current network conditions. However, for all merger simulation scenarios in 2030, the future network quality KPIs are given by forecasts made outside of the demand estimation framework.[498]

F.36 Therefore, unlike the capacity-focused model's approach to modelling the effect of investment on network congestion, quality is not determined by the quality merger simulation model. As a result, the effect of the Merger on the incentives to provide improved network quality are assumed, not tested.

F.37 In line with our critique of the projections underpinning the JBP, our provisional view is that the chosen network KPIs levels pre- and post-Merger are just one of a myriad of possible future outcomes.[499] Even absent our concerns over the survey vehicle and calibrated demand model, our provisional view is that we are not able to place material evidentiary weight on the 2030 merger simulations that rely on the specific KPIs presented by the Parties.

F.38 Further, to be able to interpret the output of the quality-focused model merger simulations as likely market outcomes we consider that it is necessary that the network quality KPIs and prices take values that could plausibly arise in a post-Merger equilibrium.

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[497] Chapter 14, The Parties' estimates of the incremental cost of capacity.
[498] Our concerns about the quantification of the network quality indicators for each operator and the Merged Entity used in merger simulation model are discussed in Chapter 14.
[499] See Chapter 14.

F.39 The Parties state that the key results of the quality-focused model are contained in the 2030 merger simulation with cost and quality efficiencies (**Scenario 3**). In Scenario 3, rivals are assumed not to be able to react to the assumed quality improvements in the Merged Entity's networks by improving their own network quality. In the simulation, unable to respond to the Merged Entity's higher quality network, in Scenario 3 the model predicts that rivals reduce their prices to defend their market shares.

F.40 Outside of the model, we note rivals may choose to respond to an improvement in the Merged Entity's network quality by increasing their own quality, not - as the model assumes - only by reducing their prices. In and of itself, an increase in rivals' quality tends to increase consumer welfare. However, if rivals were to increase quality, they would also likely increase price, which would reduce consumer welfare. When market participants are allowed to adjust both quality and prices, the overall change in consumer welfare could be higher or lower than that predicted in the Parties' model.

F.41 We further note that the Parties consider that their rivals would likely invest more – they submitted that 'in reality, BTEE and VMO2 will be incentivised to invest' and that the magnitude of the predicted market share losses for rivals predicted by the model 'seem[s] a highly unlikely outcome'.[500] Therefore, we consider that, by the Parties' own admission, the assumed network qualities in Scenario 3 could not plausibly arise in a post-Merger equilibrium.[501] Nor, by extension, do we consider that the price and quantity predictions presented in Scenario 3 are likely to arise post-Merger.

F.42 The implausibility of Scenario 3 as a post-Merger outcome in 2030 also undermines the credibility of the Parties' claim that the Merger 'will lead to a market-wide welfare gain of £1.8bn per year' (in 2030).[502] This is because the Parties' welfare-gain calculations rely on the output of Scenario 3.

F.43 Nor does the output of Scenario 3 support the Parties' submission that the Merger is 'strongly pro-competitive'.[503] This is because it is not possible to draw conclusions about the operators' optimal choices of price and quality in a post-Merger equilibrium directly from the output of Scenario 3. As a result, it does not follow that the output of Scenario 3 demonstrates that the Merger will be rivalry enhancing (including by leading to lower prices and/or higher quality). Any such claim appears to be speculative and unconnected to the output of the quality-merger simulation model.

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[500] Parties' submission, Quality-focused merger simulation model.
[501] Formally, the network KPIs used in this scenario are not, in the Parties' view, best responses to one another.
[502] Parties' submission, Quality-focused merger simulation model.
[503] Parties' submission, Quality-focused merger simulation model.

F.44 In addition to the above concerns, we note that the Parties' quality model merger simulations produce some counterintuitive findings, as explained below. We do not currently regard that these represent likely consumer and firm behaviour. Rather our provisional view is that they are likely to be directly connected to our concerns over the survey vehicle and methodology used to estimate and calibrate demand outlined above.

F.45 First, the model predicts that in Scenario 1 on Day 0 (ie no cost efficiencies and network quality held fixed at current levels), the Merged Entity would raise prices and its rivals would react to this by cutting price, on average, by -0.3%.[504]

F.46 We note that, as outlined in Chapter 8, our provisional view based on our analysis of the MNOs' strategies, our review of internal documents relating to previous price interactions and the views of third parties is that, if the Merged Entity raised its prices, its rivals may follow.

F.47 When we asked the Parties to provide an explanation for why their model predicted that rivals would cut their prices in response to price rises by the Merged Entity, they submitted that this result was driven by the real-world assumption that consumers are heterogeneous with respect to price sensitivity.[505] Given these preferences, they state that some rivals will raise the prices of some of their tariffs in response to the increase in the Merged Entity's prices while reducing the prices of other tariffs to attract more price-sensitive customers.[506] Further they submitted that, in their model, some customers on tariffs that would be relatively more expensive after the Merger would switch to tariffs that are relatively cheaper, particularly price-sensitive customers.[507] We consider that, whilst rivals may react to the Merged Entity raising its prices by reducing the prices of some of their tariffs, we would not expect the average price across all rivals to fall.

F.48 We also note that allowing for consumer heterogeneity in the demand model does not automatically lead rivals to cut price in response to a price increase by the Merged Entity. The CMA's logit demand model also allows for consumer heterogeneity in response to price changes. It too is combined with the same supply framework as used by the Parties in their quality model merger simulation to conduct a merger simulation.[508] However, despite allowing flexibility in consumer responses to price changes, rival operators in the CMA's merger simulation almost always increase, not decrease, price in response to the Merged Entity's price increases.

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[504] Parties' submission, Quality-focused merger simulation model.
[505] Parties' response to the CMA's RFI.
[506] Parties' response to the CMA's RFI.
[507] Parties' response to the CMA's RFI.
[508] See Appendix D.

F.49 Second, we note that the post-Merger predictions of the Parties' merger simulation are not unique. At our request, to check for multiple equilibria the Parties ran their merger simulation from a different start point for the Day 0, Scenario 1 merger simulation (without cost or quality efficiencies). Starting from prices that were up to GBP 2 from the pre-Merger prices used in their initial submission, the Parties found another post-Merger equilibrium.[509]

F.50 In this new, alternative equilibrium:

(a) the Merged Entity's average headline price increase is +8.1%, higher than its price increase of +6.3% in the equilibrium the Parties initially submitted;

(b) the Merged Entity's competitors average headline price decreases by -0.7% compared to -0.3% in the equilibrium the Parties initially submitted;

(c) Average market-wide headline prices increase by +1.4% and consumer welfare falls by -0.8% - broadly in line with the equilibrium the Parties initially submitted.

F.51 This alternative equilibrium is no less likely to occur post-Merger than the one initially submitted by the Parties.[510] Moreover, noting the relatively small perturbation of prices that led to the finding of this alternative equilibrium, we cannot rule out the possibility that more, equally plausible equilibria would be found with bigger deviations in the start point.

F.52 Our provisional view is therefore that the finding of at least one alternative plausible post-Merger equilibrium, together with the possibility that more may have been found if the deviations in the starting prices were increased further, does, in this instance, further limit the weight that we can attach to the quality-focused merger simulation predictions.

**Provisional conclusion**

F.53 Given these serious concerns outlined above, our provisional view is that we place no weight on the Parties' customer choice survey, the corresponding estimated and calibrated demand model, or subsequent merger simulations they are used in. Therefore, we do not consider the results of the model to be credible, including the claim that the Merger "will lead to a market-wide welfare gain of £1.8bn per year (in 2030)".

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[509] To place the deviation from the pre-Merger prices into context, GBP 2 is approximately [✂] of operator's ARPUs in FY2023 presented in the Parties' submission, Capacity-focused merger simulation model. The procedure used to search for a new equilibrium in described in more detail in the Parties response to the CMA's RFI.

[510] The presence of multiple equilibria does not necessarily reduce the evidentiary weight it attaches to any one equilibrium produced by a model. In considering the amount of evidentiary weight to place on a model's outputs, in general we take into account the plausibility of its predictions and interpret them in the context of the wider evidence base.

## Capacity-Focused Model

### Parties' submission

F.54 The Parties submitted that the capacity-focused model takes the following approach:

(a) it extends the standard price-only merger simulation model to one in which firms choose both prices and investment in capacity – using an approach drawn from the economic literature on models of capacity sharing;

(b) it calibrates that model using pre-merger prices, margins, market shares, diversion rations, network capacity and congestion level based on observed market outcomes; and

(c) it then predicts optimal post-Merger prices and capacity investment levels incorporating three stated merger efficiency effects. These are that the Merged Entity will have access to [✂]% more sites than either Party on a standalone basis and will be able to add additional capacity to sites at much lower cost through its network integration programme and the de-duplication of costs. Further it incorporates pro-competitive effects which will benefit VMO2 as a result of the upgraded Beacon 4.1 arrangements.[511]

### Our assessment

F.55 The capacity-focused merger simulation is based on a theoretical model of demand and supply in the UK mobile industry. It assumes that firms choose price and processing capacity independently of one another, but at the same time.

F.56 Meaningful adjustments of processing capacity occur over a multi-year time horizon. In contrast, prices change at a much higher frequency. Given this, our provisional view is that this model is most appropriately used as a tool to help understand how the Merger might affect long-run industry outcomes.

F.57 Before providing our provisional assessment of the model in this context, we describe the key features of the model that we believe are designed to capture salient features of price and quality competition in mobile telecommunications.

F.58 The first relates to the way the model captures how changes in the congestion level experienced by consumers affect their demand responses to price changes. Specifically, consumers are assumed to reduce demand proportionately when they

[511] Parties' submission, Overview of modelling approaches and results, and Parties' submission, Capacity-focused merger simulation model.

experience congestion. As a result, high intensity data users' demand is more affected by congestion than low intensity users' demand.

F.59 This feature of consumer behaviour is captured in the capacity-focused model by assuming congestion rotates, rather than shifts a linear demand curve. The rotation of linear demand dampens the effect that congestion has on the data demanded *and* provides stronger incentives to cut prices to mitigate against demand lost due to congestion.[512]

F.60 The second key feature of the model is that an operator's investment in its network's processing capacity directly affects consumers' demand response to price changes through its impact on the congestion.[513] However, while adding processing capacity can boost demand by removing congestion, the model assumes it is increasingly costly to do so.[514] This limits the amount of investment in processing capacity chosen by a profit maximising mobile network operator.

F.61 While we would agree both features of the model are desirable for a long-run model of the UK mobile industry, we have issues both with the overall structure of the model and the detail of its inputs and calibration (in terms of the data used to calibrate the model, the functional forms used to model costs and demand, and the assumptions used to characterise the effect of the Merger on investment costs).

F.62 One concern we have is that the Parties' capacity-focused model's simplified, reduced-form approach to modelling demand, congestion, price and capacity results in equilibrium prices falling as investment in congestion reduction increases. While we do not rule out that firms may optimally choose to cut price when making quality-improving capacity investments, we do not think it desirable to rule out that it may be optimal for firms to instead increase prices in this situation. This restriction on firm behaviour does not appear to be shared by other academic papers that have sought to model demand, price, congestion, and capacity in the mobile industry.[515] As such, our provisional view is that the capacity-focused model may impose unduly restrictive behaviour on firms.

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[512] To illustrate this, suppose that an operator is considering cutting price to reach a new, higher share of mobile data processed. All else equal, the price cut needed to achieve this is larger in a model where congestion rotates, rather than shifts demand. Intuitively, the larger price cut is needed to boost demand of the high intensity data users – who are assumed to be most affected by increased congestion – by enough to reach the targeted share of data processed.
[513] The congestion level is defined as the ratio of the quantity of data demanded on a network to its processing capacity (per unit of time). Holding fixed the quantity of data demanded, increases in the operator's processing capacity reduce the congestion level experienced by consumers. This reduction in congestion rotates consumer demand responses. In turn, proportionately increasing demand at every price level.
[514] The model assumes that investment cost increases at a rate $\kappa > 1$ as processing capacity is added. In the baseline model, $\kappa = 3$. This parameter choice does not appear to be linked to any empirical counterpart of investment cost. Instead, it appears to be chosen to ensure the model can be solved both pre- and post-Merger. See footnote 522.
[515] For example, Lhost, Pinto and Sibley (2015) introduce a load-balancing requirement for each operator in addition to linear demand system. The load-balancing mechanism ensures speed adjusts downward from a theoretical maximum to ensure data demanded and data capacity available. Elliott et al (2024) build on this approach by replacing the calibrated

F.63 More generally, it is highly desirable for any calibrated applied theory model used to predict the effect of structural changes on consumer welfare and market outcomes to be able to show that:

(a) the external data used to calibrate the model is consistent with the type of equilibrium that the model seeks to simulate. For example, if the model purports to simulate the long-run impact of a Merger on prices and investments, the data used to calibrate the model should incorporate all the relevant long-run costs and benefits of pricing or investment decisions;

(b) the assumptions used to characterise the change that is modelled are realistic and substantiated;

(c) the chosen functional forms can be motivated by observed industry features and data. Where functional forms are imposed solely for reasons of computational convenience and/or tractability, the calibrated theory model's quantitative predictions should be robust to equally plausible alternatives.

F.64 In reference to criteria (a), we believe that elements of the data used to calibrate the capacity-focused model are unsuitable for an analysis of long-run market outcomes in the UK mobile industry. We have identified two elements of the input data that we believe should be amended.

F.65 First, it is our current view that the margins best suited to calibrate the base case for an analysis of the long-run impact of the Merger should reflect the profitability earned on subscribers over their expected tenure with the firm - not just the profits gained from the first contract.[516] In line with this perspective, we do not believe it is appropriate to uniquely characterise the 'base case' of the Parties' capacity-focused model using 'acquisition margins'.

F.66 As outlined in Chapter 8, we note that the margin earned over the subscriber's tenure with an operator is likely to exceed the acquisition margin and that we consider the contribution margin to be a relevant upper-bound. Our current view is that the Parties' characterisation of the 'base case' of their model (that calibrates the model using acquisition margins) is likely to understate the likely long-run price increases, overstate quality improvements, and therefore produce overly conservative estimates of consumer harm.

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linear demand system with a more flexible demand model estimated from revealed preference data. They also replace the load-balancing model with a more sophisticated engineering model mapping observed network configurations to network quality experienced by users. Lhost, J., Pinto, B., & Sibley, D. (2015). Effects of spectrum holdings on equilibrium in the wireless industry. *Review of Network Economics*, *14*(2), 111-155. Elliott, J., Houngbonon, G.,Ivaldi, M., & Scott, P. (2024). Market Structure, Investment, and Technical Efficiencies in Mobile Telecommunications. Forthcoming Journal of Political Economy.

[516] These are also the margins used to calibrate the Day 0 and 2030 merger simulations in the quality-model. Parties' submission, Quality-focused merger simulation model.

F.67 Second, in reference to criteria (b), the pre-Merger standalone investment levels are an average of the observed network operators' CAPEX levels from 2017-2022. However, CK Hutchison told us that 3UK significantly increased its total investment in this period and that this investment was funded by the Cellnex Transaction.[517] 3UK's latest five-year budget plan [✂].[518] As a result, we consider that the current investment level input for 3UK misrepresents its competitive position in the pre-Merger scenario.

F.68 In relation to criteria (c), to help establish the robustness of the result of capacity-focused model, we asked the Parties to show how they were related to the assumed functional forms for demand and investment costs and/or provide empirical evidence clearly supporting their use. We focus first on the linear functional form chosen for the demand system.

F.69 The capacity-focused model assumes there is a representative consumer with quadratic utility. The resulting demand system is linear prices and does not allow for consumer heterogeneity in terms of income, price sensitivity, preferences over tariff features (ie data allowance), or network quality (ie download speed or coverage).[519] In addition to eliminating heterogeneity in consumer responses to price and quality changes, the linear demand system is known to dampen firm responses to pricing pressures. It is not clear what role this assumed feature of demand has on the model's Merger predictions given that both investment in congestion reducing capacity and price are simultaneously chosen.

F.70 Given the restrictions on the demand system inherited by the Parties' modelling choices, we asked the Parties to explore how the predictions of their model are affected if the demand system is replaced by an equally plausible alternative. The Parties have not done so.

F.71 Specifically, the Parties submitted that the Constant Elasticity of Substitution (**CES**) and the multinomial logit demand model would not be suitable due to their restrictive substitution patterns.[520] In the case of the logit model, in which diversion ratios are proportional to market shares, we are not convinced that the implied substitution patterns are so restrictive to warrant not attempting to explore their implications for the predictions of the capacity-focused model.

F.72 Finally, we highlight that the Parties did calibrate the more convex log-linear demand model pre-Merger. However, they told us that no valid post-Merger solution existed.[521] It is not clear whether the Parties explored this alternative

[517] Parties' initial submission, 1 May 2024, paragraph 2.15.
[518] CK Hutchison Internal Document.
[519] All features shown to influence consumer decisions in the both the CMA's demand estimation and Parties' demand estimation using stated preference data.
[520] Parties' response to the CMA's RFI.
[521] Parties' response to the CMA's RFI.

demand system in conjunction with a less convex investment function (see paragraphs F.76-F.77 below).

F.73 Our provisional view is therefore that the Parties have not been able to convincingly demonstrate that the chosen linear functional form for demand should be preferred over equally plausible alternatives. Nor have they shown how, if at all, the model's empirical predictions of the effect of the Merger on prices, investment, quantity and consumer surplus are impacted if a plausible alternative is used in place of linear demand.

F.74 The Parties state that the functional form of the investment cost and its assumed convexity parameter are chosen with the purpose of making the capacity-focused model tractable.[522] Noting the potential importance of the functional form for investment cost and its assumed convexity, we asked the Parties to provide empirical evidence from internal financial projections to support their investment cost modelling choices.

F.75 In response, the Parties told us that the investment cost function was not comparable to the estimates based on the bottom-up cost model used to calculate the net present value of investment spend used to build the future standalone and the Merged Entity's network plans.[523] However, we note that the other key components of the model are linked to the business planning discounted cash-flow forecasts. Specifically;

(a) the model's variable profits are calibrated to analogous prices, quantities and margins used in the business planning discounted cash-flow forecasts;

(b) the investment cost function's efficiencies discount is calibrated from the bottom-up cost model used to calculate the net present value of investment used to build the future standalone and the Merged Entity's networks.

F.76 Without a clear theoretical or empirical motivation for the Parties' choice of investment cost functional form and its assumed convexity, we consider a higher degree of curvature of the investment cost function to be equally as plausible as the level chosen by the Parties in their 'Base Case'. Conceptually, higher levels of convexity are consistent with a reality in which the investment costs associated with managing congestion only becoming prohibitively expensive close to the maximum of the data processing capacity.

F.77 To explore the potential impact of assuming higher investment cost convexity in the capacity-focused model, we compared the Parties' Base Case to a sensitivity analysis in which the only difference is that they assume a more convex

[522] Only a lower bound on its convexity is theoretically motivated (ie $\kappa > 1$). Parties' response to the CMA's RFI
[523] Parties' response to the CMA's RFI.

investment cost function.[524] The Parties' own sensitivity analysis shows that with a unit increase in the convexity parameter of the investment function, the post-Merger percentage change in consumer welfare decreases by 27 basis points from 0.71% to 0.44% - a fall of around 40%.[525]

F.78 Given the lack of evidence in support of the assumed convexity of the investment cost function, we cannot rule out that a higher convexity investment cost function provides a more appropriate description of reality. If so, we note that, based on the Parties' simulation results, the consumer welfare projected by the model may understate consumer harm from the Merger.

F.79 Overall, our provisional view is that there is a lack of convincing evidence that the external data used to calibrate the capacity's model are appropriate for the analysis of the effect of the Merger on long-run market outcomes. Nor are we currently convinced that the capacity-focused model's results are robust to the use of equally plausible, alternative assumptions on functional forms, their assumed curvature and input margins.

F.80 As such, our provisional view is that we unable to place evidentiary weight on the quantitative predictions of the capacity-focused model.

**Provisional conclusion**

F.81 Based on the discussion above, our provisional view is that, in principle, the capacity-focused model provides a coherent framework with which to understand the complex set of incentives faced by operators when they simultaneously choose both price and network quality (here proxied by firms choosing investments that alleviate congestion) over the long-run spanning multiple consumer contracts.

F.82 To the extent that we were able to attach any weight to the model's predictions, we consider that when calibrated to acquisition margins they are likely to understate the consumer harm (or overstate the consumer benefit) from the Merger over the long-run. Moreover, we currently find that it may be appropriate to consider a version of the model calibrated to a higher margin. We note that when the model's outputs are calibrated closer to contribution margins (ie Sensitivity 1 - albeit with implausible high counterfactual levels of investment by 3UK), the Parties' own results show that the model predicts consumer welfare falls and nominal prices rise as a result of the Merger.

F.83 However, overall, due to a combination of erroneous data used in calibration and overly restrictive and untested functional forms, we are not currently convinced the

[524] Instead of the arbitrarily assumed baseline curvature of $\kappa = 3$, they set $\kappa = 4$.
[525] Parties' submission, Capacity-focused merger simulation model; Parties' submission, Capacity-focused merger simulation model; and Parties' submission, Capacity-focused merger simulation model,

Parties' capacity-focused model is well suited to extrapolate its predictions on consumer welfare to reality. As such, our provisional view is that we should not place any evidentiary weight on the capacity-focused model's Merger price and consumer welfare predictions.

# APPENDIX G: Capacity, congestion and network quality

## Introduction

G.1 The Parties submitted that 'the prevailing conditions of competition are not delivering good outcomes for UK consumers',[526] claiming in particular that the UK's 5G network performance is behind that of other European countries. They submitted that this 'quality gap' will worsen in future, as neither 3UK nor VUK has the scale to invest sufficiently to keep pace with growing mobile traffic demand and advances in technology, while BTEE and VMO2 do not have the incentive to do so.[527]

G.2 In contrast, the Parties submitted that the Merger will deliver substantial rivalry-enhancing efficiencies and network quality improvements which will enhance competition in the UK. Their view is that '[t]he JNP will deliver a substantial step change in network capacity and quality which will make MergeCo a much more effective competitor than 3UK and VUK would be in the counterfactual.'[528] The Parties submitted a model showing that the Merged Entity would have [✂]% greater capacity than the standalone networks by 2029.[529]

G.3 In this Appendix, as part of our wider assessment of rivalry-enhancing efficiencies, we consider a range of issues relevant to the broader question of whether, and if so the extent to which, the Merger would create a more effective competitor than 3UK and/or VUK in the counterfactual, in particular by:

(a) increasing network capacity and addressing network congestion; and

(b) creating a more competitive offer by delivering a higher quality network including through improved coverage and reliability.

G.4 This Appendix is structured as follows:

(a) We begin by setting out some background on UK mobile network capacity.

(b) Next, we consider the Parties' submissions that their respective networks are sub-scale and will be increasingly so in the context of 5G.

(c) We consider the Parties' submissions that the Merged Entity's network will increase competition by delivering a higher-quality network, and by having substantially higher capacity, than the standalone networks.

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[526] Parties' initial submission, 1 May 2024, paragraph 2.1.
[527] Parties' initial submission, 1 May 2024, Section 2.
[528] Parties' initial submission, 1 May 2024, Section 6.
[529] Source: CMA Capacity Uplift Query

(d) We consider the short-term benefits of the Merger identified by the Parties, particularly arising from MOCN and sharing of 1800 MHz spectrum.

G.5 Our provisional conclusions on these points as they pertain to our overall assessment of the competition impact of the Merger are set out in Chapter 14 of these Provisional Findings.

## Background

G.6 Network capacity is essential to providing a good service to mobile customers. If a network does not have the capacity to meet mobile traffic demand at a location, the network becomes congested. From a customer's perspective, this can result in having no mobile connection, losing their connection during a call, slow internet browsing, or interrupted video.

G.7 Mobile traffic is local, with the busiest sites carrying considerably more traffic than the least busy sites. Operators seek to meet demand through a combination of:

(a) Deploying a sufficiently dense network of sites. Deploying additional sites has a significant cost relative to deploying more spectrum on sites. However, it can have the advantage of providing wider or more reliable coverage as well as increasing capacity.

(b) Deploying additional spectrum. As the mobile sector has grown, international and national agencies have made more spectrum bands available for mobile use, after which national agencies (Ofcom in the UK) have awarded licences in these bands to mobile operators, usually by auction.[530] In many cases, an operator has the option of increasing capacity at a site by deploying additional spectrum for which it already holds licences, although there may be some sites where all available spectrum is already deployed.

(c) Upgrading sites. An operator may be able to increase capacity at a site by upgrading the site equipment. For example, MIMO (multiple-input, multiple-output) is a technique which uses an array of transmission and receiver antennae to multiply the capacity of a radio link. Massive MIMO, which has been described as one of the main enabling technologies in 5G communications,[531] equips base stations with a very large number of antenna elements to improve spectral and energy efficiency.[532]

G.8 The effective combination of these factors results in networks with widespread and reliably strong mobile signals. This in turn delivers benefits through higher network

[530] Most recently, Ofcom auctioned licences in the 700 MHz and 3.6-3.8 GHz bands in 2021.
[531] See 5G Systems Development and Deployment (3gpp.org), accessed by the CMA on 13 June 2024.
[532] Improving the capacity of a base station/mast can also require the operator to upgrade the 'backhaul' element of the network, which links base stations to the core network, typically using fibre connections or fixed radio links.

performance on a number of factors, in particular good 4G and 5G coverage, faster speeds, and lower latency.

G.9 UK MNOs in aggregate typically have capital expenditure (excluding spectrum acquisition costs) of between GBP 2.5 billion and GBP 3 billion per annum,[533] a substantial proportion of which is spent on maintaining and upgrading their networks.

G.10 The need for continual upgrading of mobile networks has been mainly driven by strong growth of mobile traffic.[534] Ofcom reported average year-on-year growth of 40% from 2017 to 2021.[535] However, Ofcom submitted that 'Since then, growth has started to decline: overall traffic levels increased by around 27% between 2021 and 2022 and around 25% between 2022 and 2023.[…] In Vodafone's most recent published results it reported traffic growth of 13% between FY22/23 and FY23/24.[…]'.[536]

G.11 Ofcom submitted that 'Given recent (lower) growth in demand for mobile data, and the Parties' projections for growth in the JBP and the counterfactual it is reasonable to use our low growth scenario [of 20%] as a basis for understanding likely future capacity and congestion constraints'.[537] Ofcom noted that 3UK had much higher average usage per customer and carried more traffic per MHz than other MNOs, and that if this were to continue in future it might hit capacity and congestion constraints earlier than other MNOs in areas with high traffic.[538]

G.12 Since 2019, UK mobile operators have been deploying 5G networks. To date, 5G investment has focused on 5G NSA (non-standalone) and, where it has been deployed, it has generally had the effect of improving capacity for current mobile applications rather than meeting demand for new applications. Future developments will include deployment of 5G standalone networks[539] and 5G Advanced.[540]

## Economies of scale in mobile network provision

G.13 As part of our assessment of whether, and how far, rivalry-enhancing efficiencies would be likely to be realised, in the following we consider the Parties' submissions

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[533] Ofcom's future approach to mobile markets and spectrum Conclusions paper, 6 December 2022, figure 4.3, accessed by the CMA on 27 June 2024.
[534] Other factors which drive or have driven network investment include upgrading from 2G/3G to 4G/5G, replacement of legacy and HRV (high-risk vendor) equipment, and the Governments SRN (Shared Rural Network) scheme.
[535] Ofcom's future approach to mobile markets and spectrum Conclusions paper, 6 December 2022, paragraph 4.3, accessed by the CMA on 27 June 2024.
[536] Ofcom, response to the CMA's 19 April 2024 letter, referring to Ofcom's Connected nations UK report 2023, 19 December 2023, page 35 and Vodafone results, published May 2024, accessed by the CMA on 14 June 2024
[537] Ofcom, response to the CMA's 19 April 2024 letter.
[538] Ofcom, response to the CMA's 19 April 2024 letter.
[539] 5G SA networks have a dedicated 5G core network, rather than linking to a legacy 4G network.
[540] 5G Advanced is a higher-bandwidth, lower-latency version of 5G that will provide improved capability for services such as Extended Reality (XR).

that their networks are sub-scale, and that the Merger would enable them to achieve an efficient scale. We consider in particular whether the Parties' mobile networks are below the minimum efficient scale (**MES**).

**Parties' submissions**

G.14 The Parties submitted that mobile markets are subject to scale economies, which is why most developed countries have at most three or four MNOs.[541] They said that fixed and semi-fixed costs need to be spread over a sufficient number of customers for production to become efficient. The Parties did not present estimates of MES for UK mobile networks, submitting that this would require detailed engineering studies, that MES can change over time with technology and usage, and that MES can differ depending on whether an operator is converged and/or serves both business and consumer demand.[542]

G.15 The Parties submitted that their weaker financial performance relative to BTEE and VMO2 was a reflection of their smaller scale.[543] The Parties also submitted that '3UK and VUK need scale to deploy new innovative Advanced 5G use cases'.[544]

G.16 The Parties submitted a Frontier Economics report which had been prepared for Vodafone and previously submitted to Ofcom in 2022, explaining 'why economies of scale become even more important with the transition to 5G'.[545] The position set out in the Frontier Economics report is that:

(a) [✂] all MNOs will need to invest heavily to meet these requirements, in order to be credible in rolling out Full 5G (ie 5G SA), '[✂].'

(b) A 'hold-up' problem exists, in that 'MNOs need to commit to major investments up-front in order to enable […] new use cases, but [✂].'

(c) '[✂].'

**Assessment**

G.17 Mobile networks have high fixed costs and are subject to economies of scale. In particular:

(a) There is a fixed cost to deploying or upgrading a mobile cell at a particular location, which can then be used to serve many customers in that location.

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[541] FMN.
[542] FMN.
[543] FMN.
[544] FMN.
[545] FMN. Vodafone internal document, Annex to section 109 notice (**s109 notice**).

(b) National coverage is needed, as customers expect to be able to access mobile services from their providers at a range of different locations and when travelling around the UK.

(c) There is also a fixed cost to building and maintaining a backhaul/core network which connects mobile cells with one another, so that customers in different locations can call or text one another or access the internet.

(d) MNOs periodically participate in spectrum auctions which require upfront payment for access to mobile spectrum licences and the payment of annual licence fees (which are typically indefinite with an initial period of 20 years, after which they can be revoked on five years' notice). These licences are non-exclusive and nationwide.

G.18 The two larger MNOs in the UK have more extensive networks than the two smaller operators – BTEE has around [✂] sites and VMO2 [✂], whereas VUK has around 19,000 sites and 3UK 18,000.[546] Having a denser network may allow an operator to deliver a more reliable service for a given spectrum deployment on its network.[547]

G.19 Several stakeholders and market participants have told us that the UK mobile telecommunications industry is characterised by high fixed costs and significant ongoing investment requirements. [548] A number of mobile operators and stakeholders told us that, as a result, having sufficient 'scale' (ie sufficient subscribers providing sufficient revenue to (i) cover a high fixed cost base, and (ii) maintain and improve network infrastructure) is important to an MNO's ability to operate effectively.[549]

G.20 As we set out in Chapter 8, the presence of high fixed costs and significant ongoing investment requirements may create strong incentives for 3UK, and to a lesser extent VUK, to adopt aggressive growth strategies and innovate to win subscribers in the retail market. However, while there are clearly high fixed costs in entering the market and establishing a network, much of the ongoing cost challenge that MNOs face is in maintaining and improving network performance as mobile traffic continues to increase year on year, particularly driven by increasing demand for mobile data.

G.21 In practice, congestion is addressed on a site-by-site basis as part of this maintenance of network performance. When a site becomes congested, an MNO has the options of upgrading equipment and/or deploying more spectrum at that site, building a new site, or doing nothing if the level of congestion at a site or

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[546] Ofcom Connected Nations data 2023.
[547] Although third party measures suggest that VMO2 does not currently outperform VUK or 3UK on network quality – for example see Figure 1.13
[548] Responses to the CMA's questionnaire from: [✂]; [✂]; [✂]; [✂]; [✂] and [✂].
[549] Responses to the CMA's questionnaire from: [✂]; [✂]; [✂]; [✂]; [✂]; [✂]; [✂]; [✂]; [✂] and [✂].

across the network is deemed acceptable. In this sense, investment to manage congestion is scalable: MNOs can dial up or down the rate at which they upgrade sites (including deploying additional spectrum at a site) or expand their network, depending on their assessment of the cost versus the commercial advantage of network improvements, although we recognise that larger networks have a cost/value advantage in providing more capacity.

G.22 One possible 'hard' constraint on improving network capacity may be if the operator has no additional spectrum to deploy on congested sites or faces technical limitations (such as interference with nearby sites) on deploying additional spectrum on such sites. However, such constraints do not necessarily relate to the operator's scale, but rather its spectrum holdings.

(a) While BTEE has a larger overall spectrum holding than the Parties, VUK and 3UK each has a comparable level of overall spectrum holdings to VMO2.

(b) In awarding spectrum, Ofcom considers whether competition measures are needed to ensure that all MNOs have the opportunity to acquire the spectrum they need to remain credible competitors. In recent awards these have in some cases entailed a spectrum cap to prevent very asymmetric spectrum shares among MNOs.[550]

(c) An operator with insufficient spectrum would have the opportunity to acquire additional spectrum in future auctions.

G.23 Frontier Economics, in its 2022 report prepared for Vodafone and previously submitted to Ofcom, notes that the two larger MNOs have been more profitable than the two smaller MNOs over time, based on Ofcom analysis of MNO financial data.[551] However, we currently consider that a variety of factors may have influenced this outcome, such as the different commercial decisions made by different operators. The differences in profitability between providers may suggest that the larger providers enjoy greater economies of scale at the network level, but in our view they do not in themselves demonstrate that 3UK and VUK are sub-scale in a way that would prevent them being effective competitors.[552]

G.24 As we note in Chapter 8 The Parties' competitive position, we do not currently find evidence that either Party's size or scale is limiting its ability to provide competitive constraint across the relevant parameters of competition, and industry features such as network sharing and neutral hosts act to reduce the overall investment burden and fixed cost base faced by MNOs.

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[550] See, for example, Ofcom: Statement: Award of the 700 MHz and 3.6-3.8 GHz bands, 13 March 2020, paragraphs 1.6 to 1.8, accessed by the CMA on 27 June 2024.
[551] Vodafone internal document, Annex to section 109 notice (**s109 notice**). [✂].
[552] In addition, we note that many of the Merger synergies are non-network synergies. FMN.

G.25 In response to the Frontier Economics paper, Ofcom noted that '…it is not yet clear what the socially optimal level of 5G roll-out will be. In addition, the report does not demonstrate that scale becoming more important [in the 5G era] is the only plausible outcome, and instead there are factors that could reduce the importance of minimum viable scale.' [553]

G.26 As regards the specific points put forward in the 2022 Frontier Economics paper, we understand that to date the Parties' deployment of 5G (including VUK's launch of its 5G SA network) has been [✂], and that that appears to be the case in the sector more generally.[554] It remains to be seen how 5G provision will develop in the coming years, and in our view it is not yet clear that, as the Frontier Economics paper argues, there will be limited scope for smaller MNOs to 'flex down their investments in line with scale'.[555] We note that the suggestion of a step change in network quality from 5G deployment appears to be in tension with the submission in the Frontier Economics paper that improvements to existing services will be relatively subtle. The 'hold up' problem identified by Frontier Economics appears simply to reflect the uncertainty of future demand, which will depend on emerging new use cases.[556]

*Parties' Response to our Capacity and Congestion Working Paper on Economies of Scale*

G.27 The Parties submitted that:

(a) Their lack of scale is a persistent barrier to competition, because MNOs face large fixed costs to maintain and upgrade their networks to new technologies. 'Larger MNOs, which can recover these costs over a wider customer and revenue base, are therefore much better positioned to fully deploy new technologies.'[557] The Parties submitted that 'the network equipment that MNOs deploy to provide additional capacity efficiently at congested sites may require large incremental investments. There are therefore scale economies arising from spreading fixed equipment costs up to the capacity of the additional unit, with larger MNOs incurring lower unit costs up to that point', especially for 5G. The Parties submitted that 'capacity increases with the product of spectrum and sites in an area, whereas costs only increase with the sum of those costs.'[558]

[553] Ofcom's future approach to mobile markets and spectrum Conclusions paper, 6 December 2022, footnote 80, page 19.
[554] Vodafone internal document, Annex to section 109 notice (**s109 notice**).
[555] Vodafone internal document, Annex.
[556] This differs from a typical 'hold up' problem, in which an investment commitment by one party to a transaction increases the bargaining power of another party.
[557] Annex 4 to the Parties' response to the AIS and working papers.
[558] Annex 4 to the Parties' response to the AIS and working papers.

(b) Fair access to spectrum (including yet-to-be-released spectrum bands) is not sufficient to address imbalances in scale. The Parties submitted that 'The Parties' problem is not a lack of spectrum but the economics of deploying spectrum in the context of [✂]'.[559]

(c) There is a 'clear link' between scale, profitability, and an MNO's ability to sustainably compete in the market. 3UK and VUK have had to invest [✂] while generating smaller cashflows from mobile.[560]

(d) The Working Paper overstates the benefits of network sharing to achieve scale economies – the Parties are already in such sharing agreements, and have already leveraged all of the available scale economies, with the general trend being towards less sharing.[561]

(e) The Working Paper ignores the distinction between 'basic' 5G and 'advanced 5G' deployment.[562]

G.28 We recognise that there are relative scale advantages in the provision of mobile network services, in that larger providers are able to spread fixed costs over a larger subscriber base nationally. We also recognise that the relatively low returns of the smaller players increase the challenge of sustaining investment levels. The Parties' position is that 3UK and VUK are unable to compete effectively because they are 'sub-scale'. We have not seen evidence that relative scale advantages have prevented effective competition in the market or that they can be expected to do so in future:

(a) We recognise that BTEE, which is the market leader, has been able to maintain its position as the highest-quality network through strong investment over the years, and this is likely due in part to its large customer base.

(b) However, 3UK and VUK, despite being smaller scale, have been in the market for many years. Over this time, they have continued to invest in their networks (including most recently in 5G), and to compete against BTEE and VMO2 in successive auctions to acquire the spectrum they need to remain effective competitors. As we discuss below, both are currently performing better than VMO2 on network quality across a range of metrics, with 3UK ranking second on network performance from RootMetrics for example, despite being the smallest of the four players.

G.29 Taking the Parties' points in turn;

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[559] Annex 4 to the Parties' response to the AIS and working papers.
[560] Annex 4 to the Parties' response to the AIS and working papers.
[561] Annex 4 to the Parties' response to the AIS and working papers.
[562] Annex 4 to the Parties' response to the AIS and working papers.

(a) **Fixed costs, including at site level:** As noted, we have not seen evidence that site-specific scale economies are a source of competitive disadvantage.

(b) **Spectrum:** We recognise the Parties' submissions that they already have the spectrum holdings they need to compete but do not consider that their current lack of financial resources to deploy spectrum is inhibiting their competitive role in the market, for the reasons outlined in the chapters considering the retail and wholesale market.

(c) **Link to profitability:** Again, we recognise that there are relative scale advantages in the market. However, in general we note that a larger customer base will in the long term entail greater network investment in order to maintain a high level of quality. In addition, a wide range of factors can determine the relative financial performance of firms in a market, including the effectiveness of management decisions.

(d) **Network sharing:** We recognise that there may be limited additional benefits to network sharing that have not yet been realised but as noted above, consider that this has not prevented the Parties from acting as a material competitive constraint in the markets in which they operate.

(e) **Types of 5G:** We recognise the distinction between basic 5G and Advanced 5G. However, we note that there remains uncertainty as to the level of demand for Advanced 5G, and the timescale at which this will emerge. In the following assessment, we consider 3UK and VUK's plans and/or progress towards delivering Advanced 5G to date.

## Congestion on the Parties' Standalone Networks

G.30 As part of our assessment of whether, and how far, rivalry-enhancing efficiencies would be likely to be realised, we have considered the Parties' submissions regarding congestion.

G.31 The Parties submitted that:

(a) 3UK is a '[✂]' which '[o]ver more than two decades' has developed a reputation for poor network quality resulting from [✂], resulting in high customer churn. Without the ability to sustainably make the required investments [✂] in its [✂].[563]

(b) A standalone VUK would 'likely [✂] its current strategy of targeted 5G SA rollout limited to certain urban areas. Over time this will allow [✂], reducing VUK's strength as a competitor in the retail and wholesale markets.' [564] [✂]

[563] Parties' initial submission, 1 May 2024, paragraphs 2.10 and 2.11.
[564] Parties' initial submission, 1 May 2024, paragraph 2.33.

VUK forecasts 'a significant increase in congestion peaking at [✂]% of its sites in [✂]'.[565]

### Measuring congestion

G.32 The Parties' submissions have generally presented analysis of congestion on a per-site basis, eg showing forecasts of the number of congested sites per annum.[566] However:

(a) Mobile sites are typically split into three sectors, (each with its own antenna and equipment) – with each sector equally spaced at 120-degree intervals to provide service all around the site. A site may be congested on one of these sectors but not on the other two sectors.

(b) Most mobile sites, particularly in busier areas, carry more than one spectrum band. A site (or sector) may be congested in one spectrum band but not in another. In some circumstances it is possible to move traffic from one spectrum band to another in order to relieve congestion, but there are limitations to this. One such limitation is that 4G traffic cannot be moved to 5G bands unless users' handsets are 5G-capable. This is likely to become less of a constraint as most handsets in use become 5G-capable. A more fundamental limitation is that low frequency spectrum is better at reaching customers who are further away from the site, or who are indoors. If there is high traffic from such customers leading to congestion, they typically cannot be served by mid-band or C-band spectrum. Low frequency bands are particularly prone to congestion as they carry less capacity per MHz and there is typically less spectrum available in these bands. As a result, it can be more difficult to respond to increased demand in areas which can only be reached by these bands.

G.33 [✂].[567] [✂], distinguishing between the extended coverage area (**ECA**) – the wider geographical area covered by the site, which is served with low-frequency spectrum, and the non-extended coverage area (**NCA**), the area closer to the site, which can be served by mid-band and C-band spectrum, as illustrated in Figure G.1.[568] In addition, 3UK defines each spectrum band in each sector as a 'cell', which in practice [✂].[569] (VUK also identifies congestion on [✂].[570])

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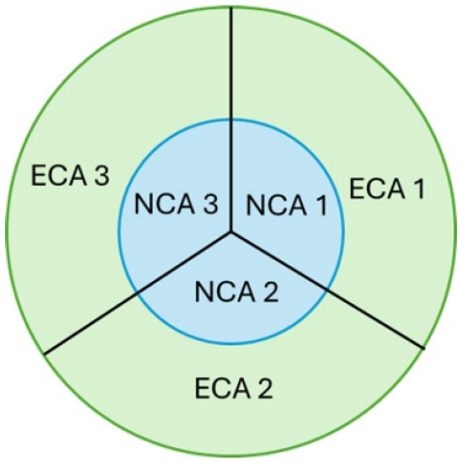
[565] Parties' initial submission, 1 May 2024, paragraph 2.37.
[566] See for example the Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[567] FMN; The Parties put back response (Appendix G: Capacity and Congestion).
[568] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[569] CMA analysis of [✂].
[570] CMA analysis of [✂].

**Figure G.1 Sector Areas on a 3UK site**




*Source: Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction, [✂].*

G.34 The Parties submitted that it is appropriate to treat a site as congested when part of the site is congested:

(a) VUK submitted that 'VUK defines a site as congested when [✂]. This is because, where [✂].[571]

(b) 3UK submitted that '[✂]:[572]

(i) In the ordinary course of business, 3UK's investment decisions [✂].

(ii) Customers typically move between cells given their close proximity, for example, moving geographically between sectors or moving across different bands. Therefore, relying on congestion data based on the cell level does not reflect the true customer experience of congestion on the network and would not be useful for 3UK to identify where improvements are needed.

(iii) Using congestion data based only on the cell level would deliver an overly optimistic view of congestion and the customer experience, and therefore [✂]'.

G.35 We do not agree that cell-level analysis is necessarily an inappropriate metric for measuring congestion, and in the following analysis we consider both site-level and 'cell'-level evidence of congestion. In particular, the Parties' position is that current and future network congestion is a limitation on perceived network quality and their ability to compete effectively.[573] In our view, considering sector-specific and band-specific congestion together allows a fuller assessment of the issue.

[571] Vodafone response to the CMA's s109 notice.
[572] CK Hutchison response to the CMA's s109 notice.
[573] See for example FMN.

However, we understand that investment decisions are made at site level across the mobile industry. In practical terms, the Parties appear typically [✂].

G.36 However, from a customer experience perspective, congestion occurs within the cell where the customer is trying to use the service at a particular point in time. A customer located in a particular cell and using a particular spectrum band is not affected by congestion in different cells or bands on the same site. In addition, as we discuss below, the Parties' internal documents [✂]. VUK sets congestion thresholds [✂].[574]

(a) VUK has not explained why customers in non-congested cells would experience a deterioration in quality.

(b) While customers may move from an uncongested cell on a site to a congested cell on the same site, they may also move in the opposite direction (ie from a congested to an uncongested cell), or to an adjacent site.

(c) 3UK has not explained why a more granular assessment would give an overly optimistic view of congestion and the consumer experience.

G.37 Whether a site or cell is identified as congested also depends on the speed threshold used. As described below 3UK uses a threshold of [✂] Mbps while VUK uses [✂] Mbps – ie if the average speed at a site or cell is below this threshold, it is identified as congested. The Parties submitted that while Ofcom considers [✂] Mbps to be the minimum speed required to deliver 'high' performance, international regulators consider that users require higher speeds.[575] We note, however, that the Ofcom Connected Nations table cited by the Parties identifies download speed thresholds as 'Good' (2Mbps), 'High' (5Mbps) and 'Very High' (10Mbps) – ie according to Ofcom 'good' performance can be delivered at 2Mbps.[576]

**3UK Standalone Network**

G.38 The Parties submitted that: 'Over more than two decades, 3UK has developed a reputation for poor network quality resulting from inferior coverage and congestion on material parts of its network, which results in high customer churn.' [577] They also submitted that: '3UK's historic strategy of offering large and unlimited data bundles has resulted in 3UK carrying the largest share of traffic in the industry (despite having the smallest subscriber base) and by far the most data traffic per

[574] FMN.
[575] Annex 4 to the Parties' response to the AIS and working papers.
[576] Ofcom's Connected nations UK report 2023, 19 December 2023, table 3.2.
[577] Parties' initial submission, 1 May 2024, paragraph 2.10.

subscriber. Historically, this has resulted in significant congestion further limiting 3UK's competitiveness.' [578]

### 3UK Network Congestion

G.39 3UK has provided estimates and forecasts of its network congestion levels, as set out in G.40. Congestion is measured in terms of the average user throughput (speed) at a site. 3UK has said that currently [✂]% of its sites are congested, on the basis that average user throughput is below [✂]Mbps at peak times. It forecasts that [✂].[579] 3UK submitted that '[✂].' [580]

G.40 We note that 3UK's account of congestion on its network appears to be in tension with its view of the same subject in relatively recent engagement with Ofcom. In May 2022, 3UK responded to an Ofcom consultation about future mobile spectrum demand.[581] 3UK submitted that it would face growing congestion without additional spectrum and asked Ofcom to aim to make the 600 MHz band[582] available for mobile use, and to support allocation of the upper 6GHz band for licensed mobile use at WRC-23[583] and award the spectrum to MNOs by 2026. 3UK reported that it had responded to recent mobile data traffic growth by purchasing additional spectrum in Ofcom awards,[584] [✂], and [✂]. 3UK predicted that it would have [✂][585] [✂], under Ofcom's medium traffic growth scenario and with [✂], as shown in Figure G.3.

**Table G.1: 3UK standalone congestion**

| *Year* | *Congested sites** | *% of sites in congested areas ([✂]Mbps) †* | *% of subscribers in congested areas ([✂]Mbps)* | *% of sites in congested areas ([✂]Mbps) ‡* | *% of subscribers in congested areas ([✂]Mbps)* |
|---|---|---|---|---|---|
| 2024 | [✂] | [✂] | [✂] | [✂] | [✂] |
| 2025 | [✂] | [✂] | [✂] | [✂] | [✂] |
| 2026 | [✂] | [✂] | [✂] | [✂] | [✂] |
| 2027 | [✂] | [✂] | [✂] | [✂] | [✂] |
| 2028 | [✂] | [✂] | [✂] | [✂] | [✂] |
| 2029 | [✂] | [✂] | [✂] | [✂] | [✂] |
| 2030 | [✂] | [✂] | [✂] | [✂] | [✂] |
| 2031 | [✂] | [✂] | [✂] | [✂] | [✂] |
| 2032 | [✂] | [✂] | [✂] | [✂] | [✂] |
| 2033 | [✂] | [✂] | [✂] | [✂] | [✂] |
| 2034 | [✂] | [✂] | [✂] | [✂] | [✂] |

*Source: *FMN.*

*† Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.*

*‡ Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.*

[578] Parties' initial submission, 1 May 2024, paragraph 2.13.
[579] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[580] FMN.
[581] CK Hutchison's internal document.
[582] Currently used for digital terrestrial television (DTT).
[583] ITU's World Radio Conference 2023 accessed by the CMA on 20 June 2024. The band was in fact allocated for mobile use in WRC 23, although Ofcom is exploring the possibility of hybrid use between mobile and Wi-Fi.
[584] 20 MHz of 700 MHz spectrum in 2021 and 20 MHz of 3.4 GHz spectrum in 2018.
[585] Extended Coverage Area: The extended coverage area (ECA) refers to locations which can only be served by 3UK's low frequency spectrum (700MHz, 800MHz and 1400MHz), while the non-ECA is all other areas which are within the coverage of its mid-band spectrum (1800MHz, 2100MHz and 3.4-3.8GHz).

**Figure G.2: 3UK congested sites forecast**

[✂]

*Source: FMN. [✂].*

G.41 In other words, while the Parties have submitted that 3UK currently has [✂] levels of congestion (around [✂] sites) which will [✂], in 2022 3UK submitted to Ofcom that it had [✂] level of congestion (expected to be around [✂] sites in [✂]), which it expected would [✂] (the submission to Ofcom did not specify the speed threshold used to identify a site as congested).

**Figure G.3: 3UK forecast congestion (Ofcom medium growth scenario)**

[✂]

*Source: CK Hutchison's internal document.*

G.42 We have assessed site-level data on congestion from 3UK, as summarised in Table G.1. The first data column shows that of around [✂] sites which are congested at [✂]Mbps, around [✂] are only congested in low band spectrum (typically 800 MHz), with [✂] congestion in mid-band (1400 MHz to 2600 MHz) and [✂] congestion in C-band. The second and third columns show that where C-band is deployed [✂]. However, for around [✂] sites where C-band has been deployed, [✂].

**Table G.1 3UK network congestion at [✂]Mbps**

| *Congested in:* | *Sites (total)* | *Sites (c-band deployed)* | *Sites (c-band not deployed)* | *Cells congested* | *ECA Cells congested* | *Non-ECA Cells congested* |
|---|---|---|---|---|---|---|
| Low band only | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| Low and mid bands | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| Mid band only | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| C-band | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| All congested | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| Total | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |
| Congested as % of total | [✂] | [✂] | [✂] | [✂] | [✂] | [✂] |

*Source: CK Hutchison's response to the CMA's s109 notice.*

G.43 As discussed above, looking at the number of sites affected by congestion may not accurately reflect the extent of congestion on a network and the impact on the customer experience. For example, if a 3UK site has deployed 800 MHz (serving the ECA of the site, and 1800 MHz (serving the NCA), then if the 800 MHz band is congested in one of the three sectors of the ECA, then the site is labelled as congested. However, it is likely that a large share of traffic at the site will be in the NCA (as sites tend to be located in busy areas), and this traffic will not be affected by congestion. Our analysis of 3UK's site-level data shows that while it is congested on [✂]% of sites, only [✂]% of cells ([✂]% of NCA cells and [✂]% of ECA cells) are congested (columns 4 to 6 of Table G.1 above.

G.44 In [✂] cases where congestion occurs on 3UK's network, only [✂] cells on a site are congested (out of up to 24), as shown in Table G.2. As the Table shows, three or fewer cells are congested in [✂] out of the [✂] congested sites on 3UK's network

**Table G.2 3UK sites with three or fewer cells congested**

| *Total Cells* | *1 cell congested* | *2 cells congested* | *3 cells congested* |
|---|---|---|---|
| 24 | [✂] | [✂] | [✂] |
| 21 | [✂] | [✂] | [✂] |
| 18 | [✂] | [✂] | [✂] |
| 15 | [✂] | [✂] | [✂] |
| 12 | [✂] | [✂] | [✂] |
| 9 | [✂] | [✂] | [✂] |
| 6 | [✂] | [✂] | [✂] |
| 4 or fewer | [✂] | [✂] | [✂] |
| **Total** | **[✂]** | **[✂]** | **[✂]** |

*Source: CK Hutchison's response to the CMA's s109 notice.*

*Parties' Response to our Capacity and Congestion Working Paper on 3UK congestion levels*

G.45 The Parties submitted that '[h]igh congestion on the 3UK network is clearly having a negative impact on customer experience[…]'. In the Parties' view 3UK, despite 'having a good 5G network in localised areas' and pricing competitively relative to other MNOs, has failed to significantly grow its market share. The Parties submit that '[t]he clear explanation for this is the poor quality of 3UK's heavily congested network [✂]'. The Parties add that 'Customers notice 3UK's network problems, and its reputation for poor network quality resulting from inferior coverage and congestion on material parts of its network [✂].'[586]

G.46 We discuss 3UK's network quality in the following section. As we note there, 3UK's network appears in general to be performing well compared to other operators, although it is behind BTEE in most measures, and its recent increase in network investment has been followed in higher rankings of network performance based on third party metrics. We recognise that 3UK may have a relatively poor quality reputation, and there may be some time delay between network quality improvements and improved consumer perceptions (we consider this issue further below – see paragraph G.63 and Figure G.15).[587]

**3UK Network Investment**

G.47 3UK submitted that it 'has significantly increased its investment in 5G since 2020 (in part funded by the proceeds of the sale of its towers to Cellnex) in an effort to break out of the vicious circle and address traffic growth and growing congestion

[586] Annex 4 to the Parties' response to the AIS and working papers.
[587] As a general point, we would expect a reputation for poor quality would, if anything, make it more difficult to attract new customers, whereas churn – ie customer switching away – would more likely be driven by their personal experience of service quality, rather than reputation.

on its 4G network. This has improved customer experience in localised areas and resulted in [✂].' [588]

G.48 3UK had a total Capex of GBP 2.3 billion from 2020 to 2022, [✂].[589] [✂].

G.49 3UK launched its 5G service to mobile customers in February 2020. [✂].[590]

**Figure G.4: 3UK's [✂] in planned 5G sites**

[✂]

*Source: FMN.*

G.50 Nevertheless, 3UK has continued to roll out its 5G network. Ofcom Connected Nations data shows that 3UK's deployment of C-band spectrum was around 3,500 sites in 2022 and 4,445 sites in September 2023. The Parties submitted that [✂].[591] Our analysis of Open Signal data show that 3UK consistently had the fastest 5G download speeds and was improving across the period from January 2023 to June 2023 suggesting that it is continuing to invest in 5G.[592]

G.51 An internal 3UK document from February 2022 describes a '4G Congestion Reduction Programme', as shown in Figure G.5.[593] The figure shows the sensitivity of the congested site count to the speed threshold used, with almost [✂] sites congested at < [✂]Mbps, but only [✂] at < [✂]Mbps. [✂].

**Figure G.5 3UK internal document, February 2022**

[✂]

*Source: CK Hutchison internal document.*

G.52 3UK planned to reduce congestion using a range of measures. We note that some of these measures related to its 'non-discretionary' site upgrades, such as upgrading Huawei sites. 3UK provided us with a progress update on the programme, as set out in Figure G.6.[594] [✂].

**Figure G.6 3UK progress on 4G Congestion Reduction Programme**

[✂]

*Source: Parties response to the CMA's RFI.*

G.53 The Parties submitted that [✂]. They said that [✂]. The Parties noted that [✂]'.[595]

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[588] FMN.
[589] FMN.
[590] FMN.
[591] Annex 4 to the Parties' response to the AIS and working papers.
[592] Chapter 8, Figure 1.16.
[593] CK Hutchison internal document.
[594] Parties response to the CMA's RFI.
[595] Annex 4 to the Parties' response to the AIS and working papers.

G.54 The Parties subsequently identified [✂]. [596] [✂].[597]

*5G SA and Advanced 5G*

G.55 The Parties submitted that investments required to deliver Advanced 5G included large-scale rollout of C-band on mMIMO equipment, high capacity fibre backhaul (linking mobile sites to the core network), and a new 5G core network and 'dense network of data centres closer to users'.[598] The Parties submitted that '[✂]'.[599]

G.56 A November 2022 internal document [✂].[600] This document [✂]. As such it needs to be interpreted with caution as a guide to what 3UK would do absent the Merger. The document [✂].

### 3UK Network Performance

G.57 A 3UK internal document from March 2022 (see Figure G.7) describes its network performance as [✂].[601] 3UK provided an update of the congestion data [✂].[602]

**Figure G.7 3UK Internal document, March 2022**

[✂]

*Source: CK Hutchison internal document.*

**Figure G.8 Congested hours on 3UK 4G cells**

[✂]

*Source: 3UK response to RFI.*

G.58 A November/December 2022 internal document shows [✂] (See Figure G.9).[603] [✂]. We note that the Parties reported that [✂].[604] [✂].

**Figure G.9 3UK internal document, November 2022**

[✂]

*Source: CK Hutchison internal document.*

G.59 The same document (slides 34-39) compares the current status of the Radio Access Network (RAN), including the following:[605]

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[596] CK Hutchison Main Party Hearing Transcript.
[597] FMN.
[598] FMN.
[599] FMN.
[600] CK Hutchison internal document.
[601] CK Hutchison internal document.
[602] Congestion is measured based on the average utilisation and capacity of the 4G cell recorded over the whole hour. 3UK measures whether a cell is congested during each hour of the day. (3UK response to question [✂] of RFI).
[603] CK Hutchison internal document.
[604] FMN.
[605] CK Hutchison internal document.

(a) ‘Network current status: [✂];

(b) Network status – planned end 2024: [✂];

(c) Network status – planned end 2027: [✂]

G.60 A further slide (56) in the same pack summarises 3UK’s ‘horizons’ to achieve a ‘strategic vision’, including a ‘[✂]’, followed by ‘[✂] (Figure G.10).[606]

**Figure G.10 3UK Strategic Vision, November/December 2022**

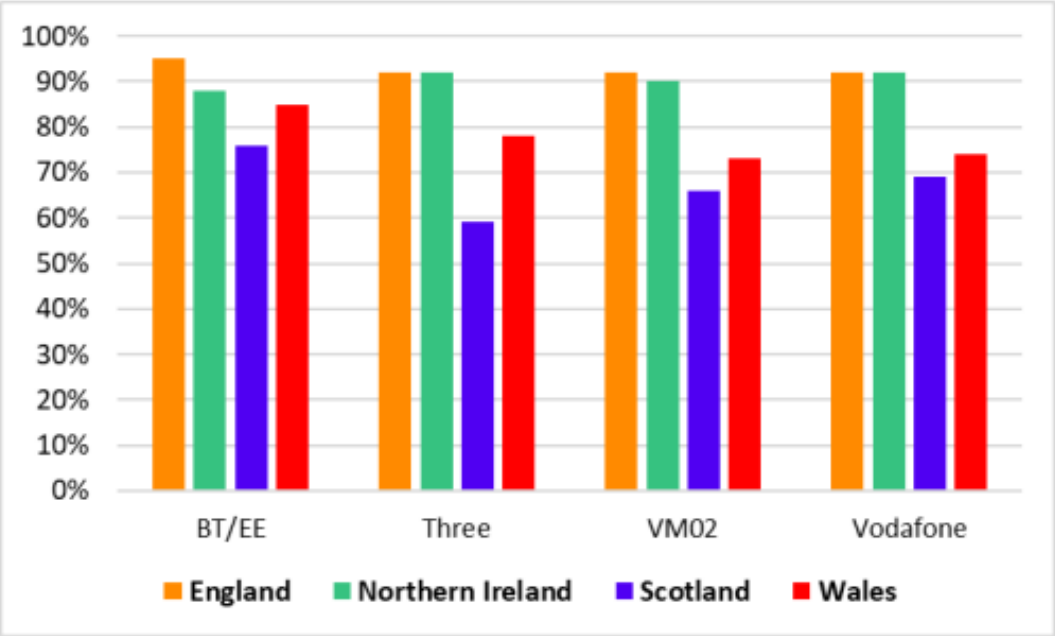
[✂]

*Source: CK Hutchison internal document.*

G.61 Third-party reports of 3UK’s network performance, including 5G coverage, indicates that it broadly compares well with other MNOs.[607]

(a) Ofcom’s Connected Nations data shows that on 4G geographic coverage, 3UK performs less well than other MNOs in Scotland, but has relatively strong coverage elsewhere.

**Figure G.11: Differences in 4G geographic coverage in England, Northern Ireland, Scotland and Wales (2023)**

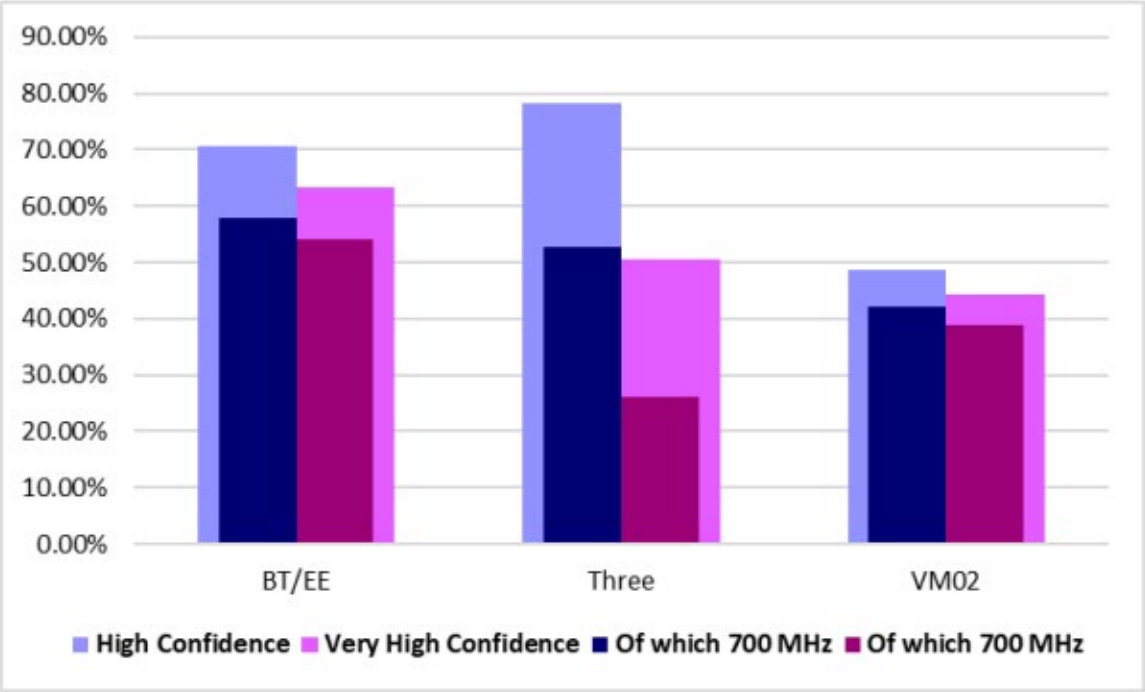



*Source: Ofcom analysis of MNO predictions (September 2023). Ofcom’s Connected nations UK report 2023, 19 December 2023, figure 3.6.*

(b) [✂].[608] [✂].

[606] CK Hutchison internal document.
[607] See Three 5G Coverage - Check coverage in your area, accessed by the CMA on 14 June 2024.
[608] Source: Ofcom Connected Nations Data.

**Figure G.12: MNO 5G Outdoor Population Coverage**



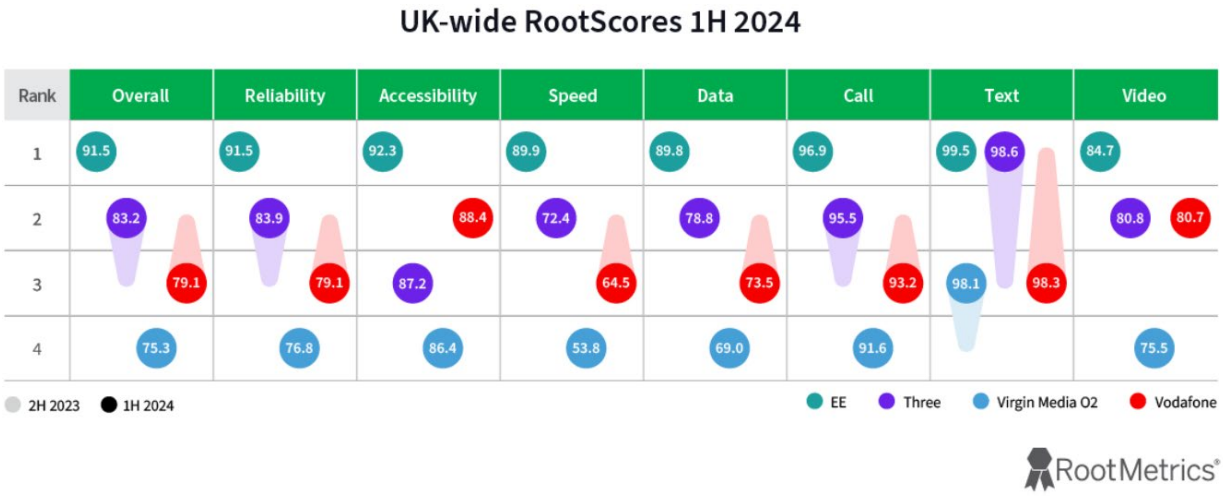

*Source: Ofcom analysis of MNO prediction (September 2023). Ofcom's Connected nations UK report 2023, 19 December 2023, figure 3.4.*

(c) RootMetrics, one of a number of firms who monitor UK MNO network performance, also suggested that 3UK was a close second to BTEE on 5G, commenting that '[EE's] top combination of 5G availability plus performance allowed EE to narrowly surpass Three and earn our Best 5G Experience prize in 1H 2024.'[609]

(d) RootMetrics reports that 3UK had the second-best network (after BT) on most metrics in the first half of 2024.[610]

[609] RootMetrics, UK Mobile Performance and 5G in Review, August 2024, Accessed by the CMA on 6 September 2024.
[610] RootMetrics, UK Mobile Performance and 5G in Review, August 2024, accessed by the CMA on 6 September 2024.

**Figure G.13 RootMetrics Network Performance scores**




*Source: RootMetrics, UK Mobile Performance and 5G in Review, August 2024.*

G.62 3UK internal documents suggest that it suffers from a relatively poor perception of its network quality, as shown for example in Figure G.14.[611]

**Figure G.14: Network perception**

[✂]

*Source: CK Hutchison internal document.*

G.63 [✂] among its own customers who have left 3UK, respondents who indicated network quality as a reason for leaving 3UK appear to have [✂] following its increase in Capex from 2020 to 2022, as indicated in Figure G.15.[612]

**Figure G.15: Reasons for leaving 3UK**

[✂]

*Source: CK Hutchison internal document.*

### 3UK Standalone Network – summary

G.64 3UK's internal documents and its 2022 submission to Ofcom[613] indicate that it has faced significant congestion in recent years, [✂]. At present, around [✂]% of 'cells' are congested, across around [✂] of its sites. Congestion is [✂], and also [✂]. The most acute congestion [✂].

G.65 On third-party measures, 3UK is performing well on coverage and close to BTEE on 5G performance. While recent RootMetrics results suggest that 3UK has the second-best network on a range of measures, it is rated some way below BTEE

[611] CK Hutchison internal document.
[612] CK Hutchison internal document.
[613] CK Hutchison's internal document.

on several measures, particularly on speed and data (despite 3UK performing well on 5G).

G.66 Until mid-to-late 2022, 3UK had ambitious plans to address 4G congestion and further roll out its 5G coverage and [✂]. While we recognise that to some extent the projections in internal documents are likely to be aspirational, there is no indication from those documents that 3UK was expecting its network quality or relative competitiveness to decline in the coming years.

G.67 In our provisional view, we have not seen evidence, based on its internal documents, that 3UK is currently facing, [✂], capacity constraints or congestion levels that would materially weaken its competitive position.

## VUK Standalone Network

G.68 The Parties submitted that VUK is sub-scale, and unable to generate sufficient returns to fund necessary network investments.[614] The Parties submitted that as a result, in the counterfactual it will [✂] its current strategy of targeted 5G rollout, [✂]. The Parties further submitted that over time, [✂], reducing VUK's strength as a competitor.[615]

### VUK Network congestion

G.69 VUK submitted that '[a]bsent the Transaction, VUK expects that it would continue to try to meet its target of limiting congestion (at [✂]Mbps) to [✂]%, equating to around [✂]% of sites', noting that '[✂]' [616]

G.70 VUK also submitted that 'VUK's internal capacity modelling indicates that, [✂]. [✂], in the longer-run, VUK anticipates that it will increasingly struggle to manage congestion [✂]. Beyond FY29, VUK expects that continued growth in busy-hour traffic will drive a steady increase in the congestion, with around [✂] being affected by congestion by FY33.'[617]

G.71 However, Frontier Economics' report 'Pro-competitive Effects of the Merger' (PCEP1)[618] presents a more negative forecast for VUK congestion, as shown in Figure G.16.[619] Here, rather than congestion to FY29 being [✂], the number of sites congested by FY29 is [✂], at both the 3Mbps and [✂]Mbps thresholds. By FY33, [✂] of VUK's sites are affected by congestion rather than [✂].

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[614] FMN.
[615] FMN.
[616] FMN.
[617] FMN. VUK notes that *'[✂].'* FMN.
[618] The FMN was submitted in January 2024, the PCEP1 in February 2024.
[619] Parties' submission, The pro-competitive effects of the Vodafone/Three merger.

**Figure G.16: Percentage of VUK sites and Cells congested at [✂]Mbps and [✂] Mbps absent the Merger, FY24 to FY34**

[✂]

*Source: Parties' submission, The pro-competitive effects of the Vodafone/Three merger.*

G.72 A Compass Lexecon paper submitted by the Parties, 'Further evidence on network efficiencies and associated customer benefits enabled by the transaction' (**PCEP2**),[620] replicates this VUK congestion forecast from the PCEP1.[621] It does not present figures for the number of subscribers in congested areas but notes that [✂].[622]

G.73 The Parties have provided a further forecast of VUK congestion under different traffic growth assumptions, as shown in Figure G.17. We note that the modelled congestion forecasts are highly sensitive to the assumed level of mobile traffic growth, with a much slower increase arising from VUK's own November 2023 forecast of traffic growth.

**Figure G.17 VUK congestion forecasts.**

[✂]

*Source: Annex 3 to the Parties' response to the AIS and working papers.*

G.74 VUK responded to Ofcom's consultation on Meeting Future Demand for Mobile Data in April 2022.[623] Like 3UK, it argued for making additional spectrum available for mobile, particularly in the upper 6 GHz band. VUK agreed with Ofcom's demand estimates (with a central estimate of 40% demand growth per year), although it noted the considerable difficulty of forecasting future demand. VUK commented that '[p]rovision of the upper 6 GHz band for mobile service would allow network operators to economically upgrade their existing network of microcell sites to support the forecast demand, staving off the prospect of networks going into congestion.'

G.75 We have assessed site-level data on congestion from VUK, as summarised in Table G.3. The first data column shows that of around [✂] affected sites, [✂] are only congested in low band spectrum (typically 800 MHz), with limited congestion in mid-band (1400 MHz to 2600 MHz) and no congestion in C-band.[624] The

[620] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[621] Parties' submission, The pro-competitive effects of the Vodafone/Three merger. In the Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction, FY24 to FY34 are presented as Year 0 to Year 10.
[622] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[623] Vodafone Response to Ofcom Consultation, April 2022, page 9, accessed by the CMA on 27 June 2024.
[624] This is supported by a November 2022 Vodafone (Europe) internal document which notes that 'the vast majority of congested cells in Networks today [✂]. Vodafone internal document.

second and third columns show that most congested sites are those where C-band has not yet been deployed.

**Table G.3 VUK network congestion, March/April 2024**

| Congested in: | *Sites (total)* | *Sites (c-band deployed)* | *Sites (c-band not deployed)* | *Cells** |
|---|---|---|---|---|
| Low band only | [✂] | [✂] | [✂] | [✂] |
| Low and mid bands | [✂] | [✂] | [✂] | [✂] |
| Mid band only | [✂] | [✂] | [✂] | [✂] |
| C-band | [✂] | [✂] | [✂] | [✂] |
| All congested | [✂] | [✂] | [✂] | [✂] |
| Total | [✂] | [✂] | [✂] | [✂] |
| Congested as % of total | [✂] | [✂] | [✂] | [✂] |

*Source: CMA analysis of Vodafone Confidential Annex.*
** In this data, VUK [✂].*

G.76 Our analysis of VUK's site-level data shows that while it is congested on [✂] of sites, only [✂] of cells are congested. This is consistent with VUK's submission, which states that in [✂] of the last [✂] financial years it has [✂] its target of limiting congestion to around [✂]% of [✂] and suggests that [✂].[625] This is supported by a May 2023 internal document, which reports [✂]. [626]

G.77 A November 2022 internal document from Vodafone (Europe) reports [✂]. The document indicates that [✂], noting that that, [✂]'.[627] As explained in PCEP 1 (paragraphs 69 and 73), cell congestion of around [✂]% translates into approximately [✂]% sites being congested.

G.78 As noted above, a May 2023 VUK document reports cell congestion at [✂]% in [✂]. It forecasts [✂].[628] We note that this could be seen as broadly consistent with the forecasts presented to us by the Parties, [✂]. However, there is no indication in this or other internal documents that [✂].

*Discussion of congestion management in VUK internal documents*

G.79 The November 2022 Vodafone (Europe) document mentioned above considers whether to allow [✂] and/or [✂], with the aim of saving on [✂].[629] It notes that:

(d) '[✂].'[630] As indicated by this document, Vodafone [✂].

(e) [✂].

(i) [✂].

[625] FMN.
[626] Vodafone internal document.
[627] Vodafone internal document .'The Parties submitted that the [✂]% Europe congestion refers to cells, not sites'
[628] Vodafone internal document [✂].
[629] Vodafone internal documnet.
[630] Vodafone internal document.

(i) [✂]%.[631]

(ii) [✂].

(f) '[✂]'.

(g) [✂].

(h) [✂].

(i) [✂].

G.80 In our view, while this document illustrates the trade-off between capex limitations and network congestion and that certain applications will degrade with these speeds, [✂].

G.81 A November 2021 VUK document considers network congestion, [✂].[632] The document notes that, [✂].[633] [✂].[634]

G.82 Similarly, a November 2022 document reports that [✂].[635] The document notes that '[✂]'[636]

G.83 An October 2023 Vodafone (Europe) strategy document notes that on the network side there will be a focus on (among other things) '[✂]'.[637]

*Parties' Response to our Capacity and Congestion Working Paper on VUK congestion levels*

G.84 In their response to our Capacity and Congestion Working Paper, the Parties said that VUK would face [✂]. [638] The Parties added that 'Whilst the forecast level of congestion varies somewhat, in line with traffic forecasts, [✂].' [639] They said that variations in the baseline level of congestion have only [✂].[640]

G.85 However, as noted above, VUK and Vodafone (Europe) internal documents, indicate [✂].[641] VUK congestion rates appear [✂], and we have not seen evidence from internal documents that [✂].

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[631] The Parties submitted that 'as explained in response to question 11 of RFI21, the information reported in paragraph (b)(ii) is based on user data from a single cell in a non-UK market from 2022 and is therefore not representative of the experience of users on VUK's network today.' (Parties response to Put Back).
[632] Vodafone internal document.
[633] Vodafone internal document.
[634] [✂]. (Vodafone internal document [✂]. Vodafone put back response (Appendix G: Capacity and Congestion).
[635] Vodafone internal document.
[636] Vodafone internal document.
[637] Vodafone internal document.
[638] Annex 4 to the Parties' response to the AIS and working papers.
[639] Annex 4 to the Parties' response to the AIS and working papers.
[640] Annex 4 to the Parties' response to the AIS and working papers.
[641] The Parties have not suggested that congestion prevents competition in other European markets – indeed they have referred to these markets as a comparator in their submissions that the UK is performing poorly eg on 5G rollout.

### VUK Network Investment

G.86 The Parties submitted that 'VUK's [✂]. VUK's [✂].'[642]

G.87 The Parties presented an analysis of VUK 5G rollout plans by Frontier Economics Figure G.18), [✂]. [643]

**Figure G.18: VUK number of 5G high band sites: forecast and actuals**

[✂]

*Source: Parties' initial submission.*

G.88 We note that, while this Figure shows that [✂].

G.89 Vodafone submitted that '[✂]'[644]

G.90 The Parties' PCEP1 submission states that 'VUK estimates that to address this [forecast] congestion, it would need to spend [✂].'[645]

G.91 This [✂] figure can also be considered in the context of VUK's overall CapEx. Vodafone states that 'VUK's network team identified that a capital expenditure budget of GBP [✂] would be necessary to undertake planned network investment activities and close the gap with the competition in terms of nationwide 5G coverage and network performance. [✂].'[646] The [✂] million which the PCEP1 states would be needed [✂] equates (in simple terms) to around GBP [✂]per annum, equivalent to a [✂]% uplift in its 2022 CapEx budget ([✂]) or around [✂] needed to '[✂]' ([✂]).[647]

G.92 A November 2022 [✂].[648] [✂]. The Parties submitted that '[✂].'

G.93 An October 2023 [✂]:

(a) '[✂];

(b) '[✂];

(c) [✂];

(d) [✂].[649]

[642] FMN.
[643] FMN.
[644] FMN.
[645] Parties' submission, The pro-competitive effects of the Vodafone/Three merger.
[646] FMN.
[647] FMN.
[648] Vodafone internal document.
[649] Vodafone internal document.

G.94 These documents indicate that VUK's 5GBR strategy is expected by VUK to have a significant benefit in controlling congestion.

G.95 The Parties submitted that the total cost that VUK would incur to bring congestion in line with its current target would be [✂], because in addition to the [✂] over FY25-FY34, [✂].[650]

G.96 We note that the increased Capex requirement submitted by the Parties is an output of the VUK capacity model prepared for the Merger, which generated a capex/opex uplift of GBP [✂] for RAN expenditure, with an assumed additional [✂] for core expenditure.[651] The period of the model extends well beyond VUK's business planning, and we have not seen evidence from internal documents that VUK [✂]. Rather, VUK's internal documents discuss [✂].

*5G SA and Advanced 5G*

G.97 The Parties submitted that VUK has started to build a 5G SA network, principally in London, Manchester, Glasgow and Cardiff. The Parties submitted that '[✂].[652] Branded '5G Ultra', the service was announced as 'the UK's first 5G Standalone mobile network for consumers'[653] Vodafone's website notes that: 'With 5G Ultra, the servers in the core network, as well as the RedStream fibre optic backbone connecting those servers to the masts and to the wider internet, will have been upgraded, too.'[654] We note that this description, and the description above of [✂], suggest that VUK [✂].

**VUK Network Performance**

G.98 RootMetrics reported VUK as having the second-highest scoring network after BTEE in the second half of 2023.[655] As shown in Figure G.19, 3UK replaced VUK at second place in the first half of 2024.[656] VUK currently has a similar score to 3UK on three of the seven metrics presented (accessibility, text and video (video is not included in the 2H 2023 table)). It has a lower score on speed, although RootMetrics reports VUK's UK-wide median download speed (at 42.8 Mbps) as being similar to 3UK's (44.5 Mbps), with BTEE leading (79.8 Mbps) and VMO2 trailing (23.3 Mbps).

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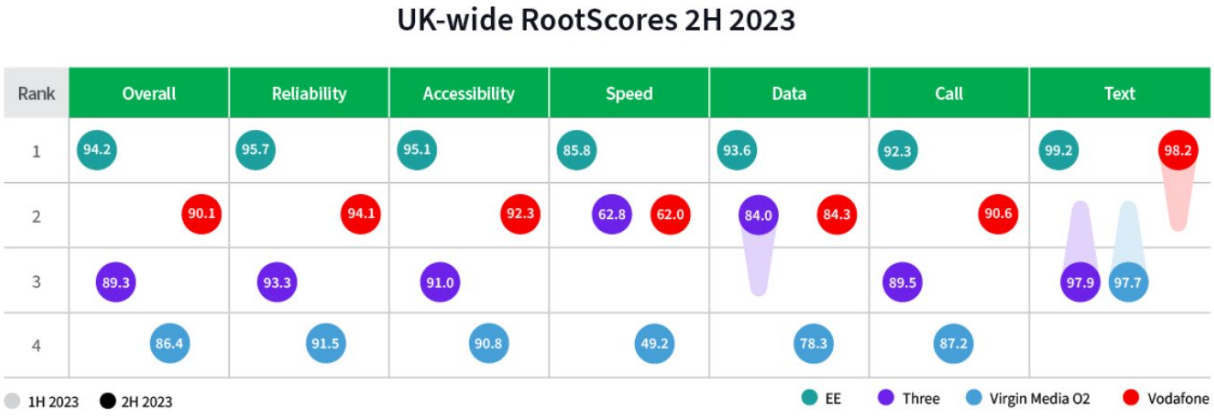
[650] Annex 4 to the Parties' response to the AIS and working papers. The Parties subsequently estimated the additional cost at [✂] (Parties response to the CMA's RFI.
[651] Parties' response to RFI 18, dated 17 July 2024, paragraphs 23.3 and 23.4.
[652] FMN.
[653] Vodafone Press release, 23 June 2023.
[654] 5G Ultra: Everything You Need To Know, June 2023. https://www.vodafone.co.uk/newscentre/smart-living/everything-you-need-to-know-about/what-is-5g-ultra/
[655] Rootmetrics, UK mobile performance review 2H 2023, accessed by CMA on 28 August 2024.
[656] RootScores are calculated using a proprietary algorithm. RootMetrics notes that: *'Because our methodology at times changes to reflect alterations in consumer behaviour, technology, and networks, you cannot directly compare a RootScore from one test period to a RootScore from another test period.'* *https://rootmetrics.com/en-GB/methodology* . Accessed by CMA on 28 August 2024.

**Figure G.19 RootMetrics Network Performance scores, 2H 2023**




*Source: Rootmetrics, UK mobile performance review 2H 2023, accessed by CMA on 28 August 2024.*

G.99 Umlaut's 2024 Mobile Network Test reports that: 'Vodafone reaches a good second place [after EE] and achieves the biggest score improvement over its previous year's results with a plus of 34 points. This makes Vodafone the most improved network in the UK this year and closes about 30 percent of the gap to EE. Vodafone showed the best voice performance in London and together with EE on the UK's roads. It is also local champion in Belfast and Leeds and shows good progress in its 5G rollout.'[657]

G.100 As set out in Figure G.11 and Figure G.12, based on Ofcom Connected Nations data, VUK has comparable 4G coverage to other operators in England and Northern Ireland, while its coverage in Wales and Scotland is behind BTEE but ahead of VMO2 and 3UK. Its 5G coverage is behind BTEE and 3UK, but ahead of VMO2.

### VUK Standalone Network - Summary

G.101 VUK's congestion levels currently appear to be at manageable levels, affecting around [✂] of cells on its network, across [✂] of sites. As with 3UK, [✂].[658] While modelling for the Parties suggests that congestion could increase over the coming years, this result is sensitive to modelling assumptions, and we have not seen any evidence from internal documents that VUK is [✂]congestion, nor that congestion is [✂]. Internal documents suggest that congestion is currently having [✂].

G.102 On third-party measures, VUK is relatively strong on coverage although it tends to be behind BTEE and 3UK on 5G. As noted above, Umlaut places it as the second-best network overall for 2024. RootMetrics results suggest that VUK has recently been overtaken by 3UK as the second-best UK network.

[657] Accenture, The 2024 mobile network test in the UK, accessed by the CMA on 2 September 2024.
[658] See Table G.4.

G.103 Internal documents indicate that [✂].

G.104 In our provisional view, we have not seen evidence, based on its internal documents, that VUK is currently facing, [✂], capacity constraints or congestion levels that would materially weaken its competitive positioning.

**Standalone networks: provisional view**

G.105 Our review of evidence from both 3UK and VUK indicates that network congestion is an issue for mobile networks, particularly affecting low frequency spectrum bands, which needs to be monitored and addressed on an ongoing basis. There is a trade-off in improving network capacity within capex/opex constraints. As regards the individual networks:

(a) [✂].

(b) VUK also appears to have recently improved its congestion levels, and in internal documents [✂]. We have not seen any evidence from internal documents that it is [✂] congestion, as indicated in the Parties' modelling in support of the Merger.

G.106 We have not seen any evidence from internal documents that 3UK or VUK sees capacity constraints as [✂]. This is to be expected as:

(a) Mobile networks have to date had to continually manage network capacity in the face of double-digit mobile traffic growth. The capacity implications of winning incremental market share are likely to be relatively limited in this context; and

(b) Congestion is particularly an issue for low band spectrum which typically serves traffic at the cell edge and/or in less populated areas – there is not a clear correspondence between an increased number of subscribers and increased congestion, as congestion appears to primarily affect the edge of the network, where there is more reliance on low band spectrum, and fewer users. In general, adding subscribers who are primarily based in high-traffic areas (often already served by C-band) will not necessarily have an effect on congestion at the cell edge of mid/low traffic areas.

G.107 As set out above, internal documents suggest that the main commercial motivations for managing/addressing congestion are (a) [✂], and (b) [✂]. We have not seen evidence from internal documents that 3UK or VUK [✂].

## Merged Entity Network

G.108 We consider here certain issues relating to the Parties' submissions that the Merger will result in rivalry-enhancing efficiencies by improving network quality and by increasing capacity.[659,660]

G.109 **Quality:** the Parties submit that '[t]he Transaction will provide a transformational uplift in terms of network KPIs [coverage, performance and reliability] and customer experience'. As a result 'MergeCo's best-in-class network will incentivise rivals (in particular BTEE and VMO2) to compete more effectively [on quality/investment and price]'.[661]

G.110 **Capacity:** The Parties submit that the Merged Entity will benefit from a 'transformational' capacity uplift of at least [✂]% compared to the standalone networks by [✂]. 'This means that MergeCo will face a very low incremental cost of adding additional customers to its base, which in turn will incentivise MergeCo to compete aggressively to fill that capacity. This will trigger a competitive response from rival MNOs in terms of both pricing and investment […] significantly enhancing competition in the UK mobile market compared with the counterfactual.'[662]

G.111 We consider each of these points in turn.

### Quality REEs

G.112 Quality improvements will generally benefit customers. However, in the present context we are specifically considering whether the Parties' claimed quality improvements will lead to a stronger competitive offer from the Merged Entity network relative to either of the standalone networks, helping them to win and retain customers, and also incentivising rivals to compete more effectively.

G.113 In 2022, Ofcom set out its view that competition between MNOs had driven the delivery of good outcomes for consumers over the previous ten years, and particularly that competition on quality has driven significant ongoing investment in mobile networks, including investment to increase capacity and, more recently, investment in 5G. Ofcom expected that competition would continue to play a key role in driving investment.[663]

G.114 We have considered the Parties' submissions on the following quality metrics:

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[659] Parties' initial submission, 1 May 2024, section 6.
[660] Note that the categories of quality-related and capacity-related REEs are set out here for ease of analysis – they are not clearly distinct in the Parties' submissions.
[661] Parties' initial submission, 1 May 2024, paragraph 6.3.
[662] Parties' initial submission, 1 May 2024, paragraph 6.11.
[663] Ofcom's Future approach to mobile markets and spectrum: Conclusions Paper, December 2022, paragraphs 3.11 and 4.1.

(a) 4G coverage;

(b) 5G coverage;

(c) Speed/throughput;

(d) Latency.

**4G coverage**

G.115 The Parties submitted that 'Despite the commercial challenges of achieving high levels of geographic coverage in rural and remote sites covering smaller residential populations, MergeCo is expected to reach [✂]% 4G geographic coverage by Year 3, significantly greater than the forecast 4G geographic coverage of both VUK and 3UK as standalone operators ([✂]% and [✂]% respectively at present)'.[664]

G.116 While we recognise that there is a benefit to increased 4G geographic coverage, we note that:

(a) Under the terms of the Shared Rural Network scheme, each of the four MNOs has committed to provide good quality data and voice coverage to 88% of the country's landmass by 30 June 2024, and 90% by 31 January 2027.

(b) The Parties' KPI assumptions for the quality-focused merger simulation model assume that the Parties' standalone 4G geographic coverage would be [✂]% (3UK) and [✂]% (VUK) in 2030, compared to [✂]% for the Merged Entity.[665]

(c) The increase to 94% (assuming MOCN is implemented) presented in the PCEP2 paper does not occur until Year 3, with a more limited uplift to 91% in Years 1 and 2.[666]

(d) While 3UK and VUK's geographic coverage was 81% and 84% respectively as of January 2024,[667] their coverage of premises was considerably higher ([✂]% each for premises with outdoor coverage; [✂]% (3UK) and [✂]% (VUK) for premises with indoor coverage).[668]

[664] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[665] Parties submission, Quality-focused merger simulation model.
[666] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[667] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[668] Ofcom Connected Nations data 2023, sheet "Mobile coverage UK and nations".

G.117 Having said that, we recognise that even in areas where there is coverage, the quality and reliability of the coverage can be variable or 'patchy' particularly in buildings and in rural areas. We recognise that the Merger has significant potential to deliver more reliable coverage and that this is likely to result in a better network experience for a significant number of customers, and potentially higher ratings in third-party metrics of network performance, which MNOs tend to advertise, and to see as an important aspect of competition. We consider this issue further in the discussion of site densification below (paragraphs 1.142 to 1.151).

**5G Coverage**

G.118 The Parties submit that 'MergeCo will be able to offer [✂]% of the UK population (in high traffic areas) the highest-quality 5G SA coverage by 2032 through its extensive C-band deployment. This surpasses coverage by VUK and 3UK's standalone networks by at least [✂] percentage points.'[669] The Final Merger Notice projects that, of 3UK's [✂] total 5G population coverage in 2032, [✂], and of VUK's [✂] total 5G population coverage in 2032, [✂].[670] We note that the Parties define high traffic areas based on where C-band is deployed so this differs between networks, so while the Merged Entity and 3UK [✂] 5G population coverage (VUK [✂]%) by 2032, for the Merged Entity [✂]% of this is 'high traffic' while for 3UK [✂]% is high traffic.

G.119 [✂].[671]

G.120 The Parties submitted that the Merger would deliver indoor C-band (ie 5G) coverage to 'many more' customers than the standalone networks Figure G.20.[672]

**Figure G.20: Forecast indoor C-band coverage 2032**

[✂]

*Source: Parties meeting slides.*

G.121 We recognise that there may be benefits from improved 5G indoor coverage, particularly as the majority of mobile use is indoors, although we note that:

(a) C-band is not the most suitable means of delivering indoor 5G coverage, which may leave consumers with poor indoor coverage in all or part of a building. Analysys Mason noted that: '…use of the 3.4-3.8 GHz band on its own will not offer a good level of indoor coverage, if deployed on outdoor

669 Parties' initial submission, 1 May 2024, paragraph 6.5.
670 FMN.
671 Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
672 Parties meeting slides.

macro cells (which has been the predominant deployment model of UK MNOs to date)'. [673]

(b) There is some uncertainty as to the value of 5G indoor coverage to customers. In the context of an award of 700 MHz and C-band spectrum, Ofcom considered that BTEE and 3UK were likely to remain strong competitors even if they did not acquire more low frequency spectrum. One of the reasons for this was that 'Indoor network coverage is just one factor considered by consumers when choosing a network provider, and provision of data-intensive services deep indoors (which is more likely to be impacted by a lack of low frequency spectrum) is very much a sub-set of consumers' concerns.'[674]

(c) Other means of delivering indoor data coverage are available, including WiFi:

(i) Ofcom has noted that: 'Where indoor coverage is poor or unreliable, other solutions can improve the user's experience. These include broadband-based voice or video calls on services such as WiFi calling, online communications services such as WhatsApp, or femtocell'.[675]

(ii) In the context of the 700 MHz and C-band award, VUK submitted to Ofcom that: '…indoor voice coverage levels are acceptable, and for indoor data there is a ready supply-substitute in the form of Wi-Fi using a fixed broadband connection.'[676]

(iii) Analysys Mason, in a report for the Spectrum Policy Forum, an industry body, commented that: 'We note that future in-building deployment of 5G could increasingly take place through Wi-Fi, or through deployment of indoor small cells, deployed either by MNOs or by third parties'.[677]

G.122 More generally, we note that 3UK has in recent years been competing strongly against BTEE to have the highest-performing 5G network. While the Merged Entity could deliver a high-quality 5G SA network, we expect that in the counterfactual all MNOs will also make some progress in rolling out their 5G provision in the coming years, including as they migrate their networks to 5G SA. As we discuss in paragraph G.97, VUK launched a limited 5G SA network in 2023, while 3UK's internal documents indicate that it is planning to do so in the coming years.

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[673] Analysys Mason, Review of spectrum market mechanisms, for Spectrum Policy Forum. Available for download from UK SPF Reports: Key insights into future spectrum policy (techuk.org).
[674] Ofcom, Award of the 700 MHz and 3.6-3.8 GHz spectrum bands, March 2020, paragraph 4.112.
[675] Ofcom's Connected nations UK report 2023, 19 December 2023.
[676] Vodafone Response to Ofcom Consultation: Award of the 700 MHz and 3.6-3.8 GHz spectrum bands, March 2019.
[677] Analysys Mason, Review of spectrum market mechanisms, for Spectrum Policy Forum. Available for download from UK SPF Reports: Key insights into future spectrum policy (techuk.org).

### Speed/throughput

G.123 The Parties submit that 'MergeCo will offer much greater speeds in the early years than either VUK or 3UK could on a standalone basis, with most of the speed improvement occurring by Year [✂].[678] Forecast average speeds for the Merged Entity and the standalone networks are set out in Table G.4.

**Table G.4 Parties' forecasts of the Merged Entity and Standalone Networks' average speeds in 2032**

| | *Merged Entity* | *3UK* | *VUK* |
|---|---|---|---|
| High traffic areas | [✂]Mbps | [✂]Mbps | [✂]Mbps |
| Mid/low traffic areas | [✂]Mbps (mid)<br>[✂]Mbps (low) | [✂]Mbps | [✂]Mbps |

*Source: FMN; Vodafone and CK Hutchison - Appendix 1 - Pro-competitive effects paper.*

G.124 Ofcom's Connected Nations Report uses the performance metrics and thresholds set out in Figure G.21 to assess mobile network performance.[679] The threshold for download speed is 10 Mbps. The Parties have noted that '…emerging use cases such as augmented and virtual reality […] require download speeds of 100 – 200 Mbps.'[680] The Parties also noted that 'Customers are particularly sensitive to the incidence of very low speeds, which lead to poor experiences such as noticeable wait times to load data-heavy websites and buffering on video streams.'[681]

**Figure G.21 Performance Metrics and Thresholds**

| | Download speed | Upload speed | Latency |
|---|---|---|---|
| Good | 2 Mbps | 0.5 Mbps | 100 ms |
| High | 5 Mbps | 1 Mbps | 50 ms |
| Very high | 10 Mbps | 2 Mbps | 30 ms |

*Source: Ofcom's Connected nations UK report 2023, 19 December 2023, table 3.2*

G.125 We have considered the impact of very low speeds on customer experience in our above assessment of congestion in the Parties' standalone networks. In the short-term demand for use cases such as augmented reality are still emerging, and these services are not widely used by mobile customers today. In the medium term, the Parties' forecasts for the standalone networks' average speeds appear sufficient to meet the required download speeds for these use cases, at least in high-traffic areas where the majority of demand is likely to be located. We recognise that having a denser network may allow the Merged Entity to deliver

[678] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[679] Ofcom's Connected nations UK report 2023, 19 December 2023,
[680] Parties' initial submission, 1 May 2024, paragraph 6.41.
[681] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.

better speeds in mid/low traffic areas which account for around 15% of mobile traffic, and this may be of value to customers in these areas, particularly if there is strong growth in demand for more data-intensive applications.

### Latency

G.126 The Parties submitted that 'MergeCo's latency [✂]. Low latency is an important enabler of applications that require enhanced quality such as mixed reality/gaming solutions or mission critical solutions for which millisecond delays cannot be tolerated, such as remote control of devices and machinery.'[682]

G.127 The Parties' forecast latency for the Merged Entity and the standalone networks are set out in Table A.1.

**Table G.5 Parties' forecasts of the Merged Entity and Standalone Networks' latency in 2032**

| | *Urban* | *Rural* |
|---|---|---|
| VUK | [✂]ms – [✂]ms | [✂]ms – [✂]ms |
| 3UK | [✂]ms – [✂]ms | [✂]ms – [✂]ms |
| The Merged Entity | [✂]ms – [✂]ms | [✂]ms – [✂]ms |

*Source: PCEP 2.*

G.128 We note that Ofcom's current threshold for 'very high performance' on latency is 30 milliseconds (see Figure G.21 above). The Parties' forecasts are that both standalone networks will be [✂] this threshold in high traffic areas in 2032, while VUK will [✂] this threshold in mid/low traffic areas. In addition, we note that [✂].

G.129 The applications for which latency is important are currently relatively niche (while latency is important for gaming, this often takes place over a broadband connection). As noted in Chapter 8, Third party evidence, among the Parties' competitors only three out of nine considered that latency was currently important to consumers when purchasing retail mobile services in the UK, and none said it was very important. As noted in Chapter 8, Table 8.1 and Table 8.2, only 2% of respondents to the CMA's UK population survey said that network response speeds for gaming was a reason for choosing their current provider and none said it was their main reason.

## Capacity REEs

G.130 The Parties' Capacity Uplift model uses the concept of a 'capacity unit' (CU), defined as the amount of capacity that can be provided by 10 MHz of 800 MHz spectrum (frequency division duplexing) which is normalised as 14 capacity units. The total number of capacity units at a site depends on the number of spectrum

[682] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.

bands deployed, and the spectral efficiency of each band (which tends to be higher for higher-frequency bands) given the MMIMO equipment deployed.

G.131 The model distinguishes between:

(a) 'Low traffic areas' [✂];

(b) 'Medium traffic areas', [✂]; and

(c) 'High traffic areas', [✂].

G.132 The modelled capacity at low traffic sites ([✂]) [✂]at mid-traffic sites ([✂]), which is in turn [✂] at high-traffic sites ([✂]). [✂].

G.133 As a result, [✂] ([✂]) of the modelled capacity uplift is in high traffic areas. In these areas, [✂] of the capacity uplift [✂]. In mid and low traffic areas combined, the Merged Entity is modelled as achieving a capacity uplift of [✂]compared to the standalone networks.[683]

G.134 This result reflects the fact that the model defines 'high traffic areas' as areas where C-band is deployed. As set out in Table G.5, [✂]. However, the Merged Entity has C-band deployed at [✂] sites, around [✂].

**Table G.6: Forecasts of Standalone and the Merged Entity network capacity in 2029**

| | *C-band deployed* | *Other* | *Total* |
|---|---|---|---|
| **#Sites** | | | |
| 3UK | [✂] | [✂] | [✂] |
| VUK | [✂] | [✂] | [✂] |
| Merged Entity | [✂] | [✂] | [✂] |
| **Capacity units per site** | | | |
| 3UK | [✂] | [✂] | |
| VUK | [✂] | [✂] | |
| Merged Entity | [✂] | [✂] | |
| **Total capacity units** | | | |
| 3UK | [✂] | [✂] | [✂] |
| VUK | [✂] | [✂] | [✂] |
| Merged Entity | [✂] | [✂] | [✂] |

*Source: [✂]*

G.135 As a comparator, based on Ofcom Connected Nations data, around [✂]% of 3UK traffic is carried on around [✂] sites where C-band is deployed, and which carry an average download traffic per site of around [✂] Pbs, while a further c. [✂]% is carried on an additional c.[✂]sites with a much lower average download traffic per site of around [✂]Pbs. 3UK currently deploys [✂] spectrum bands on these sites. Similarly, around [✂]% of VUK traffic is carried on around [✂] sites with an

[683] We understand that the Merged Entity would also continue to operate the non-integrated sites of the standalone networks, which would deliver additional capacity and network density to serve its customers. This capacity is not included in the Parties' Capacity Uplift model but would also provide some capacity, particularly in mid/low traffic areas. We consider the benefits of site densification in paragraphs 1.43 to 1.52 below.

average download traffic per site of around [✂] Pbs, while a further [✂]% is carried on around [✂] sites with average traffic of c. [✂]Pbs, again served by [✂] spectrum bands.

G.136 If we assume that, as of 2029, the Merged Entity would have a broadly similar distribution of sites across urban, suburban and rural areas, this would suggest that the Merged Entity would be deploying C-band at a large number of relatively low-traffic sites.[684] It is not clear that adding a very large amount of additional capacity – above that available to each of the standalone networks – on these sites would deliver a meaningful benefit as in many cases there would likely be sufficient capacity to meet demand from the standalone networks. While it is possible that 5G SA use cases could increase demand in these areas in the coming years, we would expect this to be at a lower level than in higher traffic areas where C-band is already deployed – again, the Parties do not expect to experience C-band congestion in these higher-traffic areas, at least for the next five years.

G.137 Next we consider the benefits – reflected in the capacity uplift model – of deploying a larger amount of spectrum per site in areas where the standalone networks would also be deploying all available spectrum in the counterfactual. The Parties have submitted that:

(a) VUK only expects to deploy its full spectrum holdings to around [✂] of its [✂] existing sites by [✂], of which only [✂] are expected to be congested at [✂] Mbps; and

(b) 3UK only expects to deploy its full spectrum holdings to around [✂] of its existing sites by [✂], of which only [✂] are expected to be congested at [✂] Mbps.[685]

G.138 We note that if the Parties will essentially have sufficient capacity in C-band spectrum at locations where this band is deployed, it is not clear that adding a large amount of additional C-band spectrum at these locations would result in a significant rivalry-enhancing efficiency.

G.139 Similarly, the Parties have said: ‘The Parties’ problem is not a lack of spectrum but the economics of deploying spectrum in the context of [✂]. This can clearly be seen in the context of their C-band spectrum deployment […]. In this context, acquiring additional spectrum would not help […].’ [686] The Parties go on to say that they do not expect the potential release of upper 6 GHz spectrum ‘to have a

[684] We note that subsequent upgrades would focus more on low/mid traffic areas.
[685] Annex 4 to the Parties’ response to the AIS and working papers.
[686] Annex 4 to the Parties’ response to the AIS and working papers.

meaningful impact on their ability to address congestion', in part because 'its use would realistically be limited to dense urban areas'.[687]

**Site densification**

G.140 While the Capacity Uplift model focuses on comparing the Merged Entity and standalone networks in 2029, the Parties plan to continue rolling out 5G in subsequent years, and in 2030 they model an increase in the number of the Merged Entity 5G sites[688] from [✂] to [✂].[689] The Parties note that while C-band will be deployed to only [✂]% of sites, 5G will be delivered over the full range of the Parties' spectrum frequencies.[690] Most of these additional sites (around [✂] out of [✂]) will be in low and mid traffic areas.[691]

G.141 The Parties submitted[692] that, although they 'currently face [✂] congestion on their C-band frequencies':

(a) [✂];

(b) [✂]:

(i) [✂] of user devices are not yet 5G capable;

(ii) Customers that are furthest away from their nearest site, towards the cell edge may not be able to access C-band spectrum, particularly at sites outside the denser urban areas.

(c) Densification will boost capacity in mid and low bandwidths and reduce inter-site distances.

(d) The Merged Entity will also densify to alleviate congestion in mid and low traffic areas.

G.142 Ofcom said it would expect a site densification of the level set out in the JBP to result in a notable improvement in network quality, particularly in areas where sites are less dense (which are more likely to be in the Mid and Low traffic areas) and in buildings. It noted that densification and C-band deployment in urban areas will provide a contiguous outdoors coverage layer in many cases and better indoor coverage with the high-capacity high-bandwidth and low-latency capabilities of 5G

[687] Annex 4 to the Parties' response to the AIS and working papers.
[688] The Capacity Uplift model calculates the MergeCo capacity based on [✂] sites, which is the number of MergeCo 5G sites in the Parties' planning – ie it does not include any non-5G sites within MergeCo – we understand these would be the non-integrated sites of the standalone networks, which would serve either VUK or 3UK customers but not both..
[689] Vodafone response to the CMA's s109 notice and CK Hutchison response to the CMA's s109 notice.
[690] Parties response to the CMA's RFI.
[691] Vodafone response to the CMA's s109 notice and CK Hutchison response to the CMA's s109 notice.
[692] Parties response to the CMA's RFI.

Standalone. Absent the densification, coverage with these capabilities is likely to be more patchy.[693]

G.143 In Ofcom's view, it is unlikely that the market would deliver any significant network densification absent the Merger because in most cases, particularly in low and mid traffic areas, it is more cost effective to improve performance by deploying more spectrum than by building more sites. Ofcom noted that few additional sites have been deployed on a commercial basis outside major urban areas (where new sites also provide valuable extra capacity), and the Government's Shared Rural Network intervention to improve coverage was done so on the basis that the market was unlikely to deliver coverage improvements in these areas.[694]

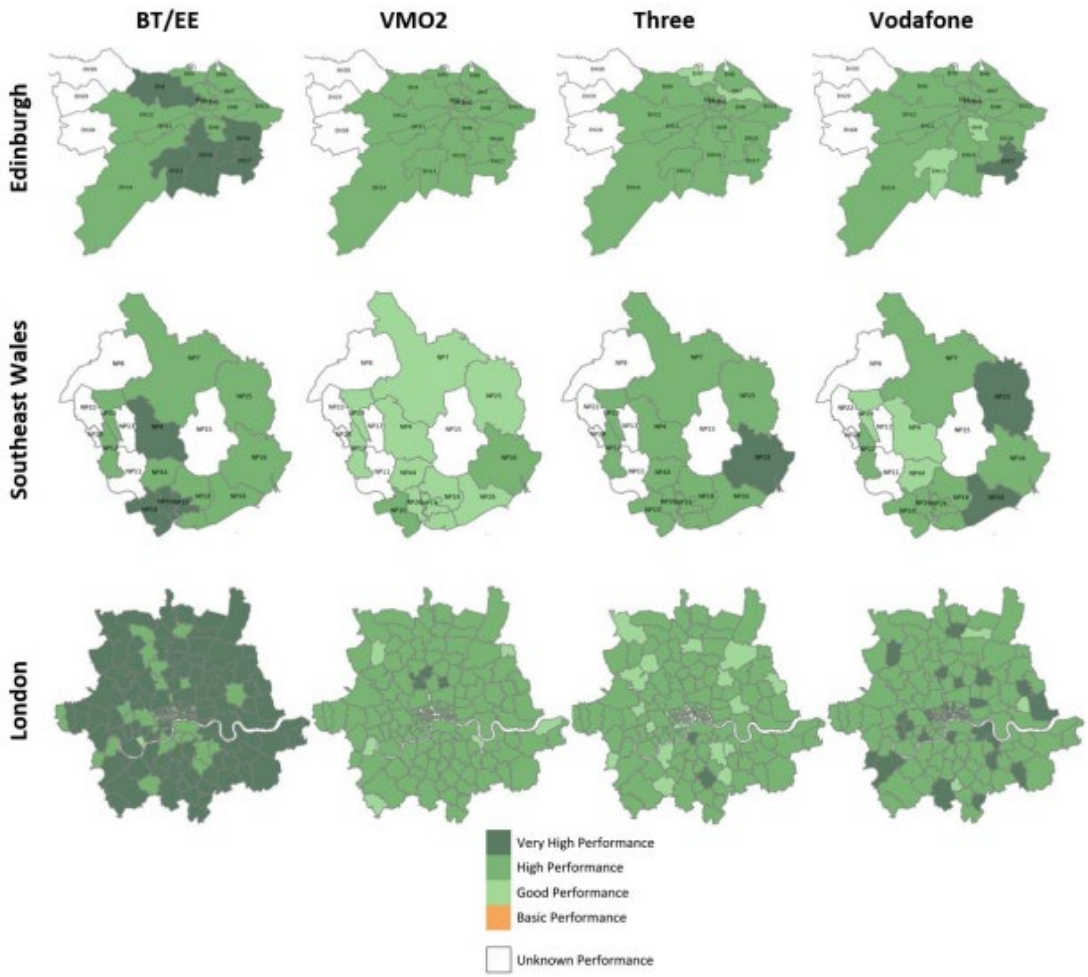
G.144 Given the limited evidence currently of customer willingness to pay a premium for services that rely on these 5G Standalone capabilities Ofcom considered it unlikely that MNOs would invest in densification for these purposes. Even if evidence of demand were to emerge, MNOs may not invest in the higher quality afforded by 5G Standalone on a dense site network if they consider that the appropriation of value from that demand may be limited by competitor response to negate any network quality advantage.

G.145 We note that the [✂]% capacity uplift, which has been central to the Parties' submissions in relation to the pro-competitive effects of the Merger, arises not from a denser network but from having more spectrum on a similar number of sites, particularly in 'high-density' areas (the Merged Entity is modelled as having a similar number of sites as each of the standalones up to 2029). Nevertheless, we recognise that greater site densification is likely to result in quality improvements which may not be fully captured in the model.

G.146 Ofcom's comments support the view that having a denser Merged Entity network has the potential to deliver a number of consumer benefits. However, we also note that: with regard to dense urban areas, (i) Ofcom Connected Nations data suggest that within urban areas where C-band is deployed, good performance appears to be available across the area (see Figure G.22 below), (ii) this is consistent with the Parties' suggestion above that access to C-band spectrum may be more of an issue at the edge of denser urban areas, and (iii) as we discuss in paragraph G.120 above, there is mixed evidence on whether indoor coverage is an important issue for the Parties' ability to compete.

[693] Ofcom, response to the CMA's 23 July 2024 letter.
[694] Ofcom, response to the CMA's 23 July 2024 letter.

**Figure G.22 5G performance in UK cities/locations**




*Source: Ofcom, Connected Nations Report, September 2023, figure 3.9.*

G.147 We also note Ofcom's views that there is limited current commercial impetus to densify networks, particularly outside densely populated areas. We also note that there may be scope for the standalone networks to improve their networks in mid/low traffic areas by deploying additional spectrum – for example, to date 3UK has not extensively deployed its 700 MHz spectrum outside dense urban areas.[695] Prior to the 700 MHz spectrum award, a 3UK '[✂]document noted that, [✂]. The main value of 700 MHz is identified as [✂]. Other benefits of 700 MHz are [✂].[696]

G.148 Taking the Parties' points in paragraph G.140 in turn, we note that:

(a) We have considered the Parties' submissions relating to congestion on their standalone networks in paragraphs G.38 to G.106 above;

(b) VUK currently has fewer than [✂] congested sites where C-band has been deployed (see Table G.4). While 3UK has around [✂] such sites (Table G.2)

[695] Ofcom response to the CMA's letter.
[696] CK Hutchison internal document.

it is making progress in addressing this issue through its congestion reduction programme.

(c) Even if some user devices are not 5G capable, C-band can relieve congestion on other bands at the same site by drawing away a substantial proportion of traffic, and this is evident from the lower low/mid-band congestion in the Parties' networks where C-band has been deployed. Moreover, the issue of non-5G capable handsets is likely to become much less important in the next few years as 5G handsets become the norm.[697]

(d) We recognise that greater site densification is likely to result in more reliable coverage in areas where coverage is currently patchy (in both urban and rural locations). The impact of densification in the longer term will depend on how many sites the Merged Entity retains. As explained in the efficiencies chapter, we consider that the Merged Entity may have incentives to reduce the number of sites post-Merger, particularly in low to mid traffic areas.

**Short-term benefits**

G.149 The Parties submitted[698] that 'MergeCo will deliver a significant reduction in congestion and a much better customer experience years before network integration has been completed:

(a) The largest capacity benefit will be delivered in the first year – the number of congested Merged Entity sites (measured using a 5 Mbps threshold during the busy hour) will fall by between [✂]% and the share of Merged Entity customers served by congested sites will fall by [✂] percentage points.' This results from:

(i) MOCN: 'use of MOCN from Day 1 will allow the Parties' customers to access the other Party's 5G C-band coverage in areas where the other Party does not have C-band coverage […], providing a significant Day 1 capacity boost[…];'

(ii) Spectrum sharing: '3UK customers will gain access to VUK's 1800 MHz spectrum, [✂]. This additional capacity can be immediately activated at virtually no cost to relieve congestion in many areas, including outside the major cities, which are currently served by 3UK's 3G and 4G networks ([✂])'; and

[697] A 3UK internal document indicates that around [✂]% of the 'handset base' will be 5G/C-band capable by 2026: The document states: 'Note: Capable handsets will need an OTA [over the air] update, so actual enabled numbers may be lower due to OTA availability / customer uptake'.
[698] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.

(iii) Site integration: more than [✂] sites will be integrated into the Merged Entity network in the first year alone ([✂] of them in high traffic areas), allowing customers of both Parties to gain access to all integrated sites, particularly in urban areas.

(b) 'Congestion is expected to continue to fall sharply over the early years as MergeCo deploys high-configuration equipment on most sites as they are integrated': by Year [✂], the number of congested Merged Entity sites will have fallen by [✂]% to approximately [✂] sites.

G.150 We consider each of these points in turn.

*MOCN*

G.151 In a meeting to respond to the phase 1 decision, VUK suggested that the implementation of MOCN would be near-instantaneous: '…there is clear evidence in terms of MOCN, multi-operator co-network, [✂] that allows each other's subscribers to use each other's network from day one, immediately.'[699]

G.152 We note that the Parties have offered differing accounts of the benefits from MOCN in different submissions. In the Final Merger Notice, use of MOCN is not presented as specific to C-band, and its initial benefits are presented as (a) elimination of 'not-spots' – ie an increase in geographic coverage, (b) energy savings relative to the energy consumption of the combined standalone networks, and (alongside 'refresh upgrades' to the RAN network) improved performance and reduced congestion.[700] In other words, coverage and energy savings were given more emphasis than capacity/congestion. In contrast, the PCEP2 paper cited above focuses on C-band (which is a 'capacity band' rather than a 'coverage band').

G.153 In addition, the PCEP2 paper notes that 'The Parties are currently determining the extent of 5G MOCN implementation' and presents key results with and without MOCN.[701] The Parties submitted that '5G Easy MOCN will be the subject of extensive testing by the Parties in order to enable them to maximise the benefits of the technology and to enable it to be implemented as soon as feasibly possible post-Transaction' and that the 'precise sites' on which 5G Easy MOCN will be implemented may vary from the Early Years model. The Parties submitted that they were 'fully confident that the benefits modelled for congestion relief in the Early Years Model will be delivered.'[702]

[699] Transcript of the Phase 1 Decision Meeting.
[700] FMN.
[701] Parties' submission, Network efficiencies and early years benefits (PCEP2).
[702] Parties response to the CMA's RFI.

G.154 We understand that MOCN would lead to some increase in geographic coverage but consider this is likely to be in areas where there is limited use of mobile connectivity. However, even if the impact of MOCN on overall coverage is limited, Ofcom told us that it would have a significant impact in reducing patchiness and therefore improve the quality of coverage. This is because even if both Parties technically have coverage in one area, obstacles or distance to the site may mean that the signal offered by one Party is unreliable.

G.155 We also consider that MOCN could have an impact on congestion. Where the Parties have deployed C-band they face no congestion on their network. We consider that the use of MOCN would therefore alleviate congestion where 3UK has deployed C-band and VUK has not, and vice-versa.

*Spectrum sharing*

G.156 3UK holds 2x15 MHz of 1800 MHz spectrum,[703] and VUK holds 2x5.8 MHz of spectrum in this band. We understand that VUK's smaller block of spectrum is less usable than a larger block would be, and because it is adjacent to 3UK's 1800 MHz spectrum, it could potentially be added to 3UK's holdings to create a 2x20.8 MHz block of spectrum.[704]

G.157 Ofcom submitted that: 'the addition of Vodafone's 1800MHz spectrum to Three's sites could play a significant role in alleviating congestion on 4G experienced by Three's customers'.[705] 'Three has 2x15MHz of 1800 MHz spectrum deployed across 13k of its sites which carries 100 PB of traffic (41% of Three's total traffic).[…] Vodafone has 2x5.8MHz of 1800MHz spectrum deployed on [✂] which carries negligible traffic, so this spectrum could be redeployed on Three's network with little impact on Vodafone's customers. In doing so we estimate it would add c.38% to Three's 1800MHz spectrum: sufficient to alleviate 4G congestion to a significant degree.'[706]

G.158 Ofcom told us that the addition of VUK's 1800MHz spectrum to 3UK's sites could play a significant role in alleviating congestion on 4G experienced by 3UK's customers. We understand this additional spectrum could help to alleviate 4G congestion in areas where 3UK is currently experiencing mid-band congestion, given the extent of traffic that 3UK carries on this band and the extent of unutilised

[703] FDD (frequency division duplexing) spectrum is packaged in paired blocks for uplink (eg uploading photos to a social media platform) and downlink (eg browsing the internet). In this case, 3UK has 30 MHz of 1800 MHz spectrum in total, of which 15 MHz is used for uplink and a separate block of 15 MHz is used for downlink.
[704] VUK's 1800 MHz spectrum is just below that of 3UK's: for uplink, VUK has 1715.9 MHz to 1721.7 MHz, while 3UK has 1721.7 MHz to 1736.7 MHz, while for downlink VUK has 1810.9 MHz to 1816.7 MHz, while 3UK has 1816.7 MHz to 1831.7 MHz. See Mobile and wireless broadband below 5 GHz - Ofcom
[705] Ofcom response to the CMA's 19 April 2024 letter.
[706] Ofcom response to the CMA's 19 April 2024 letter.

1800 MHz spectrum that VUK holds. However, we understand that it would not address congestion in low-band spectrum.

*Site integration*

G.159 We recognise that as the Merged Entity integrates the two standalone networks, customers of each network would benefit from access to the merged network. We note that the integration plan initially focuses on high-traffic areas, with [✂]% of the Merged Entity's planned future 5G sites in these areas in operation by FY27, compared to around [✂]% of sites in mid/low traffic areas.

# Glossary

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| **3UK** | Hutchison 3G UK Limited |
| **5G SA** | 5G Standalone – 5G networks which use a new 5G core network, rather than relying on the 4G core. Offers improved responsiveness and may enable innovative use cases. |
| the **Act** | The Enterprise Act 2002 |
| **A&R** | Acquisition and retention |
| **ARPU** | Average revenue per user |
| **AS** | Altman Solon |
| **Beacon** | Agreements through which VUK and VMO2 share active infrastructure. |
| **Beacon 4** | On 7 December 2023, VMO2 and the Parties signed Heads of Terms to set out intentions as to the on-going operation of Beacon (the suite of proposed amendments are referred to as 'Beacon 4') |
| **Beacon 4.1** | On 3 July, 2024, Vodafone UK and Virgin Media O2 have agreed to extend and enhance their existing mobile network sharing agreement |
| **BTEE** | BT Group plc |
| **BTL** | Below the line (in this context, 'below EBIT', largely equivalent to operating profit) |
| **CACM** | Congestion-adjusted contribution margins |
| **CAGR** | Compound annual growth rate |
| **capex** | Capital expenditure |
| the **Cellnex Transaction** | Cellnex acquisition of the passive infrastructure assets of CK Hutchison and its subsidiaries in the UK (including 3UK) |
| **CK Hutchison** | CK Hutchison Holdings Limited |

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| **CMA** | Competition and Markets Authority |
| **CMA129** | Merger Assessment Guidelines (CMA129) |
| **CMA2(revised)** | Mergers: Guidance on the CMA's jurisdiction and procedure, January 2021 (as amended on 4 January 2022) |
| **CMA UK population survey** | A UK general population survey undertaken by the market research agency DJS Research |
| **CMA customer survey** | A survey of the Parties' customers undertaken by the market research agency DJS Research |
| the **CMA surveys** | One was a general population survey and the second polled a random sample of VUK and 3UK customers |
| **CMP** | Change management process |
| **Contribution A** | Contribution margins including only the revenue and cost categories identified |
| **Contribution B** | Contribution margins incorporating only the additional cost categories submitted by the Parties assessed to be variable with subscriber volumes, based on the principles discussed |
| the **Contribution Agreement** | On 14 June 2023, Vodafone and CK Hutchison entered into a contribution agreement relating to the establishment of a joint venture. Pursuant to the terms of the Contribution Agreement, on completion, CK Hutchison will hold 49% of the issued share capital of Vodafone UK Trading Holdings Limited, the joint venture vehicle which is currently indirectly wholly owned by Vodafone; Vodafone will hold 51% of the issued share capital of this entity; and each of VUK and 3UK will sit as a wholly-owned subsidiary of this entity. |
| **CSI** | Commercially sensitive information |
| **CTIL** | Cornerstone Telecommunications Infrastructure Ltd. A 50/50 joint venture concerning passive infrastructure between |

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| | Vodafone (through its subsidiary Vantage Towers) and VMO2. |
| **CWP** | Consolidated Works Programme |
| **DSIT** | Department for Science, Innovation and Technology |
| **ECA / NCA** | Extended Coverage Area / Non-extended Coverage Area |
| **EE** | Everything Everywhere |
| **ESG** | Environmental, social, and governance |
| **eSIM** | Embedded-SIM |
| **FMC** | Fixed-mobile convergence |
| **FMN** | Final Merger Notice |
| The **FMEV Threshold** | The fair market enterprise value threshold |
| **FTTP** | Fibre to the premise |
| **FWA** | Fixed wireless access |
| **FY** | Financial year. In the context of discussing Vodafone and VUK, this means the year ended on 31 March. For CK Hutchison and 3UK, this means the year ended on 31 December |
| **FY24 LRP** | Forecast plans for Vodafone set in Spring 2023 |
| **FY25 LRP** | Forecast plans for Vodafone set in Spring 2024 |
| **GB** | Gigabytes |
| **GUPPI** | Gross Upwards Pricing Pressure Index |
| **GVA** | Gross value added |
| **H1'24** | The first half of FY24 |
| **IMD** | Index of Multiple Deprivation |
| **IoT** | Internet of things |

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| The **inquiry group** | A group of CMA panel members |
| **JBP** | Joint Business Plan (which incorporates the JNP) |
| **JNP** | Joint Network Plan |
| **JV entity** | Pursuant to the terms of the Contribution Agreement, on completion, CK Hutchison will hold 49% of the issued share capital of Vodafone UK Trading Holdings Limited, the joint venture vehicle which is currently indirectly wholly owned by Vodafone |
| **KPI** | Key performance indicator |
| **MAGs** | Merger Assessment Guidelines |
| the **MBNL Arrangements** | T-Mobile and 3UK entered into a Cooperation Agreement, Transition Agreement, Facilities and Network Sharing Agreement, and an Interpretation Agreement |
| **mbps** | Megabytes per second |
| **MD** | Managing director |
| the **Merged Entity** | For statements referring to the future, the Parties' UK telecoms businesses are together referred to as the Merged Entity. |
| the **Merger** | that the anticipated joint venture between Vodafone and CK Hutchison that will combine their UK telecoms businesses, respectively VUK and 3UK |
| **MES** | Minimum efficient scale |
| **MIMO** | Multiple-input and multiple-output – a mobile antenna system with a large number of transmit/receive elements, improving capacity, speed and reliability. |
| **mMIMO** | Massive MIMO – a MIMO system with a large number of antennas. |
| **mmWave** | Millimetre wave – the range of spectrum above 24 GHz but below 100 GHz. Includes the 26 |

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| | GHz and 40 GHz bands which Ofcom plans to award for 5G mobile provision in 2025. |
| **MNO** | Mobile Network Operator |
| **MNP** | Mobile Number Portability |
| **MOCN** | Multi-operator core network – a technology that allows two or more core networks to share the same RAN. |
| **MORAN** | multi-operator radio access network |
| **MPN** | Mobile Private Network |
| **MRG** | Minimum revenue guarantee |
| **MSP** | Multiple Site Provider |
| **MVNA** | Mobile Virtual Network Aggregator |
| **MVNE** | Mobile Virtual Network Enabler |
| **MVNO** | Mobile Virtual Network Operator |
| **NetCo** | A network level joint venture |
| **NPS** | Net promoter score |
| **NPV** | Net present value |
| **NSA 5G** | Non-standalone 5G |
| **NTQ** | Notice-to-quit |
| **OFCF** | Operating free cash flow |
| **opex** | Operating expenditure |
| **OS** | Operating system |
| **Party** | Vodafone and CK Hutchison are each a **Party** |
| the **Parties** | Vodafone and CK Hutchison |
| **PAYG** | Pay as you go |
| **PAYM** | Pay monthly |

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| **PAYM handset** | Where the user buys both their airtime and handset from a mobile provider |
| **PAYM SIMO** | Where the user buys their airtime from a mobile provider and uses it with a separately acquired handset |
| **PCEP1** | Parties' submission, The pro-competitive effects of the Vodafone/Three merger. |
| **PD** | Ofcom Provider Database |
| **Pure pricing data** | Pure Pricing tariff data available on a monthly basis from January 2019 until present |
| **Q9 documents** | Documents received in response to question 9 of the FMN |
| the **retail market** | The supply of retail mobile telecommunications services to end consumers, including both consumers and business customers in the UK |
| **RAN** | Radio access network |
| **REEs** | Rivalry-enhancing efficiencies |
| **RFI** | Request for information |
| **RMS** | Relevant merger situation |
| **ROCE** | Return on capital employed |
| **SBS** | Scaled back scenario |
| **Scenario 3** | The Parties state that the key results of the quality-focused model are contained in the 2030 merger simulation with cost and quality efficiencies |
| **SIs** | Systems Integrators |
| **SIMO** | SIM-only |
| **SLC** | Substantial lessening of competition |
| **SoHo** | Small office / home office |
| **SRN** | The Shared Rural Network scheme |

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| **STA** | Spectrum Transfer Agreement |
| **T-Mobile** | T-Mobile (UK) Limited |
| **TTWA** | Travel to work areas produced by the ONS |
| **UFCF** | Unlevered free cash flow |
| **UK** | United Kingdom |
| **V_FY** | Vodafone's reporting year-end, i.e. the year ended 31 March. For example, V_FY23 means the year ended 31 March 2023 |
| **VMO2** | VMED O2 UK Limited |
| **Vodafone** | Vodafone Group plc |
| **VUK** | Vodafone Limited |
| **WACC** | Weighted average cost of capital |
| the **wholesale market** | the supply of wholesale mobile telecommunications services in the UK |
| the **Wireless Infrastructure Strategy** | This strategy sets out a policy framework to help deliver the government's priority of growing the economy and to ensure the UK benefits from advances in wireless connectivity for the next decade |
| **YTD** | Year-to-date |