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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.

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 On 13 September 2024, we notified our Provisional Findings and a non-confidential version of our Provisional Findings report was published on the inquiry webpage on 16 September 2024. As we 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, we also published a Remedies Notice on the inquiry webpage.

B.17 Following signing of the relevant confidentiality ring undertakings required to protect confidential information, the confidential version of the Provisional Findings report was disclosed to certain of the Parties' external advisers on 13 September 2024.

B.18 Between 3 October 2024 and 5 November 2024 we published a number of non-confidential responses to our Provisional Findings report and Remedies Notice on the inquiry webpage.

B.19 We held response hearings with Vodafone and CK Hutchison on 8 and 9 October 2024 respectively. After publishing our Provisional Findings report we also conducted remedies hearings and calls with a number of third parties, including Ofcom, the sector regulator, and issued a number of requests for information.

B.20 On 5 November 2024 we published our Remedies Working Paper on the inquiry webpage, setting out a detailed assessment of the different remedies options and our provisional decision on remedies. The confidential version of the Remedies Working Paper was disclosed to certain of the Parties' external advisers on the same day, inside the confidentiality ring.

B.21 Between 15 November 2024 and 20 November 2024, we published a number of non-confidential responses to our Remedies Working Paper on the inquiry webpage.

B.22 A non-confidential version of the Final Report has been published on the inquiry webpage.

B.23 We would like to thank all those who have assisted our inquiry.

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 response to the CMA's s109.
[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 for [✂].[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 it [✂].[15] CK Hutchison submitted [✂], and demonstrates that [✂].[16] We note that this demonstrates CK Hutchison and 3UK discussing [✂] within current budgets, following growth momentum in particular businesses lines which they are economically incentivised to support.

C.7 Discussing some of these documents as set out in our Provisional Findings, CK Hutchison submitted:

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[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.
[16] Parties' response to the Provisional Findings, 4 October 2024, Annex 1, paragraph 4.24(c).

(a) In respect of the 2022 document,[17] that [✂][18] [✂].[19] CK Hutchison further submitted [✂]. [20]

(b) In respect of the 2023 document,[21] CK Hutchison submitted that these comments had been taken out of context, that [✂], and – considering 3UK's [✂].[22]

C.8 We consider that a range of factors – including (as mentioned by CK Hutchison) [✂] – are likely to influence capital expenditure plans. However, we nonetheless consider that this evidence demonstrates some influence of [✂] in CK Hutchison's plans for 3UK. This may be expected in the context of CK Hutchison and 3UK [✂]. We also consider that – given 3UK's budget process is [✂] – it is unlikely that 3UK's implementation of its budget, once set, is [✂].

3UK's [✂]

C.9 We have found evidence that [✂] with the aim of [✂]. We see this for example in [✂],[23] and in documents relating to [✂].

(a) A document prepared in July 2021, appearing to discuss early 'synergies' expectations for the Merger, discussed [✂], being [✂].[24]

(b) A document referencing an [✂],[25] contemplated in 2020, [✂].[26] This document also references 3UK's [✂].[27]

C.10 We have also seen evidence of 3UK's [✂].

(a) 3UK's budgeting documents over recent periods indicate [✂],[28] [✂].[29]

(b) [✂],[30] [✂].[31]

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

[17] Referring to CK Hutchison internal document.
[18] Parties' response to the Provisional Findings, 4 October 2024, Annex 1, paragraph 4.24(a).
[19] Parties' response to the Provisional Findings, 4 October 2024, Annex 1, paragraph 4.24(a).
[20] Parties' response to the Provisional Findings, 4 October 2024, Annex 1, paragraphs 4.24(a) – 4.24(b).
[21] Referring to CK Hutchison internal document.
[22] Parties' response to the Provisional Findings, 4 October 2024, Annex 1, paragraphs 4.24(d).
[23] Forecasts developed [✂]. [✂]. (CK Hutchison internal document). Updated projections [✂] (see CK Hutchison internal document).
[24] CK Hutchison internal document.
[25] [✂].
[26] CK Hutchison internal document.
[27] Commentary in this document [✂]. CK Hutchison internal document.
[28] For example, [✂]. CK Hutchison internal documents.
[29] An internal document shows [✂]. CK Hutchison internal document.
[30] For example, [✂]. CK Hutchison internal documents.
[31] 3UK's [✂]. CK Hutchison internal document.

(i) In December 2023, [✂].[32]

(ii) In May 2023, [✂].[33]

3UK's expectations of future financial performance

C.11 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 [✂].[34]

(b) 3UK's long term forecast [✂]. [✂],[35] [✂], [36] [✂]. [✂].[37]

(c) 3UK's current five-year plan, [✂]. [✂][38] [✂].[39]

(d) In response to our Provisional Findings, CK Hutchison submitted that the CMA should not rely [✂].[40] We consider CK Hutchison's comments on 3UK's areas of growth in Chapter 8, and observe that available evidence of 3UK's achieved performance in FY24 largely demonstrates that it has continued to see growth, and has performed in line with many of its expectations. We nonetheless recognise that 3UK is likely to face challenges as a result of its relative size and scale, and expect that this would influence the level of investment and network performance that 3UK would deliver absent the Merger (as compared to the JBP).

VUK

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

C.12 Regarding VUK's expectations of future ROCE (as compared to WACC) performance we see evidence in its internal documents that VUK [✂]. More

[32] CK Hutchison internal documents.
[33] CK Hutchison internal document.
[34] CK Hutchison internal document.
[35] This is based on 3UK's achieved FY23 figures (shown in Parties' response to the phase 1 Issues Letter) and projected FY24 performance. CK Hutchison internal document [✂].
[36] A 3UK internal document shows [✂]. [✂]. CK Hutchison internal documents.
[37] CK Hutchison internal document [✂].
[38] TSA means the Telecommunications Security Act 2021, as described at CK Hutchison response to the CMA's RFI.
[39] Parties' response to the CMA's RFI.
[40] Parties' response to the Provisional Findings, 4 October 2024, Annex 1, paragraphs 4.28.

recently, as set out in Chapter 8, VUK's recent financial performance, [✂] paragraph C.15) [✂].

(a) Vodafone's [✂], dated March 2020, [✂].[41]

(b) An update [✂] in November 2020, setting out a review of financial and strategic updates, set out that VUK was [✂].[42]

(c) Vodafone's [✂], dated March 2021, [✂].[43]

(d) A VUK [✂] from October 2021, summarised that [✂]. [✂].[44]

(e) Vodafone's [✂], dated March 2022, outlined that [✂]. [✂].[45]

(f) Vodafone's March 2023 [✂] noted that VUK was [✂].[46]

(g) Another March 2023 [✂], noted that VUK's [✂]. [✂].[47]

C.13 We have also found evidence that VUK considers itself [✂] and [✂] in the consumer mobile segment:

(a) [✂], written in January 2021, from [✂] discusses the [✂].[48] It mentions [✂]. The [✂] discusses that, [✂], VUK is [✂]. [✂].

(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 [✂];[49]

(ii) In a February 2021 document, VUK discusses the advantages of other market participants [✂], and that it [✂].[50]

(iii) Another document from around this time (February 2021) discusses that [✂] and explores [✂].[51]

[41] Vodafone internal document. We note that Vodafone's performance reviews of VUK as set out in certain internal documents cited below [✂]. [✂]. Our review of evidence relating to this, informing our view, is set out later in this appendix.
[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.
[50] Vodafone internal document.
[51] Vodafone internal document.

(iv) A later document, prepared in March 2023, also discusses a [✂], who [✂].[52]

(v) Another document dated in 2023 [✂].[53]

VUK's perceptions of its growth performance

C.14 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 [✂];[54]

(ii) The same commentary is made in a document from October 2022 [✂];[55]

(iii) The same graph updated for [✂] subsequently in April 2023, [✂].[56]

(b) This is consistent with Vodafone's perspective of [✂]. For example, Vodafone's [✂], which [✂].[57]

Vodafone's treatment of [✂]

C.15 In response to our Phase 1 Decision and Working Papers, Vodafone submitted that our consideration of VUK's financial performance [✂] should include [✂].

C.16 In response to this, we clarified our understanding of [✂]:

(a) We confirmed with Vodafone that [✂]. [58] [✂].

(b) We reviewed Vodafone's LRP documents over recent periods, and note that these suggest that it generally does not consider [✂] paragraph C.12 [✂]. More recently, it has considered [✂].[59]

(c) We note that Vodafone's submissions of VUK's management accounting [✂], suggesting that Vodafone and VUK's perspective of VUK's performance, in the ordinary course of business, does not take these into account.[60]

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

[52] Vodafone internal document.
[53] Vodafone internal document.
[54] Vodafone internal document.
[55] Vodafone internal document.
[56] Vodafone internal document.
[57] Vodafone internal document.
[58] Vodafone response to the CMA's RFI.
[59] Vodafone internal document.
[60] Vodafone response to response to the CMA's s109 notice.

appearing to make significant efforts to explain the need for/ benefit of [✂] to CK Hutchison.[61]

C.17 Following our publication of Provisional Findings, Vodafone made further submissions in respect of [✂], and told us that:

(a) [✂].[62]

(b) [✂] if VUK did not [✂]. [63]

C.18 We note however Vodafone currently provides services [✂]. We therefore consider it appropriate, in the context of this review, to consider VUK's financial performance as overwhelmingly presented across its internal documents (ie on the basis of [✂]).[64]

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

C.19 As also set out in Chapter 8, overall, we consider that:

(a) 3UK documents show that it does, in some cases, [✂]. It also [✂]. It has seen a [✂], although 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.20 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'.[65]

C.21 VMO2's internal documents suggest that it also views operating scale as an important factor in providing a competitive mobile offering. For example:

[61] Vodafone internal documents; CK Hutchison internal document.
[62] Parties' response to the Provisional Findings, 4 October 2024, Annex 1, paragraph 4.46(a).
[63] Parties' response to the Provisional Findings, 4 October 2024, Annex 1, paragraph 4.47.
[64] Parties' response to the CMA's RFI [✂].
[65] BTEE internal document.

(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 [✂].[66]

(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 [✂].[67]

(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 [✂].[68]

C.22 Overall, we 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.23 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.24 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.25 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

[66] VMO2 internal document.
[67] VMO2 internal document.
[68] VMO2 internal document.

customers' perception of it – including to roll out NSA 5G at pace in certain areas.[69]

VUK

C.26 Vodafone's internal documents also convey [✂]. [✂] including as priorities both the [✂] together with the [✂].[70] [✂].[71]

C.27 The Parties submitted that the CMA mischaracterised VUK's internal documents relating to its network ambitions. The Parties submitted that VUK's internal documents convey [✂] 5G rollouts, including the fact that VUK's [✂].[72] In more detail, the Parties submitted that:[73]

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

(b) [✂]; and

(c) There is [✂].

C.28 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.[74] In this document, [✂].[75] This document shows that, as of [✂].[76]

C.29 Despite VUK's several [✂] in its 5G rollout plans, such as aiming for [✂], [77] it remains that VUK's internal documents indicate its ambition and strategy [✂],[78] which the Parties accept in their submissions.[79] Further, we have not found evidence in Vodafone's internal documents to suggest that [✂] has hampered its ability to meet its customers' needs. In response to our Provisional Findings the Parties' submitted that there are internal documents that show that [✂] has hampered its ability to meet its customers' needs.[80] However, the internal documents quoted by the Parties do not clearly link these two points, rather they

[69] For example, CK Hutchison internal documents. See also CK Hutchison internal document.
[70] Vodafone internal documents.
[71] Vodafone response to the CMA's RFI; Vodafone internal document; and see also 'VUK launches 5G Ultra, the UK's first 5G Standalone mobile network for consumers', June 2023, accessed by the CMA on 1 December 2024..
[72] Annex 1 to the Parties' response to the AIS and working papers and Parties' response to the Provisional Findings, 4 October 2024, Annex 1, paragraphs 5.27-5.30.
[73] Annex 1 to the Parties' response to the AIS and working papers; Vodafone internal documents.
[74] Vodafone internal document.
[75] Vodafone internal document.
[76] Vodafone internal document.
[77] Vodafone internal document.
[78] For example, Vodafone internal documents.
[79] Annex 1 to the Parties' response to the AIS and working papers.
[80] Parties' response to the Provisional Findings, 4 October 2024, Annex 1, paragraph 5.35.

broadly relate to addressing future customer needs and how VUK compares to other operators in the market.[81]

Third parties' documents

BTEE

C.30 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 geographic coverage' and '5G population coverage'. The document states that BT Group 'continue to prioritise [✂].[82]

(b) An [✂] states that BTEE's consumer priority is [✂]. The document sets out goals to achieve this, such as to [✂].[83]

(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'.[84]

C.31 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 [✂]. [✂].[85]

(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 [✂].[86]

(c) The [✂] states that BTEE's [✂] through EE's [✂] BT's strategy [✂].[87]

(d) A [✂] outlines key risks on the consumer risk register, with [✂].[88]

(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

[81] See, for example, Vodafone internal document.
[82] BTEE internal document.
[83] BTEE internal document.
[84] BTEE internal documents.
[85] BTEE internal document.
[86] BTEE internal document.
[87] BTEE internal document.
[88] BTEE internal document.

than 3UK's (based on having reliable network coverage, the largest network, the fastest network, and being the best for 5G), and is [✂].[89]

C.32 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 [✂].[90]

(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, 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 [✂].[91]

C.33 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 [✂].[92]

(b) A [✂] states that [✂].[93]

(c) A [✂] states that BTEE [✂]. The document further states that BTEE's strategy includes [✂] and to [✂] though being the [✂].[94]

(d) The [✂] also shows that BT Group [✂]. For example, the document states that [✂]. It also states that [✂].[95]

(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 [✂].[96]

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

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[89] BTEE internal document.
[90] BTEE internal document.
[91] BTEE internal document.
[92] BTEE internal documents.
[93] BTEE internal document.
[94] BTEE internal document.
[95] BTEE internal document.
[96] BTEE internal document.

(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.35 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 and [✂] ranked second by four network research providers, and states that [✂]. The document further states that VMO2's [✂], and that for VMO2 [✂].[97]

(b) The 'Strategic Plan' dated 21 June 2023 states that VMO2's [✂] and [✂].[98]

(c) An internal document dated 27 November 2023 on '4G / 5G Investment' states that [✂], showing that VMO2 is [✂]. The document outlines a [✂].[99]

(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 [✂].[100]

C.36 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 [✂].[101]

(b) A Board Meeting document from 1 March 2022 states that VMO2 'will [✂]', with [✂]. The document also states that [✂] in their networks due to [✂].[102]

(c) An internal document dated 5 April 2022 titled 'State of the Sector Q4-21', by [✂], states that [✂].[103]

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[97] VMO2 internal document.
[98] VMO2 internal document.
[99] VMO2 internal document.
[100] VMO2 internal document.
[101] VMO2 internal document.
[102] VMO2 internal document.
[103] VMO2 internal document.

(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 [✂].[104]

C.37 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 [✂].[105]

(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 [✂].[106]

(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 [✂].[107]

(d) The 'Strategic Plan' dated 21 June 2023 shows that VMO2 considers [✂] and additional [✂] is required [✂].[108] For example:

(i) [✂].

(ii) [✂].

(iii) [✂].

(iv) [✂].

C.38 Overall, we 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.

[104] VMO2 internal document.
[105] VMO2 internal document.
[106] VMO2 internal document.
[107] VMO2 internal document.
[108] VMO2 internal document.

Perceptions of other MNOs' network quality

Parties' documents

C.39 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.

Third party documents

BTEE

C.40 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'.[109]

(b) A [✂] states that while BTEE [✂].[110]

C.41 A BT Group [✂] states that 'UK MNOs pursue different strategies: [for example] [✂]'.[111]

C.42 Overall, we 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.43 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 [✂].[112]

(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 [✂].[113]

[109] BTEE internal document.
[110] BTEE internal document.
[111] BTEE internal document.
[112] VMO2 internal document.
[113] VMO2 internal document.

(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 [✂].[114]

C.44 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 [✂]. [✂].[115]

C.45 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 [✂].[116]

(b) A VMO2 internal document dated 25 October 2021 for a Board meeting, [✂] is said to have the [✂], [✂] is considered the [✂] and 3UK a [✂].[117]

C.46 Overall, we 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.47 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.[118]

(b) Another document notes 'VMO2 performance isn't keeping up with other MNOs' and 'VMO2 network performance is lagging behind MNOs'.[119]

[114] VMO2 internal document.
[115] VMO2 internal document.
[116] VMO2 internal document.
[117] VMO2 internal document.
[118] Sky Mobile internal document.
[119] Sky Mobile internal document.

C.48 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'.[120]

Post-Merger network investment strategies

Parties' documents

C.49 Evidence from the Parties' internal documents relating to post-Merger network investment strategies is discussed in Chapter 10. The corresponding evidence from third parties' internal documents is discussed below.

Third parties' documents

BTEE

C.50 BTEE's internal documents suggests that it considers [✂].

(a) The [✂] the Merger as [✂].[121]

(b) A BTEE [✂] states that 'a merger [between VUK and 3UK] would create a new market leader based on mobile connections / spectrum assets'.[122]

(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 [✂]. [123]

(d) The [✂] sets out BT Group's [✂]. It states that it needs to [✂] between the merged company and others'.[124]

(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 [✂])'.[125]

[120] Sky Mobile internal document.
[121] BTEE internal documents.
[122] BTEE internal document.
[123] BTEE internal documents.
[124] BTEE internal document.
[125] BTEE internal document.

(f) An internal document dated [✂] states that [✂] BTEE's [✂] if the 3 / Voda[fone] merger goes ahead [✂]' and that 'the joined forces could be [✂].'[126]

C.51 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 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 [✂].[127]

(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'.[128]

(c) [✂] also set out BT Group's [✂].[129]

(d) The [✂] provides a Board update on the Merger. For example:[130]

(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 [✂].[131]

C.52 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.[132]

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[126] BTEE internal document.
[127] BTEE internal document.
[128] BTEE internal document.
[129] BTEE internal documents.
[130] BTEE internal document.
[131] BTEE internal document.
[132] BTEE internal document and BTEE email.

(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 'does nothing to tackle the underlying barriers to investment', that it 'would raise prices' and that 'there's no focus on customer service'.[133]

C.53 Overall, we consider that most of BTEE's internal documents indicate that BTEE considers that if the Merged Entity were to challenge [✂]. BTEE would consider [✂].

VMO2

C.54 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 [✂].[134]

(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.'[135]

C.55 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 [✂].[136]

(b) An internal document dated 25 January 2024 on mobile investment options states that the [✂] and that [✂].[137]

(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 [✂].[138]

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[133] BTEE internal document.
[134] VMO2 internal document.
[135] VMO2 internal document.
[136] VMO2 internal document.
[137] VMO2 internal document.
[138] VMO2 internal document.

C.56 Overall, we consider that VMO2's internal documents indicate that:

(a) VMO2 considers [✂]; and

(b) It considers that [✂].

Retail

C.57 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.58 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.59 In a document from January 2022, 3UK sets out the three pillars to its commercial strategy in the consumer retail segment, which include [✂].[139] Further in this presentation, 3UK elaborates on how it intends to [✂] – [✂].[140] [✂].[141] [✂],[142] [✂].[143]

C.60 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 [✂].[144]

C.61 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

[139] CK Hutchison internal document.
[140] CK Hutchison internal document.
[141] CK Hutchison internal document. Also, CK Hutchison internal document.
[142] CK Hutchison internal document.
[143] For example, CK Hutchison internal documents.
[144] CK Hutchison internal document. Also, CK Hutchison internal documents.

against that of [✂]. For example, in a document dated [✂]. [✂], the document states that [✂].[145] In the same document, [✂].[146]

C.62 Finally, we found a number of internal documents that [✂].[147] For example:

(a) [✂].[148] [✂];[149]

(b) [✂];[150] and

(c) [✂].[151]

C.63 The Parties submitted that [✂].[152] We consider that, in the round, 3UK's internal documents show that its pricing strategy is primarily aimed at competing with MNOs, [✂].[153]

C.64 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 [✂].[154] [✂].[155]

(b) In August 2022, 3UK provided [✂].[156] 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 [✂].[157] [✂]. [158]

Business

C.65 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.[159]

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[145] CK Hutchison internal document.
[146] CK Hutchison internal document.
[147] [✂].
[148] CK Hutchison internal document.
[149] CK Hutchison internal document.
[150] CK Hutchison internal document.
[151] CK Hutchison internal document.
[152] Parties' response to the phase 1 Issues Letter.
[153] CK Hutchison internal document.
[154] CK Hutchison internal document.
[155] CK Hutchison internal document.
[156] CK Hutchison internal document.
[157] CK Hutchison internal document.
[158] CK Hutchison internal document.
[159] FMN.

C.66 We found evidence in 3UK's internal documents of ambitious growth plans in the business retail segment, going [✂]. For example:

(a) [✂].[160]

(b) [✂].[161]

(c) [✂].[162] [✂].[163]

C.67 3UK's growth plans in the [✂] subsegment are further evidenced [✂].[164] [✂].[165]

C.68 [✂].[166] [✂].[167]

SMARTY

C.69 In August 2017, 3UK launched a digital sub-brand, SMARTY, which offers hybrid pre-paid services and had approximately [✂] subscribers as of September 2023.[168]

C.70 In 3UK's recent internal documents, the SMARTY brand is identified as an area of [✂].[169] [✂].[170]

C.71 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, [✂].[171]

(b) In a January 2022 document, 3UK identifies establishing and growing the SMARTY brand as one of the 3UK strategies it will implement to [✂].[172] To reach its objective of growing SMARTY, [✂].[173]

[160] CK Hutchison internal document.
[161] CK Hutchison internal document.
[162] CK Hutchison internal document.
[163] CK Hutchison internal document.
[164] CK Hutchison internal document.
[165] CK Hutchison internal document. Also, CK Hutchison internal document.
[166] CK Hutchison internal document.
[167] CK Hutchison internal document. Also, CK Hutchison internal document.
[168] FMN.
[169] For example, CK Hutchison internal document.
[170] CK Hutchison internal document. Also, CK Hutchison internal document.
[171] CK Hutchison internal document.
[172] CK Hutchison internal document.
[173] CK Hutchison internal document.

C.72 The [✂] role of SMARTY in 3UK's competitive strategy is further emphasised [✂][174] [✂].[175]

FWA

C.73 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, [✂].[176]

C.74 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) [✂].[177] [✂].[178]

(b) [✂].[179]

C.75 3UK's internal documents indicate that FWA has continued to be a strong focus throughout [✂]. For example:

(a) [✂],[180] [✂].[181]

(b) [✂][182] [✂].[183]

C.76 [✂].[184]

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

C.77 3UK's internal documents discussing its network investment strategy are discussed in paragraph C.25 above.

Customer experience

C.78 We also found evidence in 3UK's internal documents that improvements to customer experience has been another area of focus [✂].[185]

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[174] FMN.
[175] CK Hutchison internal document.
[176] FMN.
[177] CK Hutchison internal document.
[178] CK Hutchison internal document.
[179] CK Hutchison internal document.
[180] [✂]. See CK Hutchison internal document.
[181] CK Hutchison internal document.
[182] The CMA understands this refers to FWA [✂].
[183] CK Hutchison internal document.
[184] CK Hutchison internal document.
[185] For example, CK Hutchison internal documents, and CK Hutchison internal document.

C.79 [✂].[186]

C.80 In their submissions, [✂]. [✂].[187]

Brand reputation

C.81 The Parties acknowledged in their submissions that all mobile operators compete on branding, undertaking considerable investments to support their brands and presence in the supply of retail mobile services, and gave the example of 3UK sponsoring Gogglebox.[188] [✂].[189]

C.82 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) [✂].[190] [✂].[191]

(b) [✂].[192] [✂].[193]

VUK's competitive strategy

Challenging the converged players

C.83 [✂].[194]

C.84 [✂].[195] [✂].[196] [✂].[197] [✂].[198] [✂].[199] [✂].[200]

C.85 [✂].[201] [✂].[202]

Business

C.86 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

[186] CK Hutchison internal document.
[187] FMN.
[188] FMN.
[189] CK Hutchison internal document.
[190] CK Hutchison internal document.
[191] CK Hutchison internal document.
[192] CK Hutchison internal document.
[193] CK Hutchison internal document.
[194] Vodafone internal documents.
[195] Vodafone internal document. Also, Vodafone internal documents.
[196] Vodafone internal document.
[197] Vodafone internal document.
[198] Vodafone internal document.
[199] Vodafone internal document.
[200] Vodafone internal document. Also, Vodafone internal document.
[201] Vodafone internal document.
[202] Vodafone internal document.

it to meet the needs of larger business customers (public sector, corporate and medium SMEs).[203]

C.87 [✂].[204] [✂].[205] [✂].[206]

C.88 [✂],[207] [✂].[208]

Network ambitions

C.89 VUK's internal documents discussing its network strategy are discussed in paragraphs C.26 – C.29 above.

Pricing strategy

C.90 [✂].[209] [✂].[210] [✂].[211]

C.91 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 [✂],[212] while another notes that VUK considered that because BTEE is [✂].[213] VUK considered [✂],[214] but [✂][215] noting it [✂].[216] [✂].[217]

Third party documents

BTEE

C.92 BTEE's internal documents relating to its network strategies are discussed in paragraphs C.30 – C.34 above. In this section we discuss its wider competitive strategy in retail.

C.93 Internal documents from BTEE show that it positions itself at a premium to the rest of the market in most subsegments. [✂]. For example:

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[203] FMN.
[204] For example, Vodafone internal documents.
[205] Vodafone internal document.
[206] Vodafone internal document.
[207] [✂] Vodafone internal documents.
[208] Vodafone internal documents.
[209] For example, Vodafone internal documents.
[210] For example, Vodafone internal document.
[211] Vodafone internal document.
[212] Vodafone internal document.
[213] Vodafone internal document.
[214] Vodafone internal document.
[215] Vodafone internal document.
[216] Vodafone internal document.
[217] Vodafone internal document.

(a) An internal document dated [✂] states that the [✂].[218]

(b) An internal document dated [✂] states that for [✂], BTEE [✂]. The document [✂].[219]

(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 [✂]. [220]

C.94 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:[221]

(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 [✂].[222]

(ii) An internal document dated [✂].[223]

(iii) A [✂] states that [✂]. The document states that this [✂]. [224]

(iv) An internal document dated [✂] for the BT Group [✂].[225]

(c) A [✂]. BTEE is doing this by [✂].[226]

C.95 Internal documents also show that BTEE [✂], for example MNOs implementing similar inflation-linked price rises.

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[218] BTEE internal document.
[219] BTEE internal document.
[220] BTEE internal document.
[221] BTEE internal document.
[222] BTEE internal document.
[223] BTEE internal document.
[224] BTEE internal document.
[225] BTEE internal document.
[226] BTEE internal document.

(a) A [✂] states that [✂]. The document also states that as this is the [✂] and that BT Group [✂].[227]

(b) The internal document [✂] for the BT Group [✂]. It states that [✂] and that [✂].[228]

(c) A [✂] acknowledges that [✂].[229]

C.96 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 [✂].[230]

(b) An internal document [✂] shows different BT Group [✂]. [✂].[231]

(c) The [✂] states that [✂].[232]

C.97 Overall, we 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.98 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 [✂].[233]

(b) A 'Consumer Mobile Strategy' internal document dated 9 September 2021 states that [✂], stating that [✂] strategy is [✂], [✂] strategy is an [✂], and

[227] BTEE internal document.
[228] BTEE internal document.
[229] BTEE internal document.
[230] BTEE internal document.
[231] BTEE internal document.
[232] BTEE internal document.
[233] VMO2 internal documents.

[✂] strategy is to be [✂]. The document further states that [✂] and that since [✂]. [✂].[234]

(c) A monthly CEO update dated 23 October 2023 states that VMO2's focus in mobile is [✂].[235]

(d) A Board Meeting document dated 1 March 2022 states that VMO2's [✂], with [✂].[236]

(e) A VMO2 'Strategic Plan' dated 21 June 2023 outlines VMO2's brand portfolio strategy. This includes wanting to target [✂].[237]

(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 [✂].[238]

C.99 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 £[✂] to £[✂]) because [✂], and future treatment plans include another [✂] in 2024 which [✂].[239]

C.100 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 [✂].[240]

(b) A monthly CEO update dated 22 February 2023 shows VMO2 monitoring announcements in the mobile sector, such as '[✂]', that [✂], and that [✂].[241]

(c) A VMO2 'Strategic Plan' dated 28 May 2023 states [✂].[242]

C.101 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)

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[234] VMO2 internal document.
[235] VMO2 internal document.
[236] VMO2 internal document.
[237] VMO2 internal document.
[238] VMO2 internal document.
[239] VMO2 internal documents.
[240] VMO2 internal documents.
[241] VMO2 internal document.
[242] VMO2 internal document.

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 that EE had a revenue gain over £[✂] by 2023. The document states that [✂].[243]

(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 [✂].[244]

(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 [✂].[245]

(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 [✂].[246]

C.102 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 [✂].[247]

(b) An internal document dated 12 December 2022 on [✂].[248]

(c) A monthly CEO update dated 19 January 2024 sets out VMO2's [✂]. [✂].[249]

(d) An internal document dated 2 February 2024 on 'customer issues that impact corporate stakeholders & reputation' [✂].[250]

[243] VMO2 internal document.
[244] VMO2 internal document.
[245] VMO2 internal document.
[246] VMO2 internal document.
[247] VMO2 internal document.
[248] VMO2 internal document.
[249] VMO2 internal document.
[250] VMO2 internal document.

C.103 A ‘Price Rise Review’ dated 6 February 2024 sets out VMO2’s [✂]. [✂].[251]

C.104 A VMO2 [✂] dated 23 April 2024 shows [✂]. [✂].[252]

C.105 VMO2’s internal documents relating to its network strategies are discussed in paragraphs C.35 – C.38 above. In this section we discuss its wider competitive strategy in retail.

C.106 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 [✂].[253]

(b) A Board Meeting document dated 1 March 2022 states that [✂]. [✂].[254]

(c) The ‘Strategic Plan’ dated 21 June 2023 states that [✂]. [✂].[255]

C.107 Overall, we 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.108 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 [✂].

(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

[251] VMO2 internal document.
[252] VMO2 internal document.
[253] VMO2 internal document.
[254] VMO2 internal document.
[255] VMO2 internal document.

selling and upselling customers to higher tariffs through tiered pricing and extra data offers. [✂].[256]

(b) Another internal document notes that it aims to grow its subscriber base by balancing pricing competitiveness with its costs, which are based on customer data usage, such that its profitability varies by tariff due to the average customer utilisation of the data allowance.[257]

(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'.[258]

(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. [✂].[259]

C.109 Sky Mobile also uses its 'Piggybank' offering as a competitive differentiator, where it allows customers to roll over unused data allowances.[260] Sky Mobile announced the reduction of the time period customers could roll the data over from 3 years to 1 year in April 2024.[261]

C.110 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 [✂].[262]

(b) A market research document from Q1 2022 notes that 'Increased data bundle sizes (including growth of unlimited) [✂]'.[263]

(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 [✂]'.[264]

C.111 We consider that Sky Mobile's documents show that its competitive strategy is to drive sustainable growth through balancing price competitiveness with its cost structure [✂].

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[256] Sky Mobile internal document.
[257] Sky Mobile internal document.
[258] Sky Mobile internal document.
[259] Sky Mobile internal document.
[260] Sky Mobile internal document.
[261] Sky Mobile internal document.
[262] Sky Mobile internal document.
[263] Sky Mobile internal document.
[264] Sky Mobile internal document.

Closeness of competition and competitive constraints

C.112 We first present evidence from the Parties' internal documents and then third parties' internal documents on the closeness of competition and competitive constraints.

Parties' internal documents

Evidence from 3UK's internal documents

C.113 We carried out a systematic review of 3UK's [✂],[265] [✂].[266] We also observed this in another category of competitive monitoring documents produced by 3UK, [✂].[267]

C.114 3UK consistently benchmarks itself against the performance of other MNOs having regard to a wide range of metrics ([✂]).[268]

Pricing

C.115 The evidence from 3UK's internal documents shows that the price positioning of the other MNOs plays a critical role in terms of [✂].[269]

C.116 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 [✂].[270] Further:

(a) [✂].[271]

(b) [✂].[272]

C.117 In its most recent cross-brand pricing principle update from January 2024, 3UK sets out its [✂].[273] The same document notes that the [✂] to include [✂] due to its [✂], which we understand refers to [✂].[274]

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[265] [✂] FMN.
[266] For example, CK Hutchison internal documents.
[267] For example, CK Hutchison internal documents.
[268] For example, CK Hutchison internal documents.
[269] For example, CK Hutchison internal documents.
[270] For example, CK Hutchison internal documents.
[271] CK Hutchison internal document.
[272] CK Hutchison internal document.
[273] CK Hutchison internal document.
[274] CK Hutchison internal document.

C.118 This was followed in March 2024 by an update to SMARTY-specific [✂].[275] [✂].[276] [✂].[277]

Market initiatives

C.119 We found some evidence of 3UK having particular regard to the competitive impact of its new market initiatives, [✂]. For example, [✂].[278] [✂].[279] [✂].[280]

C.120 In terms of promotional activity and spend, our view is that 3UK primarily monitors campaigns initiated by [✂].[281] For the purposes of tracking [✂].[282]

Business segment

C.121 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.[283]

C.122 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) [✂].[284]

(b) [✂].[285]

(c) [✂].[286] [✂].

C.123 3UK's internal documents relating to the business retail segment do not feature MVNOs as part of the competitive landscape.

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[275] CK Hutchison internal document.
[276] CK Hutchison internal document.
[277] CK Hutchison internal document.
[278] FMN and CK Hutchison internal document.
[279] CK Hutchison internal document.
[280] CK Hutchison internal document.
[281] CK Hutchison internal documents.
[282] CK Hutchison internal documents.
[283] 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.
[284] CK Hutchison internal document.
[285] CK Hutchison internal document.
[286] CK Hutchison internal document.

MVNOs

C.124 We have found in some categories of 3UK internal documents references to a [✂]. [✂].[287] [✂].[288]

C.125 In an August 2022 presentation entitled [✂] are listed as 'key competitors' to [✂] (ie not independent MVNOs).[289] The same document shows that in terms of '[✂] offers none of those listed on the slide and [✂].[290]

C.126 In an October 2022 [✂], 3UK discusses in response to [✂].[291]

C.127 In response to the Parties' submission [✂],[292] we note that:

(a) [✂].

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

Evidence from VUK's internal documents

C.128 We carried out a systematic review of [✂]. [✂].[293] [✂] [294] [✂].[295]

C.129 Similarly to 3UK, VUK consistently benchmarks itself against the performance of other MNOs having regard to a wide range of metrics ([✂]).[296]

C.130 We [✂]. In the same slide, [✂] include [✂]. [✂] is shown on the slide as [✂].[297]

Pricing

C.131 The evidence from VUK's internal documents shows that the price positioning of the other MNOs plays a critical role in terms of [✂].[298]

C.132 We carried out a systematic review of all [✂]. [✂]:

(a) [✂].[299]

(b) [✂].[300]

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[287] CK Hutchison internal documents.
[288] CK Hutchison internal document.
[289] CK Hutchison internal document.
[290] CK Hutchison internal document.
[291] CK Hutchison internal document.
[292] Annex 1 to the Parties' response to the AIS and working papers.
[293] [✂].
[294] Vodafone internal documents.
[295] Vodafone internal documents.
[296] For example, Vodafone internal documents.
[297] Vodafone, internal documents.
[298] For example, Vodafone internal documents.
[299] For example, Vodafone internal documents.
[300] For example, Vodafone internal documents.

(c) [✂].[301]

C.133 The extent of the competitive constraint exercised by 3UK [✂]. For example:

(a) [✂];[302]

(b) [✂];[303]

(c) [✂];[304]

(d) [✂],[305] [✂];[306] and

(e) [✂].[307]

Market initiatives

C.134 As part of their documentary evidence, [✂]:[308]

(a) [✂];

(b) [✂]; and

(c) [✂].

C.135 [✂].[309] [✂].[310]

C.136 [✂].[311]

C.137 [✂].[312]

C.138 [✂].[313]

[301] Vodafone internal document.
[302] For example, Vodafone internal documents
[303] Vodafone internal document.
[304] Vodafone internal document.
[305] Vodafone internal document.
[306] Vodafone internal document.
[307] For example, Vodafone internal documents
[308] FMN; Vodafone internal document and Annex 1 to the Parties' response to the AIS and working papers. The CMA has not sought to confirm or reproduce this analysis.
[309] Vodafone internal document.
[310] Vodafone internal document.
[311] Vodafone internal document.
[312] Vodafone internal document.
[313] Vodafone internal document.

Business segment

C.139 With regard to current competition, we have found several references in VUK's internal documents [✂].[314] [✂].[315] [✂].[316]

C.140 Internal documents also suggest that VUK [✂]. For example, [✂].[317] [✂].[318] [✂].[319] [✂].[320]

C.141 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, [✂].[321] [✂].[322]

C.142 We found some infrequent references in VUK's internal documents to 3UK entering the corporate and public sector subsegments. [✂].[323] [✂].[324]

C.143 VUK's internal documents contain references to BTEE being [✂] important competitor in the business retail segment. For example, [✂].[325] [✂].[326] [✂].[327] [✂].[328]

C.144 VUK's internal documents relating to the business retail segment do not feature MVNOs as part of the competitive landscape.

MVNOs

C.145 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 [✂].[329]

C.146 Regarding the internal VUK [✂] documents highlighted by the Parties to [✂],[330] we note that:

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[314] Vodafone internal documents.
[315] Vodafone internal document.
[316] 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.
[317] Vodafone internal document.
[318] Vodafone internal document.
[319] Vodafone internal document..
[320] Vodafone internal document.
[321] Vodafone internal document.
[322] Vodafone internal document.
[323] Vodafone internal document.
[324] Vodafone internal document.
[325] Vodafone internal document.
[326] Vodafone internal document.
[327] For example, Vodafone internal documents.
[328] Vodafone internal document.
[329] Vodafone internal document.
[330] Annex to Parties' initial submission; and Vodafone internal documents.

(a) With the exception of [✂].

(b) In relation to [✂].

C.147 Further, the internally commissioned research, [✂] of January 2024, [✂].[331] [✂].[332] The Parties submitted that [✂].[333] However, we observe [✂].

C.148 The same document contains [✂] which highlights that [✂]. [✂].[334] Finally, we observe that [✂].[335] 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.149 As also set out in Chapter 8 in the evidence from the Parties' internal documents section, we 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 [✂], [✂]and [✂]) 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).

[331] Vodafone internal document.
[332] Vodafone internal document.
[333] Annex 1 to the Parties' response to the AIS and working papers.
[334] Vodafone internal document.
[335] The Parties submitted that [✂].

Third parties' documents

Competitive positioning

C.150 Documents discussing the different competitive position of mobile operators in relation to network quality are discussed in paragraphs C.40 – C.48.

C.151 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 intensive industry' with 'low marginal costs', and that there are 'players with different value chain positions'. The document also states that [✂].[336]

(b) The BTEE [✂] dated [✂] states that 'UK MNOs pursue different strategies: [✂]. The document also states that [✂].[337]

C.152 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'.[338]

(b) The [✂] states that MVNOs are [✂].[339]

(c) A BT Group internal document [✂] shows that [✂]. Despite this, the document still shows that BT Group [✂].[340]

(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'.[341]

[336] BTEE internal document.
[337] BTEE internal document.
[338] BTEE internal document.
[339] BTEE internal document.
[340] BTEE internal document.
[341] BTEE internal document.

C.153 Another BTEE internal document also shows that [✂]. [✂] shows BTEE monitoring [✂], the [✂]. The document states that [✂].[342]

C.154 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: [343]

(i) [✂];

(ii) [✂];

(iii) [✂];

(b) A VMO2 Executive Committee pre-read dated 12 August 2022 states that [✂].[344]

C.155 VMO2 internal documents also show that [✂] is [✂]. For example:

(a) The VMO2 'Consumer Mobile Strategy' dated 9 September 2021 describes [✂] as a [✂]. [✂].[345]

(b) The VMO2 'Strategic Plan' dated 21 June 2023 states that [✂].[346]

C.156 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.[347]

C.157 Overall, we 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

[342] BTEE internal document.
[343] VMO2 internal document.
[344] VMO2 internal document.
[345] VMO2 internal document.
[346] VMO2 internal document.
[347] Sky Mobile internal documents.

(c) [✂] is [✂] and [✂].

Price competition

C.158 BTEE's internal document [✂], sets out monthly consumer ARPUs (average revenues per user) for different mobile operators, and shows that [✂].[348]

C.159 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 [✂].[349]

(b) An internal document dated [✂] for the BT Group [✂] sets out [✂]. The document explains that BTEE [✂]. However, it also noted that [✂].[350]

(c) An [✂] states that [✂]. The document also states that [✂].[351]

(d) A BT Group [✂].[352]

C.160 A VMO2 monthly CEO update dated 19 April 2024 sets out a comparison of [✂]. The document shows that:[353]

(a) [✂];

(b) [✂];

(c) [✂].

C.161 A VMO2 monthly CEO update dated 19 April 2024 shows VMO2 [✂] its [✂]. For example:[354]

(a) [✂];

(b) [✂];

(c) [✂].

[348] BTEE internal document.
[349] BTEE internal document.
[350] BTEE internal document.
[351] BTEE internal document.
[352] BTEE internal document.
[353] VMO2 internal document.
[354] VMO2 internal document.

C.162 A VMO2 'Price Rise Review' dated 6 February 2024 states that VMO2 implemented [✂].[355]

C.163 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 <£10 price range, by 45% in the £15-20 price range, and by 80% in the >£20 price range. The document also states that the 'PAYG [ie pre-paid] market [is] growing with low MVNO pricing'.[356]

(b) The [✂] states that MVNOs are 'hyper competitive at low end SIMO price points' because they have 'no ROI [return on investment] requirement[s]'.[357]

(c) The BTEE [✂] states that the value segment is a growing share of the consumer retail segment, and that [✂] for example because [✂].[358]

(d) A BTEE internal document dated [✂] assesses the external context for mobile dynamics, and states that the [✂]. [✂].[359]

(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.'[360]

C.164 A VMO2 monthly CEO update dated 19 April 2024 shows VMO2 [✂]. It shows that [✂]. Specifically, the document shows that:[361]

(a) [✂];

(b) [✂];

(c) [✂].

C.165 Sky Mobile's documents also show it monitors the prices of, and its performance against, both MNOs and MVNOs (most notably Tesco Mobile).

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[355] VMO2 internal document.
[356] BTEE internal document.
[357] BTEE internal document.
[358] BTEE internal document.
[359] BTEE internal document.
[360] BTEE internal document.
[361] VMO2 internal document.

(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 [✂].[362]

(b) Another document includes Sky Mobile monitoring all four MNOs (including some of their sub-brands) and Tesco Mobile expected 2024 price increases.[363]

(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'.[364]

C.166 Overall, we consider that third party internal documents relating to price competition indicate that third parties consider that:

(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.167 [✂]'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 [✂].[365]

(b) A [✂] states that [✂], citing VUK and 3UK as an example of in-market consolidation, [✂].[366]

(c) [✂] states that [✂].[367]

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[362] Sky Mobile internal document.
[363] Sky Mobile internal document.
[364] Sky Mobile internal document.
[365] [✂]internal document.
[366] [✂] internal document.
[367] [✂] internal document.

C.168 Some [✂] internal documents show that [✂].

(a) [✂] reports [✂], stating that it [✂].[368]

(b) A [✂] and sets out [✂].[369]

(c) [✂] both state in regard to the 'Vodafone internal restructure & merger [with respect to] Three' that [✂].[370]

C.169 [✂] one [✂] states that '[✂]'.[371]

C.170 Overall, we 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 [✂].

[✂]

C.171 [✂] internal documents show [✂].

(a) An internal document dated [✂] for the [✂].[372]

(b) An internal document dated [✂] for [✂].[373]

(c) A 'UK M&A Opportunities Update' dated [✂] states [✂].[374]

(d) A [✂] dated [✂] sets out [✂].[375]

(e) A monthly CEO update dated [✂] states [✂].[376]

C.172 An internal document dated [✂] assesses 'Mobile Market Opportunities' open to the [✂]. [✂].[377]

C.173 Overall, we 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 [✂].

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[368] [✂] internal documents.
[369] [✂] internal document.
[370] [✂] internal documents.
[371] [✂] internal document.
[372] [✂] internal document.
[373] [✂] internal document.
[374] [✂] internal document.
[375] [✂] internal document.
[376] [✂] internal document.
[377] [✂] 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, absent efficiencies. The CMA's modelling uses an estimated demand model to flexibly capture subscriber preferences for mobile services. We then simulate the price effects of the Merger absent efficiencies based on the model.

D.2 In undertaking the analysis presented in this appendix the CMA benefited from discussions with Ofcom and the CMA's academic advisor in econometrics. Additionally, we have taken into account the Parties' response to the Provisional Findings.[378] These comments and discussions have informed the analysis described throughout this appendix.

D.3 The main results of the CMA's exercise are the following:

(a) Consumers' valuations of tariff features vary across individuals. Consumers value 4G download speed and 4G network coverage - key aspects of current network quality.[379] The results of the model predict that subscribers also value aspects of 5G network quality (download speed) less than 4G aspects of network quality, however consumers do not value other aspects of 5G network quality such as upload speed and coverage. One potential reason for the low willingness to pay for 5G is that 5G network quality may be less commonly experienced by consumers than 4G speeds (eg because some consumers do not have a 5G-enabled phone, there are still limited use cases 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 5.5% for 3UK and 2.6% for VUK with smaller rises for rivals. The overall welfare loss to UK consumers implied by these price rises is approximately £216 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.

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[378] Parties' response to the Provisional Findings, 4 October 2024, Annex 4.
[379] In this appendix, when we refer to a consumers experience of 'speed', we mean the average speed measured in a consumer's local travel to work area. Similarly, by a consumers experience of 'coverage' we refer to this as the coverage measured within a consumer's local travel to work area (See the data section for details).

(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.4 This rest of this appendix sets out:

(a) the datasets we use;

(b) the demand estimation and its results;

(c) our merger simulation and sensitivity analysis; and

(d) a summary of our conclusions.

Data

D.5 To estimate a model of subscriber demand in the UK retail market the CMA uses four datasets:

(a) **Ofcom Provider Data (PD):** Provided by Ofcom, this is a 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 June 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 chosen 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.[380] 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 100x100 metre pixel level for each network in the UK. We have this data for 2022 and May and September 2023.[381] This data is used to compute the 4G and 5G coverage associated with each network.

[380] More information can be found at the providers website Mobile & Broadband Pricing Consultants | Pure Pricing, accessed by the CMA on 3 September 2024.
[381] 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.

(d) **Opensignal**: 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.6 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.7 Ofcom's PD is an individual subscriber choice database containing the tariffs subscribers purchased and used in the period January 2022 to June 2023. [382] 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.8 The PD 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.[383] 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.9 In cleaning the data, we take 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 exclude 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).[384] Where there are duplicates in the data, we drop them, so each subscriber only has one

[382] 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.
[383] 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.
[384] 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.

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.10 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 areas (Northern Ireland).[385] 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.[386]

D.11 Finally, we restrict the PD to focus only on subscribers who purchase PAYM SIMO tariffs.[387] This is due to data quality and modelling concerns:

(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.

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[385] Scotland and Northern Ireland do not have lower super output areas (**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.
[386] 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.
[387] For estimation, we use the definitions of contract types as reported in the PD data. In limited cases, these differ from the definitions in the Pure Pricing dataset. In the Parties' response to Provisional Findings, the Parties submitted that the CMA had included some Handset contracts as SIMO. (Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraphs 3.9-3.11). Following a discussion with Ofcom, the CMA has updated its approach to classifying contracts to align with the approach used by Ofcom in their Monitoring Consumer Outcomes in the Mobile Sector report.

Pure Pricing Data

D.12 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.13 The Pure Pricing dataset contains monthly information on all tariffs that were publicly available for purchase in each month.[388] For each available tariff the dataset provides information on tariff characteristics such as price, contract length, contract type, allowances for data, voice and messaging, extras and discounts.[389]

D.14 To combine the Pure Pricing dataset with the PD, we dropped tariffs with missing information on key variables (price, contract type, contract length, and 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.[390]

Connected Nations Data

D.15 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.16 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.[391] 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 100x100 metre pixel in the UK for each technology and frequency band in a given area.[392] Ofcom told us that these signal strength predictions 'represent a reasonable basis for estimating

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[388] While Pure Pricing is a comprehensive list of tariffs available in our time period it does not include all possible tariffs. The main tariffs excluded in Pure Pricing 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.
[389] 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.
[390] 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).
[391] 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.
[392] 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.

signal strength (and coverage) in aggregate' and we note they are used by Ofcom to analyse coverage in its Connected Nations Reports.[393]

D.17 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 the 100 x 100 metre pixels to determine whether there is at least a 95% probability of there being sufficient coverage in the area to use basic 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.18 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.[394] 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.19 When defining the coverage area, we use the 2011 definitions of Travel to Work Areas (**TTWA**s).[395] 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.20 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.21 Descriptive results of the CMA's analysis of the 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

[393] 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.
[394] dBm stands for decibel-milliwatts and is a unit of measurement for the power of a signal.
[395] TTWAs are produced by the ONS as based on a statistical analysis of census data.

in a TTWA in a month is 8 percentage points for 4G coverage and 24 percentage points for 5G coverage.

Opensignal Data

D.22 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.[396] In particular, we use 4G and 5G average download and upload speed results in each TTWA from open signal file size tests for each network from January 2023 to June 2023.[397]

D.23 In our analysis we only considered download speed results in TTWAs where there was over 25% coverage and over 50 conducted tests.[398] 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.[399]

D.24 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.25 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.26 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.

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[396] 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.
[397] 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.
[398] 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.
[399] 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.

Demand Model and estimation approach

D.27 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.28 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.

D.29 For our econometric model of UK mobile demand, we use the standard discrete choice model.[400] 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.30 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.31 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.[401]

D.32 Furthermore, due to data limitations discussed at paragraph D.11 above, we estimate the demand model for PAYM SIMO subscribers in the first 6 months of 2023.[402]

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[400] 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.

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

[402] 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

D.33 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

(b) (Finite) Data allowance in GB

(c) A dummy for unlimited data[403]

(d) A dummy for whether the tariff has an extra (eg a free period of Netflix, BT Sport, etc)[404]

(e) Brand dummies for the brand (ie EE, O2, Three, Vodafone, Sky Mobile, Tesco Mobile) 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) ε_{ijt} is an (IID) error term which is assumed to follow a Type-1 Extreme Value distribution

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.

[403] In the Parties' response to Provisional Findings, the Parties submitted that there were potential errors in how data allowances were reported in the underlying data. In particular, the Parties submitted that the contract names in the provider data suggest different data allowances to those reported in the data allowance field that the CMA used to construct its data allowance and unlimited data variables. (Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 3.23c). It is difficult to judge which variables are correctly reported across providers. For example, we note that the contract name was more consistently missing across providers and thus possibly more inaccurately reported. We also note that the market shares by data allowances (see Chapter 5) appear in line with what we would expect across providers, and data allowances in the provider data are in line with those reported in contracts in pure pricing over the same period.

[404] In the Parties' response to Provisional Findings, the Parties submitted that the CMA's treatment of extras may lead to bias as it does not differentiate between extras. (Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 3.23a). We agree that disaggregating into more granular types of extras would be preferable. However, data limitations prevent the CMA from further disaggregating the variable. We note this aggregation would be a particular issue if two contracts had the same characteristics except for price. However, as discussed in paragraph D.42, the CMA does not allow for this. The Parties submitted that not including roaming in the analysis (for example, in extras) may lead to bias (Parties response to the Provisional Findings, 4 October 2024, Annex 4 paragraph 3.23b). The low comparability of roaming descriptions between providers, the similarity of roaming within provider contracts, and limited evidence that roaming is a strong factor in consumer purchase decisions meant the CMA did not include it in the analysis. We also note that despite having access to the underlying data used for the CMA's analysis, the Parties have not shown that the CMA's approach to extras or roaming would lead to significant bias.

D.34 In the equation in D.33 α, β and σ are estimated coefficients. Meanwhile, β and σ are vectors of coefficients and V_{ijt} is the non-random component of the individual's utility.

D.35 For the purposes of the model, we consider network quality at the level of the 2011 definition of 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.[405]

D.36 In the model there are six network quality measures for each network in each month and TTWA:[406]

(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.37 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 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.38 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.[407] Here due to the availability of individual-level data, observed

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[405] In the Parties' response to the Provisional Findings, they submitted that the model fails to capture the importance consumers attach to nationwide network quality as in the CMA's model, network quality is only captured at the TTWA level or by brand fixed effects. (Parties response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 3.13-3.16) We do not model national-level network quality as we argue that TTWAs are sufficiently large to capture the main areas where consumers live and work. Additionally, in the model, brand fixed effects will capture any reputation for or advertising of quality at a national level. The Parties have not shown that an alternative approach would materially change results or that the network quality outside a consumer's TTWA is important in consumer decisions.

[406] 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. The Parties submitted in their response to Provisional Findings that this is a limitation of the CMA's analysis as factors such as reliability are important. (Parties response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 3.17). Regarding reliability, our view is that our coverage measure partly captures this as, by construction, coverage provides a measure of the percentage of the chance of receiving a certain quality of service in a TTWA.

[407] For example this was the approach taken by the CMA in the Arçelik / Whirlpool EMEA merger inquiry.

consumer characteristics and detailed geographical data, we have chosen not to estimate a model allowing for unobserved heterogeneity.

D.39 Our model assumes that the unobserved determinants of utility are uncorrelated with the observed characteristics of products, notably price.[408] 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.

D.40 In principle, a correlation between observed and unobserved determinants of utility may arise due to factors other than unobserved product characteristics, for example advertising. As such despite the CMA's attempts to mitigate endogeneity concerns, we cannot be certain that there is no correlation between the error term and price. As a result, we cannot exclude the possibility that our estimate of the parameter on price is biased towards zero.[409]

D.41 For estimation we base our results on a sample of 10,000 subscriber choices from the PD.[410] Sampled choices reflect the market shares in pay-monthly SIMO.[411] Table D.1 shows the market shares used to construct the sample.

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

	%
Brand	*Share*
EE	[20-30]
BT	[0-5]
Plusnet	[0-5]
O2	[20-30]
Virgin Media	[5-10]
Tesco Mobile	[5-10]
Vodafone	[10-20]
Three	[10-20]
Sky Mobile	[5-10]
iD Mobile	[0-5]
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.

[408] 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

[409] The Parties' response to the CMA's Provisional Findings submits that the CMA did not appropriately consider or address potential endogeneity concerns (Parties response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 3.22). In this setting, for the reasons discussed in Goldberg (1995) and formalised and expanded on in Berry and Haile (2024), the presence of detailed individual choice data (in our case, exceptionally high-quality data on an individual's (local) network quality, characteristics, and tariff information) gives granularity that mitigates the need for quantity instruments. Regarding other forms of endogeneity, it is never possible to rule out that these exist. However, the inclusion of several network quality variables, brand fixed effects, and interactions with individual characteristics helps to mitigate this concern. Berry, S and Haile, P. (2024) Nonparametric Identification of Differentiated Products Demand Using Micro Data. *Econometrica*, *92*(4), 1135-1162.

[410] 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.

[411] 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.

Note: The market shares are based on those in Chapter 8, and market share estimates submitted by Ofcom.

D.42 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.[412] Where there are multiple instances of the same tariff, we use the median price of the corresponding tariffs.

D.43 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.[413] 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.44 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.

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

Brand	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
EE	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
O2	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Other (includes BT, PlusNet, iD mobile and Talk Mobile)	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Sky Mobile	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Tesco Mobile	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
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.45 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 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

[412] We remove from the choice set the chosen option, so it does not appear as a duplicate.
[413] 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.

telecommunications such as Bourreau et al (2021), and to a lesser extent Elliott et al (2024).[414] [415]

Estimation results

D.46 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

D.47 It is important to remember that the estimation is based on PAYM SIMO consumers when interpreting the results.[416] To generalise outside of this segment requires further assumptions. For example, extrapolating the results on willingness to pay requires consumer preferences to be similar across segments.

Coefficients

D.48 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.49 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 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.

[414] 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).
[415] Elliott, J., Houngbonon, G.,Ivaldi, M., & Scott, P. (2024). Market Structure, Investment, and Technical Efficiencies in Mobile Telecommunications. Forthcoming Journal of Political Economy.
[416] In response to our Provisional Findings, the Parties submitted that because the model is estimated on PAYM SIMO data, its results cannot be generalised outside of this market segment (Parties response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 3.6). In particular, the Parties submitted that the focus on PAYM SIMO means results understate the constraint of other segments and that generalisation is inappropriate due to the different market dynamics of segments.

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

Coefficient	*Value*	*Standard Error†*	*TStatistic*
Price over income	-547.47	3.33	-164.61
brand: EE	2.74	0.47	5.86
brand: O2	1.80	0.44	4.07
brand: Other±	-1.90	0.45	-4.22
brand: Sky Mobile	-0.39	0.44	-0.88
brand: Tesco Mobile	0.62	0.44	1.39
brand: Three	0.90	0.45	2.01
brand: Vodafone	2.23	0.46	4.85
Percentage of 4G coverage	-5.23	1.47	-3.56
Percentage of 5G coverage	1.01	1.39	0.73
Extra	1.83	0.38	4.78
Unlimited	11.06	0.47	23.71
Contract length	-0.07	0.02	-3.06
Data allowance given the contract is limited	0.05	0.00	12.92
Download speed 4G (For areas with more than 25% 4G coverage)	-0.05	0.04	-1.17
Download speed 5G (For areas with more than 25% 5G coverage)	0.06	0.01	4.18
Upload speed 4G (For areas with more than 25% 4G coverage)	0.30	0.12	2.55
Upload speed 5G (For areas with more than 25% 5G coverage)	0.03	0.06	0.41
log(age) * perc_4G_coverage	2.01	0.36	5.59
log(age) * perc_5G_coverage	-0.38	0.36	-1.06
log(age) * extra	-0.17	0.10	-1.72
log(age) * unlimited	-2.19	0.12	-17.69
log(age) * contract length	0.00	0.01	0.04
log(age) * limited * data	-0.01	0.00	-11.63
log(age) * download speed 4G (For areas with more than 25% 4G coverage)	0.02	0.01	2.20
log(age) * download speed 5G (For areas with more than 25% 5G coverage)	-0.02	0.00	-3.93
log(age) * upload speed 4G (For areas with more than 25% 4G coverage)	-0.09	0.03	-3.07
log(age) * upload speed 5G (For areas with more than 25% 5G coverage)	-0.01	0.02	-0.72

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

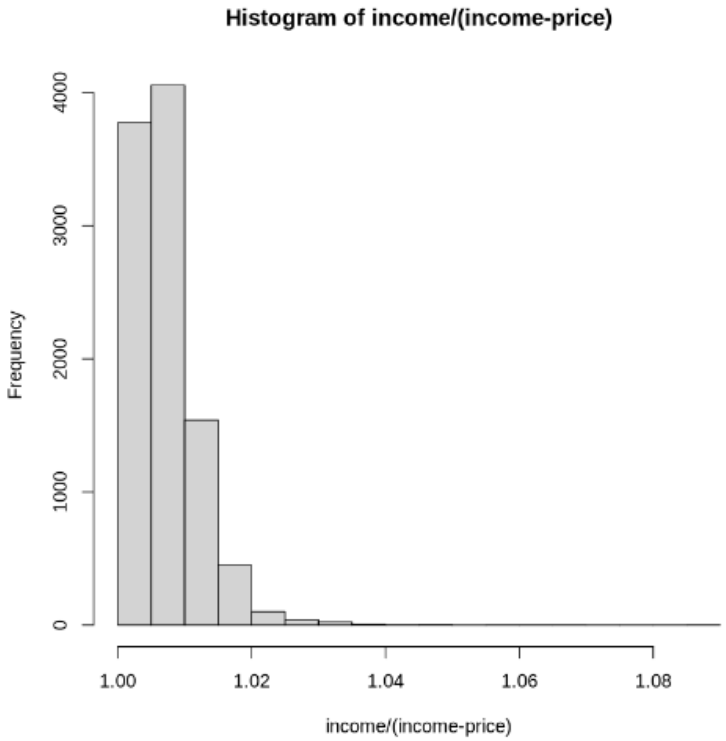
D.50 Willingness to pay (**WTP**) is the amount of income a consumer would forgo for a specified improvement in a tariff feature or an aspect of network quality. For example, it measures how much extra would a subscriber pay on top of the tariff price for an additional 5 Mbps of download speed.

D.51 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.52 We note that formally the above calculation for WTP is only a good approximation where price is a small share of income ($\frac{y_i}{y_i - p} \cong 1$).[417] 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

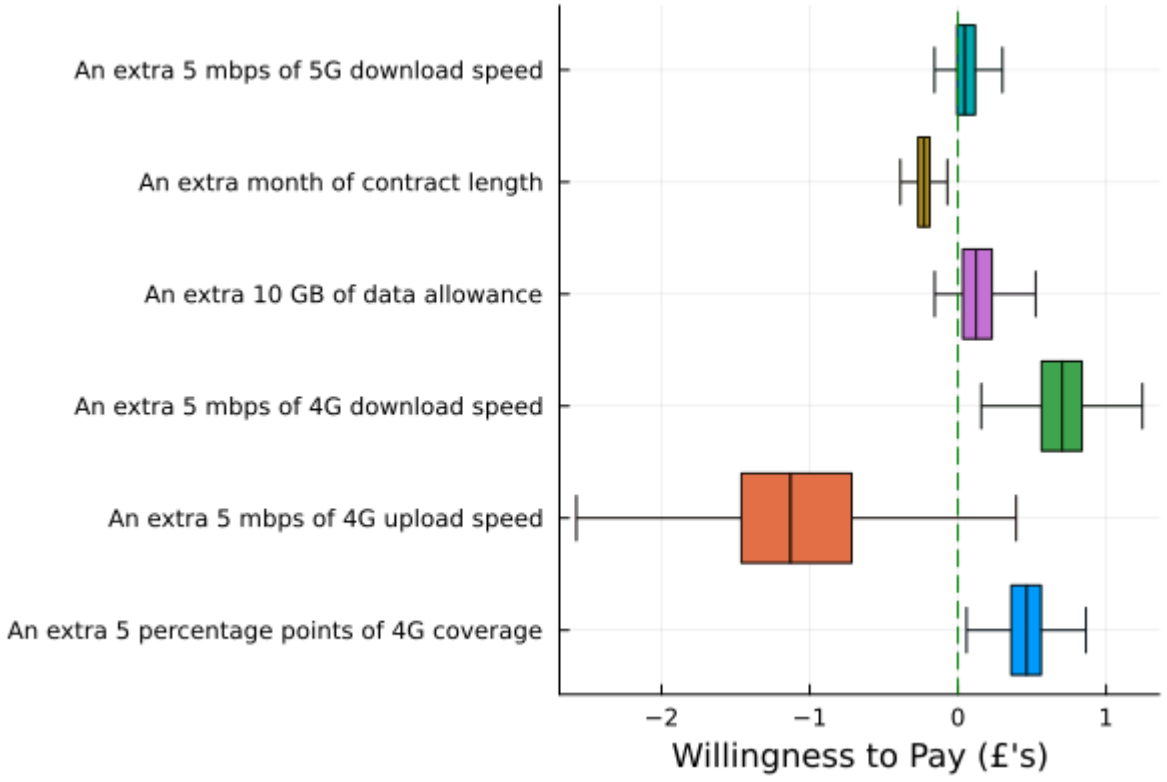


Source: CMA analysis of Ofcom provider data, Ofcom Connected Nations data, Pure Pricing Data and Opensignal Data.

D.53 Figure D.2 and Figure D.3 below show boxplots of estimated distribution in our sample of subscriber willingness to pay in GBPs 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.

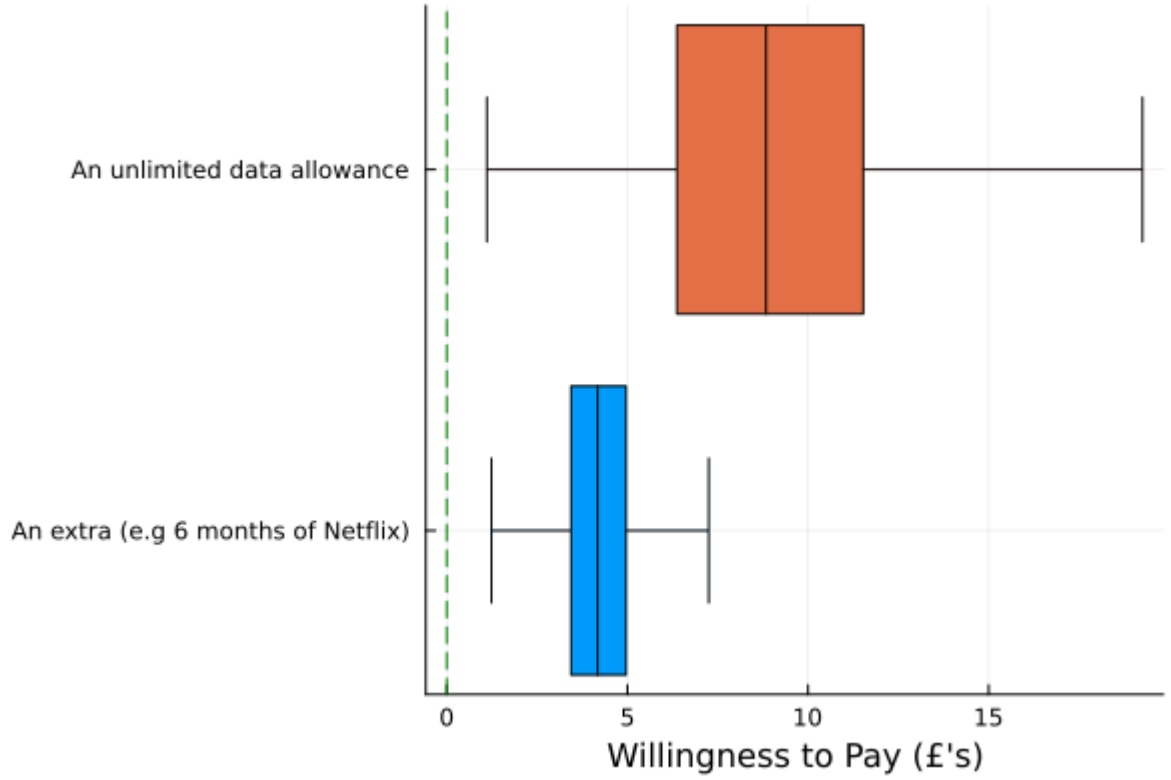
[417] See Train, K. E. (2009). *Discrete choice methods with simulation* for a discussion of the estimation of willingness to pay in logit models.

Figure D.2: CMA econometric estimates of willingness to pay (GBPs 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 (GBPs per month)



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

D.54 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 average 4G download speed has a median valuation of £0.70 (2023 £s), 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 £0.46.

D.55 In contrast we estimate a more varied valuation for average 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. In our data, the valuation is positive for those in their early twenties or below and negative or 0 for those older. This may reflect different usage patterns between age groups.[418]

D.56 Notably, compared to 4G measures we only estimate a positive valuation for average 5G download speed and no other network quality variables. Specifically, we find average 5G download speed is valued less than average 4G download

[418] In the Parties' response to Provisional Findings, they submitted that negative willingness to pay results were implausible (Parties response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 3.25-3.27). Here, negative results are not reflections that the model is implausible. Instead, negative results reflect that tariffs bundle several characteristics some of which may not be valued by all consumers who purchase that tariff. For example, a consumer may have a negative valuation for a 1 Mbps of 4G upload speed. However, as all tariffs have some upload speed and there is limited individualised pricing or tariff design, they still prefer this tariff to others in the market and are willing to purchase the good.

speed. While 5G network quality measures of upload speed and coverage have willingness to pay estimates close to £0 such that their values cannot be statistically distinguished from £0 for any subscribers in the sample (at the 95% confidence level).[419]

D.57 It is unclear why consumers value 4G more than 5G. One potential reason for the low willingness to pay for 5G is that aspects of 5G network quality may be less commonly experienced by consumers than 4G speeds (eg because some consumers do not have a 5G-enabled phone, there are still limited use cases or because it is still being rolled out in some areas).

D.58 Data allowance (for limited contracts) is valued positively by most consumers with only a fraction having 0 or negative valuation. As can be seen from Figure D.4 below, there is a positive valuation amongst younger subscribers. This is consistent with higher internet usage by younger audiences.[420]

Figure D.4: 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.59 Other willingness to pay estimates are as follows:

[419] This can be seen from the table of coefficients shown above.
[420] See Global internet users age distribution 2024 | Statista, accessed by the CMA on 3 September 2024.

(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 £8.83.

(c) Extras are also valued positively with a median valuation of £4.18 which seems plausible given extras typically include a period of free access to a streaming service.[421]

D.60 More generally the results show that there is variation in the willingness to pay for different characteristics across consumers included in our sample.

D.61 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 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).[422] As such we do not consider that the WTP estimates presented here can be directly compared to the Parties' WTP estimates.

D.62 Additionally, in our demand model willingness to pay estimates are linear in aspects such as speed. This means that in the model willingness to pay does not depend on the current level of speed. Additionally, results are estimated on data on the first half of 2023. As such, our estimates may not be indicative of the value that consumers would place on changes in network quality where those changes are significantly greater than the levels observed in the real world data used to calibrate our estimates.[423,424] 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.

[421] 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.
[422] 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.
[423] 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 1 Mbps increase from a base of 10 Mbps is possibly valued more than a 1 Mbps increase when the base is 500 Mbps.
[424] In their response to Provisional Findings, the Parties submitted that the CMA's analysis is unable to yield reliable estimates of consumers' valuation of the levels of network quality achieved by the JNP (Parties response to the Provisional Findings, 4 October 2024, Annex 4, paragraphs 3.12-3.20). To the extent that the JNP will deliver changes outside the range observed in the data (for example, while day 1 benefits may be in this range, benefits of delivering the full JNP may not be), we agree.

Diversion ratios

D.63 Next, we show what our econometric results imply for closeness of competition. To do so, we calculate operator-level price diversion ratios.[425] 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.64 Formally the diversion ratio from tariff *j* to *k* in the case of price being the characteristic of interest is given by: [426]

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

D.65 The operator diversion ratio is then constructed by aggregating the diversions for each product as shown below.[427] In that sense it differs from the firm level 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.66 Table D.4 shows the results with values on the diagonal reporting the diversion to the outside good. We see that the Parties provide a constraint on each other, and the diversion is 15.7% from 3UK to VUK and 16.0% from VUK to 3UK.

D.67 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%, 10% to Tesco Mobile and 7% to Other. Tariffs offered by BTEE and VMO2 brands pose a strong competitive constraint with diversion ratios above to 25%.

[425] 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.
[426] 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.
[427] 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.

Table D.4: CMA's econometrics operator price diversion ratios in PAYM SIMO

							%
FROM/TO	*BTEE*	*SKY*	*VM02*	*TESCO*	*OTHER*	*THREE*	*VODAFONE*
BTEE	5%	9%	32%	10%	6%	18%	19%
SKY	20%	9%	26%	10%	6%	15%	14%
VMO2	28%	10%	8%	11%	7%	18%	19%
TESCO	21%	9%	26%	8%	6%	15%	14%
OTHER	20%	8%	25%	9%	9%	16%	13%
THREE	24%	8%	28%	10%	7%	8%	16%
VODAFONE	26%	8%	29%	9%	6%	16%	5%

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

D.68 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 similar diversion between the Parties.

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

							%
FROM_TO	*BTEE*	*SKY*	*VM02*	*TESCO*	*OTHER*	*THREE*	*VODAFONE*
BTEE	-	8	33	10	6	17	21
SKY	22	-	27	9	6	14	15
VM02	31	9	-	11	6	17	20
TESCO	23	8	27	-	5	15	15
OTHER	22	8	25	9	-	15	14
THREE	26	8	28	9	6	-	17
VODAFONE	29	8	30	9	5	15	-

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 in PAYM SIMO (4G coverage)

							%
FROM_TO	*BTEE*	*SKY*	*VM02*	*TESCO*	*OTHER*	*THREE*	*VODAFONE*
BTEE	-	8	33	10	6	17	21
SKY	23	-	27	9	6	14	15
VM02	31	9	-	11	6	17	20
TESCO	23	8	27	-	5	15	15
OTHER	22	8	25	9	-	15	14
THREE	26	8	28	9	6	-	17
VODAFONE	29	8	30	9	5	15	-

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

Robustness

D.69 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.70 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 statistically rejected to be different from 50,000 sample coefficients at the 5% level.[428]

D.71 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.[429] 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.72 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.

D.73 Finally, our willingness to pay estimates are comparable to those in a recent study of the 2015 French market.[430] For 4G data we find a 10 Mbps speed increase has a median willingness to pay of £1.41, in comparison Elliott et al (2024) find a value of EUR 2.84 (approximately £2.64) for a 10 Mbps speed increase.[431] We view these as comparable given the different contexts of the studies.

Merger Simulation

D.74 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.

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[428] 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.
[429] Formally the Kolmogorov–Smirnov tests whether two samples come from the same underlying distribution
[430] Elliott, J., Houngbonon, G.,Ivaldi, M., & Scott, P. (2024). Market Structure, Investment, and Technical Efficiencies in Mobile Telecommunications. Forthcoming Journal of Political Economy.
[431] To calculate the approximate figure, we use the 2015 exchange rate and then adjust for inflation between 2015 and 2023.

D.75 In their response to our Provisional Findings, the Parties submitted that by not accounting for REEs, the CMA's analysis is incomplete and inherently overstates any alleged consumer harm.[432] They then provided a version of the CMA's modelling accounting for REEs.[433] The CMA's analysis of REEs is set out in Chapter 14. As explained in Chapter 14, regarding the savings in incremental costs of capacity (one of the REEs modelled by the Parties), we have limited evidence that capacity costs impact pricing in the short run. Therefore, we do not consider this in the modelling presented in this section and instead consider the impact of capacity cost savings as an REE in Chapter 14.

D.76 Concerning other REEs such as quality efficiencies, as discussed in Chapter 14, while the CMA accepts there may be some quality efficiencies, we disagree with the Parties' quantification of some parts of the quality efficiencies.[434] Thus, given we have insufficient certainty over the level of quality improvement, we do not consider this in our quantitative modelling presented in this appendix and instead discuss the impact of quality efficiencies in Chapter 14.

D.77 As the focus of our model is to assess the impact of the Merger on prices, we do not attempt to solve for price and investment decisions simultaneously, or attempt to explain, or take account of, what changes in network quality might result from the merger. [435] In that sense our results provide a short-term view of the impact of the merger.

D.78 In this section we discuss the CMA's merger simulation and the robustness of its results.

Supply Model

D.79 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 flexible demand system. It has previously been used by other competition authorities and in academia to study mergers in telecoms.[436] Additionally, the

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[432] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 3.29.
[433] Parties response to the Provisional Findings, 4 October 2024, Annex 4, paragraphs 3.30-3.52.
[434] See Chapter 14 for details. For use in the CMA's merger simulation, the Parties model quality efficiencies in two parts. Firstly, they model the 'Day 1' 4G geographic coverage improvements; by assuming that in each 100 x 100 metre coverage area, the Merged Entity's network becomes the maximum of the 4G coverage of 3UK and VUK. Secondly, they model 'Day 1' download speed increases, by taking the mid-point of the observed pre-merger average 4G download speeds for VUK and 3UK from the OpenSignal data in each TTWA. That mid-point value is then assumed to increase [✂] post-Transaction. Parties response to the Provisional Findings, 4 October 2024, Annex 4, footnotes 50 and 51.
[435] Trying to model the impact of a Merger on both price and quality would also present some additional challenges that may detract from the ability to assess the impact of the merger on prices. 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.
[436] 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).

supply-side model used is the standard supply-side model which is also used by the Parties in their quality-focused merger simulation.

D.80 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.81 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.82 The multi-product Bertrand first-order condition (FOC) for tariff j is then:

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

D.83 In matrix terms, the system of FOCs is:

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

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.84 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:

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

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

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

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

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

D.85 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:[437]

$$(\boldsymbol{p}^* - \hat{\boldsymbol{c}}) \leftarrow \boldsymbol{\Lambda^{-1}}(\boldsymbol{p}^*) \cdot \boldsymbol{\Gamma}(\boldsymbol{p}^*)' \cdot (\boldsymbol{p}^* - \hat{\boldsymbol{c}}) - \boldsymbol{\Lambda^{-1}}(\boldsymbol{p}^*) \cdot s(\boldsymbol{p}^*)$$

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.86 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.87 We calculate the margin for tariff j using the recovered marginal costs $\hat{c}_j$:

$$\text{Implied margin for tariff } j = \frac{p_j - \hat{c}_j}{p_j}$$

D.88 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.89 For consumer welfare changes, we consider the change in consumer surplus which we calculate as the change in:[438]

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

Merger simulation results

D.90 Before presenting the merger simulation results, we check what the model implies in terms of operator-level margins and implied market shares.[439] Table D.7 shows the margins and market shares implied by the model.

[437] 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.
[438] 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.
[439] 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**
BTEE	[✂]	[20-30]
SKY Mobile	[✂]	[5-10]
VM02	[✂]	[20-30]
TESCO Mobile	[✂]	[5-10]
OTHER	[✂]	[0-5]
THREE	[✂]	[10-20]
VODAFONE	[✂]	[10-20]

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

D.91 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.[440]

D.92 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.93 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 retail 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.94 Table D.8 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 5.5% on average and VUK's tariffs by 2.6%. This translates into an annual retail price increase of £8.20 for the average 3UK customer and £5.36 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 0.4% respectively. Other providers such as Tesco Mobile and Sky Mobile would also raise prices.[441]

[440] In particular, the sample is based on contestable subscribers 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 better capture the long run value of having a subscriber. See also Appendix E for a discussion how to capture the long run value of having a subscriber via margins.
[441] The estimated price changes are 0.05% for Tesco Mobile, 0.18% for Sky Mobile, and 0.07% for Other.

D.95 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.[442]

(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.96 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	5.5	-1.8pp
VFUK	2.6	-1.3pp
BTEE	0.6	+0.8pp
VMO2	0.4	+0.9pp
Change in consumer welfare		-1.4%

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.97 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 1.4% decrease in consumer welfare.

D.98 As discussed above, the results of the merger simulation are only based on PAYM SIMO data. This translates into an average annual reduction in the welfare per subscriber of £2.41 (in 2023 £s). If we extrapolate the harm per PAYM SIMO subscriber by assuming this GBP value of harm would be the same in other segments in the consumer retail market (not just the SIMO segment on which the model is estimated), then excluding consideration of any cost efficiencies, product

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

repositioning or network quality changes, the annual cost to UK consumers from the Merger is approximately £216 million a year (in 2023 £s).[443]

D.99 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.

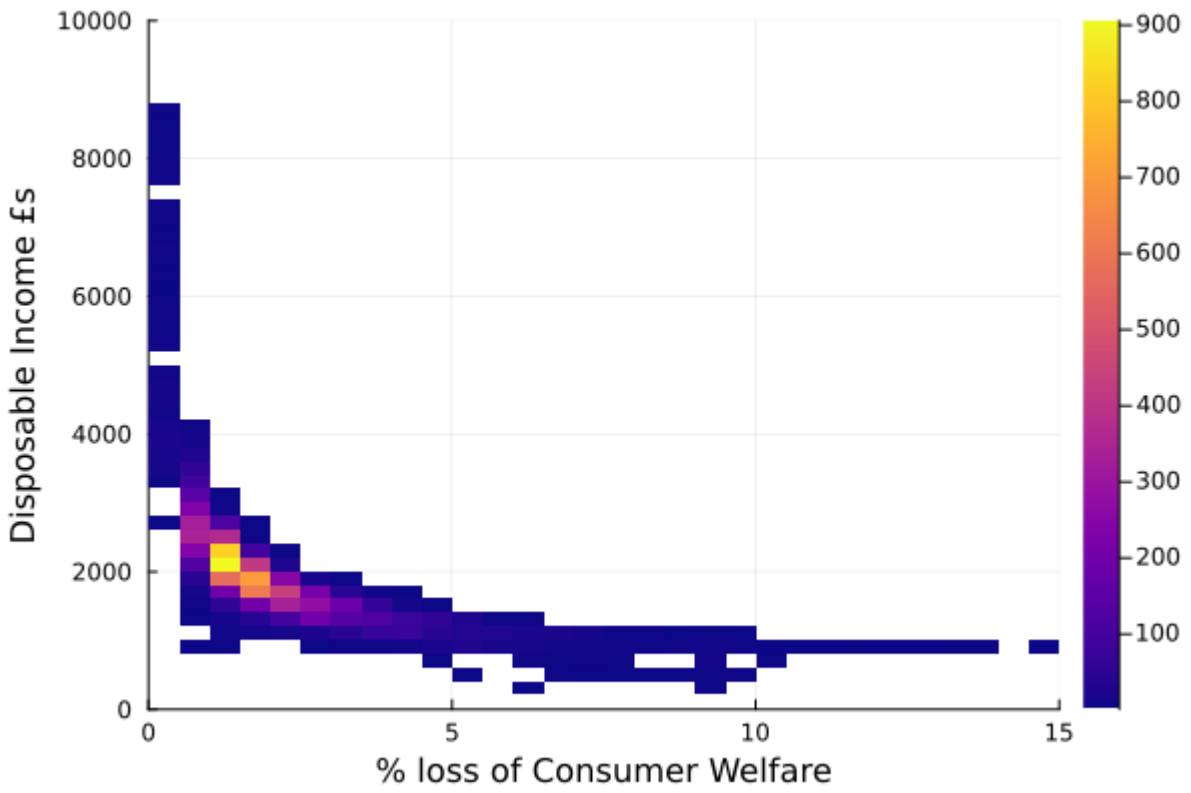
D.100 Figure D.5 shows the estimated consumer welfare changes for different income groups. The Figure is a 2-dimensional histogram where the lighter colours indicate a higher number of consumers at a given point. The Figure shows a larger impact on the welfare of subscribers with lower incomes.[444] 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.[445]

[443] This number multiplies the per subscriber consumer welfare change in the model by the number of subscribers in the UK retail market.
[444] In the Parties' response to our Provisional Findings, they submit that this is largely driven by assumptions imposed on the model (Parties response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 3.52). This is incorrect. The model is able to estimate alternative relationships between income and price sensitivity.
[445] In the 10,000 sample of subscribers used in these results subscribers of tariffs under the Three brand have a median monthly income of £[✂] which is lower than other MNOs in the sample.

Figure D.5: 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.

D.101 We consider that the modelling is a likely lower bound on the pricing impacts of the Merger, absent efficiencies. 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.[446]

(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

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

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.102 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 or quality efficiencies in the simulation (for the reasons outlined in paragraph D.75). If present rivalry enhancing efficiencies would lower the estimated consumer harm resulting from the Merger.

Robustness

D.103 To ensure the robustness of our merger simulation results, we have carried out a number of sensitivity checks.

D.104 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 +/- £2.5 of pre-merger prices we have found no additional (pure strategy) equilibria.

D.105 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 7.5% of tariffs were estimated to have marginal costs less than zero.[447] We consider possible explanations for these below zero estimates to include:

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

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

D.106 Finally, we have compared our elasticities to those in recent studies.[448]

(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.[449]

[447] Tariffs with negative marginal costs were often low-priced tariffs, ie less than a £5 monthly charge.
[448] 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.
[449] 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).

We find firm level own-price elasticates in the market for MNOs to be between -2.55 and -3.54. 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 model and -2.97 in their dynamic model. These are comparable to the estimate in our (static) model of -3.53. Note that a comparison with the authors' results suggests that considering dynamic effects leads to a lower estimated price sensitivity. This is consistent with the view that our model likely underestimates the Merger's anticompetitive effects.

Alternative estimates of consumer harm

D.107 As noted above we consider that the consumer harm estimate from the econometrics merger simulation is likely an underestimate (see paragraph D.101). In this section, we explore an alternative approach to estimating of consumer harm. This alternative approach allows us to understand the impact of 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.108 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. 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.109 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 in the data used for the econometric analysis. The operator shares are calculated as the sum of the pre-Merger individual tariff shares.

D.110 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 conclusions to alternative input margins, we compute a version of the model that is calibrated using the contribution margins submitted to us by BTEE, VMO2 and the Parties.[450] The price, share and margin inputs into the calibrated sensitivity exercise are shown in Table D.9 below:

[450] 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.

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 [✂]	[✂]	[0-5] or [0-5]

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.111 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.112 To then calibrate the models (logit or linear) we use the methodology of Taragin and Sandford (2022) as presented in the R package 'antitrust'.[451] 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.113 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 δ_i's and α) and $2n$ equations (the n choice probabilities and n first order conditions). To calibrate the model the antitrust package first finds the α that minimises the FOC before then using the choice probabilities to recover δ_i's.

D.114 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.

D.115 The results for different input assumptions are shown in Table D.10 below:

[451] For details, see antitrust Reference Manual, accessed by the CMA on 3 September 2024.

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 calibration	*5%*	*Assumed to be by share*	*Econometrics margins*	*Logit*	*6.1% (3UK), 3.2% (VUK)*	*£244m*	*-*
Functional form - linear symmetric	*5%*	*Assumed to be by share*	*Econometrics margins*	*Linear*	*4.3% (3UK), 2.7% (VUK)*	*£244m*	*99.8%*
Functional form - linear non-symmetric	*5%*	*Using econometrics diversion ratios*	*Econometrics margins*	*Linear*	*4.1% (3UK), 2.7% (VUK)*	*£230m*	*94.2%*
Lower outside good	*1%*	*Assumed to be by share*	*Econometrics margins*	*Logit*	*6.4% (3UK), 3.3% (VUK)*	*£256m*	*104.7%*
Contribution margins	*5%*	*Assumed to be by share*	*Contribution-A margins (no calibration of MVNO margins)*	*Logit*	*13.4% (3UK), 5.5% (VUK)*	*£450m*	*184.1%*
Contribution margins and reduced constraints from MVNOs	*5%*	*Assumed to be by share*	*Contribution-A margins (MVNO margins calibrated to the econometric margins)*	*Logit*	*12.3% (3UK), 7.5% (VUK)*	*£784m*	*320.9%*

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; and VMO2 response to the CMA's s109 notice.

D.116 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.117 As expected, due to the stylised nature we find a calibrated harm estimate is different to the harm we computed in the CMA's merger simulation. The calibrated annual harm is slightly higher in the calibration at £244 million as opposed to £216 million. This is driven in part my higher price effects in this alternative estimation (6.1% and 3.2% here compared to 5.5% and 2.7% in the econometric model for 3UK and VUK respectively).

D.118 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.119 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. [452] Linear models imply an even lower pass-through than logit demand. The results here show that the harm is lower than in the logit demand in the symmetric case. Although lower, the harm estimate is close to that of the baseline despite lower price rises predicted for the Parties. 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 than in the baseline and higher prices for the rivals.

D.120 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.121 Finally, rows 5 and 6 show the results when we use contribution-A margins (see Appendix E). As noted in Appendix E, we consider these contribution margins to be a useful proxy of the longer-term value of winning a customer to an operator.[453] By changing the margins targeted in the calibration we capture the impact of a higher existing level of market power pre-merger. Therefore, the purpose of rows 5 and 6 is to reflect on the sensitivity of the harm estimate to the level of pre-existing market power.

D.122 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. [454]

D.123 Row 6 targets non-MNOs margins to match those in the econometric margins and shows the highest harm estimate reflecting the high margins used in the calibration. A possible limitation of the calibration presented in row 6 is that it calibrates MVNO shares pre-transaction to be close to 0.[455] This potentially understates the constraint of MVNOs. As such, row 6 can be seen to show how

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[452] 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

[453] In the Parties' response to Provisional Findings, the Parties submitted that the CMA's calculation of contribution-A margins may not accurately reflect the longer-term value of winning a consumer as price-sensitive consumers may not be captured by the measures that measure profitability across the total subscriber base (Annex 4 to the Parties response to the Provisional Findings, 4 October 2024, paragraph 2.17-2.20). Regarding the Parties' submissions, we consider that the longer-term value of winning a consumer is an important metric to consider, and we note that the Parties themselves frequently track and highlight similar metrics in the course of regular internal and external performance reporting. Our use of contribution margins is further discussed in Appendix E.

[454] When not targeting non-MNO margins in row 5 the calibration estimates low margins for non-MNOs.

[455] This limitation was also highlighted by the Parties in their response to the Provisional Findings (Parties, supplementary note on merger simulation robustness analysis).

the harm estimate may change if there was both higher pre-merger market power for MNOs (as captured by the use of contribution-A margins) and a reduced competitive constraint of MVNOs (which could for example be seen as an extreme version of a wholesale SLC).

D.124 Overall, the table shows that the range of harm based on these simple calibrations is £230 million to £784 million annually in the UK. As discussed in the merger simulation results section, we consider that these are still likely to be underestimates of the Merger's impact (absent efficiencies) as the model does not capture important aspects of the market such as the long run impact (expect possibly in the case of the sensitivity using contribution-A margins), and wholesale interactions (except to an extent in the sensitivity presented in row 6).

Conclusions on the CMA's econometric analysis

D.125 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.126 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 place limited or no value on 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 experienced by consumers than 4G speeds (eg because some consumers do not have a 5G-enabled phone, there are still limited use cases 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 5.5% for 3UK and 2.6% for VUK with smaller rises for rivals. The overall welfare loss to UK consumers implied by these price rises is approximately £216 million annually (2023 prices). As described in more detail in paragraph D.101, 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 effect of the Merger on wholesale market.

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

D.127 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 on impact of the merger on retail 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.[456]

E.2 In this appendix 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 prices 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.[457] We note that quantitative assessments of price effects have previously been undertaken in a range of previous telecommunications industry mergers.[458]

E.3 The Parties submitted that the GUPPI approach is an inappropriate and misleading tool for considering pricing incentives in this merger because it does not take into account the significant efficiencies brought about by the Merged Entity's new network and their impact on the market and other competitors.[459] They further submitted that it is critical that the substantial REEs delivered by the

[456] CMA87, paragraphs 4.6-4.7.
[457] Retail merger commentary (CMA62), April 2017, paragraph 5.12.
[458] 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*.
[459] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 2.2a.

Merger are considered alongside the impact of any loss of rivalry between VUK and 3UK.[460]

E.4 We consider that the GUPPI is a useful measure which can provide 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, including the extent to which these are sufficient to offset any potential upward pricing pressure arising from the Merger in Chapter 14. We have also considered the quantitative analysis submitted by the Parties in Appendices D and F.

E.5 We consider each of the following areas in turn in this chapter:

(a) diversion ratios;

(b) margins; and

(c) the GUPPI.

Diversion ratios

E.6 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.7 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.8 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.9 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

[460] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 2.4a.

subscribers on each of the Parties' brands and segment (ie pre-paid and post-paid).[461]

E.10 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 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.11 Table E.1 and Table E.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 E.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.
Note: Base size: n = 636

[461] 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.

Table E.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.
Note: Base size: n = 575

E.12 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.[462]

(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.[463]

E.13 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

[462] 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'.
[463] 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'.

forced diversion question, we also used the approach outlined in paragraph E.13(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 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.[464]

E.14 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.[465] 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.15 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.16 For a given diversion ratio, a higher margin increases the value of sales 'recaptured'. The higher the economic profit earned on recaptured sales, the

[464] These represented <1% of respondents for each of 3UK and VUK.
[465] Parties' response to the GUPPI working paper.

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.17 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.[466] 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.[467]

E.18 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 costs.[468] 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.[469]

E.19 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.20 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.21 Below we describe what each of these margins measure and discuss both the CMA's and Parties' estimates for them.

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[466] 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).
[467] For an example, see J Sainsbury PLC / Asda Group Ltd merger inquiry, Appendix F: Margin Calculations.
[468] 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.
[469] CMA62, Technical Box 1: Calculating variable profit margins, page 33.

Contribution margins

E.22 Contribution margins capture revenues less all variable costs related to sales volumes and provide the 'contribution' to fixed costs.

E.23 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.24 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**).[470]

E.25 We have used both sources of data to compute contribution margins.

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

E.26 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.[471]

E.27 The following revenues and costs, earned and incurred over V_FY23 for each Party, were included in the Parties' contribution margin estimates:[472]

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

(b) [✂];[473]

(c) [✂]; and

(d) [✂].

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

E.28 As noted at paragraph E.23 we requested quarterly contribution margin data for the period 1 January 2022 to 31 March 2024 from all MNOs active in the UK.

[470] Parties submission, Capacity-focused merger simulation model.
[471] Parties response to the CMA's RFI.
[472] Parties response to the CMA's RFI; Parties submission, Capacity-focused merger simulation model.
[473] [✂], see Parties response to the CMA's RFI.

E.29 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:[474]

(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;[475] and

(g) Handset and equipment costs.[476]

E.30 We also asked all MNOs to identify any further variable cost categories to be considered as part of our analysis.

E.31 Each Party identified several further cost categories.[477] 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.32 We also tested the Parties' requests for the inclusion of additional cost categories by considering responses provided by other MNOs. BTEE identified no further

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[474] Vodafone response to the CMA's s109 notice; CK Hutchison response to the CMA's; Parties response to the CMA's RFI.
[475] [✂].
[476] 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. [✂].
[477] 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: [✂].

variable cost categories to be considered (in addition to those listed at paragraph E.29), noting that many further cost categories may include a mixture of fixed and variable elements.[478] VMO2 included some further cost categories identified as part of its internal measurement of 'cost of sales', but identified this category as 'fixed and other COS [costs of sales]'.[479]

E.33 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 paragraph E.29 (**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 paragraph E.31 (**Contribution B**).[480]

E.34 The Parties submitted 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 paragraph E.31 – the inclusion of certain additional cost categories in Contribution B that are considered to be variable with subscriber volumes.[481] The Parties re-iterated this view in response to our Provisional Findings.[482]

E.35 We consider Contribution A to be useful for our analysis. 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.[483] Another MNO (VMO2) labelled its additional cost category submitted as 'fixed and other COS [costs of sales]', suggesting that it also sees other cost categories as having a mixture of fixed and variable elements.[484] We therefore consider that Contribution A reflects an approach which is consistent with the views of other industry participants, and we note that it has broad similarities with [✂],[485] and is likely to be reasonable.

E.36 We recognise that the distinction between 'fixed' and 'variable' costs – while useful – is not always clear cut, particularly because of differing perspectives on how to distinguish between the 'short' and 'long' run. However – taking account of considerations of the Parties, BTEE and VMO2 (discussed above) – we find

[478] BTEE response to the CMA's s109 notice and BTEE email.
[479] VMO2 response to the CMA's s109 notice.
[480] With respect to the cost categories excluded from Contribution B: considering VUK, [✂]. For 3UK, [✂], to aid consistency [✂].
[481] Parties' response to the GUPPI working paper.
[482] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraphs 2.17 – 2.20
[483] BTEE email.
[484] VMO2 response to the CMA's s109 notice.
[485] [✂]. [✂] Vodafone response to the CMA's s109 notice.

Contribution A to be a useful and reasonable upper bound to the contribution margin, presented alongside our other estimates.

Congestion-Adjusted Contribution Margins ('CACM')

E.37 As part of their 'pro-competitive effects paper' (**PCEP1**) and merger simulations submissions, the Parties provided contribution margins adjusted for congestion.[486] The respective congestion adjustments (ie deductions to the margin) were [✂] percentage points (**pp**) for 3UK and [✂]pp for VUK. The Parties submitted that it is critical that congestion-adjusted margins are used when assessing the likely competitive effect of the Merger.[487]

E.38 The congestion adjustment for each of VUK and 3UK is calculated on a standalone basis. [✂].[488]

E.39 The Parties submitted that it was important for us to include an estimate of CACM, because they have demonstrated that – in the counterfactual – many VUK and 3UK sites would be capacity constrained [✂]. In this context, the Parties submit, network capex and opex are marginal costs of serving additional subscribers.[489]

E.40 As discussed in 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 and, other things equal, provide better quality. We also consider that these factors are more likely to feed into longer-run pricing decisions (such as decisions which feed into the development of wholesale contracts), and may impact retail pricing over longer time horizons. However, as explained in Chapter 14, we have found limited evidence that capacity costs impact retail pricing decisions over the short run. We have therefore excluded margins with the CACM adjustment from our analysis.

Acquisition margins

E.41 The acquisition margin incorporates only the revenues and costs associated with new ('gross adds') customers acquired over the course of V_FY23. The acquisition 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.[490]

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[486] Parties submission, Quality-focused merger simulation model; Parties submission, Quality-focused merger simulation model
[487] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 2.16.
[488] Parties submission, The pro-competitive effects of the Vodafone/Three merger.
[489] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 2.14.
[490] Parties submission, Capacity-focused merger simulation model.

E.42 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).[491]

E.43 [✂].[492] [✂].

E.44 The Parties' estimates of acquisition margin are shown as **Acquisition**.

Input margin estimates

E.45 At Table E.3, we set out the results of the margin estimation undertaken for each of the categories of potential margin inputs discussed above.

Table E.3: 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.46 We have considered the relevance of these margins to our assessment.

E.47 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:

[491] Parties response to the CMA's RFI.
[492] [✂]. See Parties response to the CMA's RFI

(a) [✂];[493] and

(b) [✂].[494]

E.48 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 [✂].[495] [✂].[496]

E.49 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 [✂].[497]

(b) the standard profitability metrics that both Parties ordinarily track and measure in [✂],[498] [✂].

E.50 Therefore, our 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.

E.51 The Parties submitted that contribution margins on the subscriber base are unlikely to be indicative of the longer-run value of recaptured customers. This is because the customers who switch in response to a price increase are by definition price sensitive and therefore more likely to switch/search for better deals. Further they state that this group of customers is unlikely to be captured by the average subscriber on the Parties' network – which includes customers that have been with the Parties for more than eight years.[499] We note that the Parties have not provided any evidence to support their claim that customers who switch following price increases have a higher propensity to switch/search for new deals and, by implication, that they tend to have shorter tenures. Further, even if customers who switch in response to a price increase have a higher propensity to switch/search, to the extent that operators expect a proportion of these customers to remain with them beyond their initial contract term, the acquisition margins would understate the longer-run value of winning a customer. For the reasons

[493] Parties response to the CMA's RFI.
[494] Vodafone internal documents show [✂]. [✂].
[495] Vodafone submission and CK Hutchison submission.
[496] See Vodafone internal documents.
[497] [✂]. [✂], for example, see Vodafone internal documents. [✂]. [✂], see, for example, CK Hutchison internal documents.
[498] For example, VUK [✂]. 3UK [✂]. [✂]
[499] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 2.20(b).

outlined above, we consider that contribution margins are an appropriate upper-bound of this long-run value.

GUPPI

E.52 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.53 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.[500] 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.54 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.55 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.56 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.[501]

E.57 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

[500] 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.

[501] 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.

upper bounds of GUPPI. Table E.4 reports the GUPPI evaluated using the diversion ratios from the CMA survey (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 £[✂] and the corresponding figure for 3UK is £[✂].[502]

E.58 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 E.4: 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.59 The GUPPI figures in Table E.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 concluded that, in the absence of efficiencies, 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 Entity's own prices and therefore magnify the effect of the Merger on prices.

[502] 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.

E.60 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.[503] The Parties further state that our approach is overly narrow as it focuses only on price as a competitive parameter and does not account for the impact of efficiencies on rivals.[504]

(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;[505] 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.[506] They further state that they consider these effects are 'insignificant compared with the effect of incorporating efficiencies'.

E.61 In relation to paragraph E.60(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 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. We further note that our analysis focuses on understanding the pricing pressure arising from the Merger in the absence of efficiencies and our assessment of how rivals may react to potential efficiencies is outlined in Chapter 14.

[503] Parties' response to the GUPPI working paper.
[504] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 2.21(a)(ii).
[505] Parties' response to the GUPPI working paper.
[506] Parties' response to the GUPPI working paper.

E.62 In relation to paragraph E.60(b), as set out in Chapter 9, our view is that before consideration of any potential efficiencies, there is scope for an SLC in the wholesale market. In relation to paragraph E.60(c), we also do not consider that the increase in GUPPI due to recaptured MVNO sales estimated by the Parties is in absolute terms an immaterial increment on the pricing pressure arising from the Merger in the absence of efficiencies. We therefore consider that both of these reasons mean that, absent efficiencies, our GUPPI estimates are likely to underestimate the pricing pressure.

E.63 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.[507] 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.[508]

(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.[509] They further submit that implementing a price increase is also likely to entail longer-term reputational risks.

E.64 In relation to paragraph E.63(a), we note that the Parties have not provided any evidence to support their claim that rivals would respond to a price rise by the Merged Entity by becoming more competitive 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 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.

E.65 We also note that the Parties' claims are inconsistent with the evidence which we have gathered. As set out in Chapter 13, we consider that entry and expansion is unlikely to mitigate a reduction in competition. Moreover, as outlined in Chapter 8, our view based on our analysis of the MNOs' strategies, our review of internal

[507] Parties' response to the GUPPI working paper.
[508] Parties' response to the GUPPI working paper.
[509] Parties' response to the GUPPI working paper.

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. This is consistent with the findings of our merger simulation as outlined in Appendix D. Overall, we therefore do not consider that rivals will seek to respond to a price increase by becoming more competitive.

E.66 In relation to paragraph E.63(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. We further 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 paragraph E.59. 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.[510]

E.67 Notwithstanding this we note that 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 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.

E.68 In response to our Provisional Findings, the Parties submitted that the relevant question is about the likely constraint on prices when the overall evidence is addressed in the round, including whether there is evidence that the commercial factors which they cite are considered in their commercial decision making.[511] Further they submitted that we should not consider whether the Parties have increased prices previously, but instead whether a post-Merger price increase is the most commercially attractive strategy.[512] In relation to these submissions, we note that our GUPPI analysis suggests that the Merged Entity would increase its profit by raising prices, and that this is consistent with our merger simulation presented in Appendix D. We have not seen any evidence that the commercial factors cited by the Parties are sufficient, in practice, to remove this incentive.

[510] Linear demand is typically considered more conservative in relation to predicted price effects compared to other common demand systems. This can also be seen in the CMA's alternative analysis in Appendix D which shows lower price effects when linear demand is used. For further discussion see for example, Valletti, T. M., & Zenger, H. (2020). Mergers with Differentiated Products: Where Do We Stand? In SSRN Electronic Journal. Elsevier BV.
[511] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 2.21 (b)(i).
[512] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 2.21 (b)(ii).

E.69 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.[513] We consider that these results are directly related to the size of the Parties' suggested quality improvements and claimed cost reductions. As set out in Chapter 14, in regard to quality, we consider that, the JBP would, if fully implemented, in time lead to significant and long-lasting quality improvements, but the Parties would not have the incentive to deliver the full JBP and the quality improvements would consequently be lower. In regard to the Parties' claimed cost reductions, as also set out in Chapter 14, we consider that there is limited evidence of 3UK and VUK taking account of traffic growth and capacity in retail pricing, and in light of this, we cannot use the Parties' estimate of the effect of the Merger in reducing incremental cost of capacity as an estimate of downward pricing pressure.

[513] 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);[514] and,

(b) The 'Capacity-Focused Model' prepared by Frontier Economics (VUK's advisers).[515]

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).[516]

F.3 Having received the Parties' response to Provisional Findings, we have updated our analysis of the models and, where applicable, updated our assessment.

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 prices and aspects of network quality and were asked to select their

[514] Parties' submission, Quality-focused model.
[515] Parties' submission, Capacity-focused model.
[516] Parties' submission, Overview of modelling approaches and results.

preferred option. Each respondent was invited to repeat this exercise but with different choices five times;

(b) an econometric demand model is used to estimate the value that customers attach to price and the different aspects of network quality. They do this either by:

(i) estimating these values directly using their survey responses, or;

(ii) combining estimated price and network quality valuations obtained using their survey data with information on real market shares in the SIMO market, firm conduct assumptions, and the Parties' observed margins to calibrate an augmented demand model to better approximate observed consumer choices.

(c) Finally, the results of the augmented demand model are 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.[517]

Our assessment

F.5 Next, we provide our 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.[518]

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.[519]

F.8 The Parties have not provided sufficiently detailed information on which recruitment methodologies have been used for the panels and we are therefore unable to assess their fitness for purpose, particularly regarding:

[517] Parties' submission, Overview of modelling approaches and results.
[518] Good practice in the design and presentation of customer survey evidence in merger cases (CMA78), May 2018.
[519] CMA78, paragraphs 2.29-2.30.

(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).

F.9 The Parties, in their response to the Provisional Findings, reasserted that they have provided the CMA with information on recruitment methodologies used by the online panels.[520] However, the information referenced is very high level and neither gives sufficient detail to be able to assess the quality of sampling, nor provides any comfort that recruitment sources are not materially biased with respect to the survey.[521]

F.10 The CMA had the option of using non-random online panels for its own UK customer and, particularly, population surveys, but decided this approach would not be fit for purpose. Instead, it committed the additional time, expense and resources to using random probability-based survey methodologies to meet the survey quality thresholds appropriate for the evidential needs of the case.

F.11 The Parties, in their response to the Provisional Findings submitted a repeat of their survey choice experiment using a sample based on a random sample methodology; this was intended to address the Provisional Findings' concerns with the online panel approach.[522] However, under this approach, a post out of survey invitations to a random sample of 10,000 UK addresses yielded only 54 survey responses, representing a response rate of 0.54%. This is very low and falls a long way short of assessment criteria set out in the CMA's survey good practice.[523]

F.12 We consider that respondents' cognition of the choice experiments in the Parties' survey are inadequately tested and not well understood. Respondents were presented with five choice sets. In each set, respondents were asked to choose one of 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, is different to what consumers would be presented with in real-life settings, for example, on price comparison websites, and includes metrics that may be unfamiliar to many respondents.

[520] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 5.4(a).
[521] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 5.6(b).
[522] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 5.6(b).
[523] CMA78, paragraphs 4.38 (g), (h)

F.13 The Parties, in their response to the Provisional Findings,[524] cited Uswitch as an example of a price comparison website that displays information on several attributes of network quality. However, metrics for network speed and coverage on Uswitch are not displayed prominently and, even then, only after clicking into information relating to a particular tariff. Further, this was more prominent than on other price comparison websites we looked at.

F.14 We 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.15 We understand that the survey questionnaire was not cognitively tested with customers in line with good practice.[525] This is particularly problematic with this survey given the cognitive demands it places on respondents and the scope for respondents misunderstanding the information provided about tariff attributes. Key results of the survey, for the purpose of the simulation model, depend, critically, on the quantitative trade-offs between the attribute metrics set out in the survey's choice experiment and, therefore, on the survey respondents' interpretations and understanding of these metrics, particularly those relating to aspects of network quality. We do not consider that the pilot survey, conducted among employees of Compass Lexecon, Freshfields Bruckhaus Deringer, and Slaughter and May, provides sufficient testing in this context, in particular because:

(a) It provides limited insight into interpretation and understanding of choice experiment attributes and associated metrics; and

(b) The pilot survey participants can reasonably be assumed to be atypical of the UK population.

F.16 Our assessment is therefore that we have a number of concerns with the Parties' customer choice survey and that it falls short of requirements set out in the CMA's Survey Good Practice.[526] We note that the Parties engaged with us in advance of conducting their survey (as is recommended in the good practice guide).[527] 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

[524] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 5.7(e).
[525] CMA78, paragraph 2.55.
[526] CMA78.
[527] CMA78, paragraph 1.23.

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.17 The Parties used the responses from the Parties' customer choice survey to estimate consumer demand for SIM-only contracts. The Parties presented two models:

(a) A stated preference (**SP**) demand model

(b) A revealed preference (**RP**) demand model

F.18 Our assessment of the Parties' demand modelling in the quality-focussed merger simulation model is discussed below.

*The stated preference (**SP**) model*

F.19 The parameters of the SP demand model allow consumers to have heterogeneous preferences over the attributes of the hypothetical tariffs they are presented with in the Parties survey. Like the CMA's econometric demand model estimated using consumer's observed behaviour, the resulting demand model is flexible and can, in principle, capture rich substitutions patterns. Because there are no other factors that affect the individual respondents' choice of hypothetical tariff, the Parties' SP model does not allow for tariff-specific unobservables to affect respondents' utility.

F.20 However, when applied to the Parties' version of the SIM-only choice set faced by consumers in the reality, the predicted market shares implied by the estimated SP demand model differ substantially from observed counterparts. As we discuss in more detail below, the overall fit is poor. For example, the predicted share for all O2 tariffs in the SP demand model is only 5.4%, much less than its observed share of 23%. Conversely, the predicted shares of MVNOs are substantially overstated by the SP model (the predicted share is 31% but the observed share is only 9%).[528]

F.21 Further, the diversion ratios derived from the demand model estimated using the survey data (pre-calibration) differ substantially from corresponding estimates from 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 [✂].[529]

[528] Parties' response to the CMA's RFI.
[529] 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.

F.22 Further, when combined with the Parties' chosen model of firm conduct, the SP demand model's price elasticity estimates predict margins that are close to, or over 100%.[530] These are [✂] as the margins the Parties choose to calibrate their demand model to.[531] This suggests that survey respondents are, in the Parties own view, insufficiently price sensitive.

*The revealed preference (**RP**) model*

F.23 To help mitigate concerns over the fit of the SP model to real world consumer choice data, the Parties augment their demand model to allow for unobserved tariff characteristics to affect consumers' decisions and rescale the non-random component of their utility from using the tariff.[532] They also add a supply model that assumes operators compete by simultaneously setting tariff prices in each period.

F.24 In principle, these changes enable the demand model to more closely match observed market shares and, when combined with the supply model, predict the economic margin earned by the Parties. In this sense, the rescaled and relocated utility functions in the Parties' augmented demand model are intended to more closely reflect consumers' revealed preferences and the Parties' pre-merger market power (ie. as reflected in economic margins). Hereafter, we refer to this calibrated model as the Parties' revealed preference (**RP**) demand model.

F.25 To be able to quantify the scale parameter and tariff levels unobservables in the RP demand model, the Parties add empirical restrictions that link modelled outputs to observed market shares and margins to the original stated-preference demand model estimation framework. These extra restrictions ensure that the RP demand model:

(a) matches the sum of the modelled share of subscribers of each operator's individual tariffs to the observed operator-level market shares; and,

(b) minimises the sum of squared differences between the Parties' economic margin implied by the combined RP demand and supply model and the Parties' observed contribution margins (adjusted for congestion costs). The result is an augmented version of the original SP demand model estimator.

F.26 One way to ensure that the identifying power of the RP demand model fully exploits the variation in the available stated and revealed preference data when estimating the RP demand model's parameters is to perform estimation in a single

[530] Parties' response to the CMA's RFI.
[531] The Parties target a margin of [✂] for 3UK and [✂] for VUK. Parties' submission, Quality-focused merger simulation model.
[532] 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. There are no tariff unobservables in the Parties' customer choice survey and these parameters are constrained to zero in the stated preference model.

step.[533] However, this can be challenging to implement. As such, the Parties use a bespoke, sequential numerical procedure.[534] This is implemented in two steps:

(a) First, the stated preference demand model is estimated using only the data collected from individuals' responses to the discrete choice experiment in the Parties' survey. These are not subsequently updated in the algorithm.

(b) Second, holding fixed the consumer valuations of observable tariff attributes from the first step, the market share and margin restrictions are used to calibrate the scale parameter and tariff levels unobservables affecting revealed, but not stated consumer preferences.

F.27 Below we highlight a few of our most significant concerns with the Parties bespoke numerical procedure.

F.28 First, the system of inverse demand equations used to compute product unobservables is fundamentally under-identified.[535] This is because only eight operator-level observed aggregate market shares are used to calibrate the 150 unobserved tariff characteristics. In this context, under-identification means that the Parties' RP demand model cannot point identify the correct set of values for its parameters that are consistent with the share of subscribers that choose each tariff in reality and the Parties' observed margins. Without the correct, unique set of parameters, the RP model cannot produce a reliable forecast for how a merger will impact prices, market shares, and overall welfare.

F.29 In the second step of their numerical procedure, the Parties' attempt to 'solve' the under-identification issue by using a constrained least squares regression that assigns values to the unidentified unobserved tariff characteristics.[536] Specifically, the Parties regress the predicted tariff shares produced by the SP model when applied to the Parties' SIMO choice set on a set of factor variables – one for each tariff. The coefficients on each tariff's dummy variables are summed for each operator and are constrained to match aggregate observed market shares.

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[533] State of the art software is regularly used in the academic literature to solve optimisation problems in a single step. The resulting optimiser contains the parameters of the corresponding econometric (demand) model being estimated. For example, Dubé, Fox and Su (2012) show how the closely related workhorse IO Berry-Levinsohn-Pakes (**BLP**) model can be expressed and solved as a constrained optimisation problem. Dubé, J. P., Fox, J. T., & Su, C. L. (2012). Improving the numerical performance of static and dynamic aggregate discrete choice random coefficients demand estimation. *Econometrica*, *80*(5), 2231-2267.).

[534] Some computationally challenging optimisation problems are often solved using iterative procedures. For example, the workhorse IO Berry-Levinsohn-Pakes (BLP) model is solved using a numerical procedure that exploits the special structure of the model. See for example Conlon, C., & Gortmaker, J. (2020). Best practices for differentiated products demand estimation with pyblp. *The RAND Journal of Economics*, *51*(4), 1108-1161.

[535] The system of inverse demand equations is under-identified because it contains more unknown unobserved tariff characteristics than it does equations. As a result, there are many sets of unobserved tariff characteristics in the Parties RP model that are consistent with the observed data.

[536] The Parties only 'solve' the under-identification problem from a computational point of view. That is, their algorithm provides values for 150 unobserved tariff characteristics from only 8 aggregate market shares. The values of the 150 unobserved tariff characteristics are mostly determined by the tariff share predictions of the SP model when applied to the Parties version of the SIMO choice set – not market shares reflecting consumer's revealed preferences.

F.30 As the estimated coefficients are, therefore, adjusted predictions of the original SP model's purchase probabilities for real world SIMO tariffs. If the SP model originally over (under) predicted aggregate operator level shares, then the estimated coefficients tend to imply new, smaller (larger) fitted tariff shares. While an operator's fitted tariff shares sum to match the operator's observed share of subscribers, in the absence of observed tariff-level shares this procedure provides no guarantee that the individual fitted tariff shares are a good match to those implied by actual consumer choices.[537]

F.31 Once estimated, given the SP model's attribute parameters (taken from step 1) and a candidate scale parameter, the Parties' procedure finds the unobserved tariff characteristics that exactly reproduce the new fitted shares. Then the Parties' margins in the model are calculated and compared to their observed counterparts. This final step is repeated across a grid of scale parameters values. The set of attribute, scale and unobserved tariff characteristics parameters in the RP model are those that provide the 'best fit' to the Parties' observed margins.

F.32 This procedure cannot address the identification problem described above unless the expected RP model tariff-level shares equal their observed counterparts.[538] To see why, consider the following hypothetical example.

F.33 Suppose that, for each operator, the SP model's predicted shares of customers subscribing to tariffs with different data allowances are very different to their observed counterparts.[539] In this case, we'd conclude that the SP model provides a poor approximation to consumers' revealed preferences over data allowances.

F.34 Further suppose that for each operator, the sum of the SP model's predicted tariff-level shares happens to exactly match its observed share of subscribers. That is, even though the SP model in this hypothetical example does accurately predict the true operator shares – it does so for the wrong reasons. This is clearly an inappropriate demand model to use as an input into a wider modelling exercise whose goal it is to predict the effect that a merger has on prices of tariffs differentiated along multiple characteristics (ie GB allowance, etc).

F.35 However, if the Parties apply their bespoke numerical procedure to attempt to mitigate the fundamental under-identification issue described in paragraph F.28, the calibrated RP model picks the same unobserved tariff characteristics values as the SP model. As a result, the RP model reproduces the SP model's incorrect tariff share predictions.

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[537] The Parties did not use their portion of the provider data (see Appendix D) to compute the share of their subscribers on each tariff.
[538] A necessary condition for identification in the Parties' RP model is that the tariff level shares implied by the stated preferences model are the same as the share of subscribers that choose each tariff in reality.
[539] We use tariff categorised data allowance to help fix ideas. Any difference between the predicted and observed distribution of within-operator tariff-level subscribers shares for each operator suffices.

F.36 This hypothetical example demonstrates that the under-identification issue cannot be solved through the application of the Parties algorithm.[540] Instead, even after the Parties' sequential numerical procedure is applied, the calibrated RP model inherits the SP's model's inability to accurately predict the share of each operators' subscribers on tariffs by data allowance. Moreover, it illustrates that the Parties' attempt to 'correct' any inaccurate predictions of within-operator tariff shares by the SP model will is not primarily driven by observed differences in the types of tariffs purchased by subscribers for each operator.[541]

F.37 To show that the under-identification issue is not simply a hypothetical concern, Table F.1 below compares the share of customers within each operator on tariffs grouped in five data allowance ranges. It contains three panels. The top panel shows, for each MNO, the predicted share of each operator's subscribers in each data allowance category when the SP demand model is applied to the Parties current SIMO choice sets. The middle panel shows the same within-operator shares by data allowance predicted by the Parties calibrated RP demand model. The bottom panel shows the observed data within-operator shares in 2023 used in the CMA demand estimation.[542]

F.38 Focussing on the top two panels, Table F.1 highlights that the Parties' failure to meet the identification requirement is not fixed by any later adjustment. This is clearly illustrated by the fact that the predicted within-operator shares for each data allowance grouping under the RP model are almost identical to those prediction by the SP model.[543] 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.

F.39 In their response to Provisional Findings, the Parties acknowledge that the model is under-identified but claim that the attempt to mitigate it only results in 'minor inaccuracy owing to a lack of data inaccuracy at the tariff level'.[544] To explore this claim, the bottom panel of Table F.1 shows the observed within-operator tariff shares in telecoms provider data used by the CMA's demand model.[545] For all network operators, in almost all data allowance groupings, the subscriber shares in the Parties' RP model are materially different from those in the observed provider data.[546] We do not consider that these differences constitute 'minor inaccuracies'.

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[540] See footnote above.
[541] Only by chance would any adjustments coincide with observed within-operator tariff shares.
[542] These shares are calculated using a random sample of 50,000 customers from the provider data (see Appendix D for details).
[543] The only major difference between the two models is that the RP model now matches the observed operator shares.
[544] Annex 4 to the Parties' response to the Provisional Findings, 4 October 2024, paragraph 5.15 [CONFI RING ME7064.23 – PF Annex 4 Strictly Confidential – Contains business secrets.pdf
[545] The Parties did not use, but had access their own provider data (see Appendix D for details)
[546] See Appendix D for details of the provider data.

Table F.1: Distribution of tariff popularity within providers by data allowance range

	Data allowance (GB):				
	0 - 8	*8 – 25*	*25 - 100*	*100 - 500*	*Unlimited*
Predicted Within-Operator Subscriber Shares according to the Parties' SP Model					
3UK	[10-20]%	[20-30]%	[20-30]%	[10-20]%	[20-30]%
BTEE	[20-30]%	[5-10]%	[20-30]%	[10-20]%	[30-40]%
VMO2	[20-30]%	[20-30]%	[10-20]%	[10-20]%	[10-20]%
VUK	[20-30]%	[20-30]%	[20-30]%	[20-30]%	[10-20]%
Predicted Within-Operator Subscriber Shares according to the Parties' RP Model†					
3UK	[10-20]%	[20-30]%	[20-30]%	[10-20]%	[20-30]%
BTEE	[20-30]%	[5-10]%	[20-30]%	[20-30]%	[20-30]%
VMO2	[20-30]%	[20-30]%	[20-30]%	[10-20]%	[10-20]%
VUK	[10-20]%	[20-30]%	[10-20]%	[20-30]%	[10-20]%
Predicted Within-Operator Subscriber Shares in CMA's Estimation Data					
3UK	[20-30]%	[20-30]%	[20-30]%	[0-5]%	[30-40]%
BTEE	[50-60]%	[20-30]%	[10-20]%	[0-5]%	[5-10]%
VMO2	[30-40]%	[30-40]%	[5-10]%	[10-20]%	[0-5]%
VUK	[40-50]%	[10-20]%	[10-20]%	[10-20]%	[10-20]%

Source: CMA analysis of Parties data and CMA analysis of PD data.
†The RP model is calibrated to the Parties contribution margin less congestion costs. The same figures for the RP model calibrated to acquisition margins are very similar and are omitted for brevity.

F.40 Furthermore, the key economic outputs from this approach do not appear to be consistent with observed data or other evidence sources.

F.41 The diversion ratios between the Parties in the RP demand models appear implausibly low. For the acquisition margin calibration, the diversion ratios between the Parties are [✂].[547] 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.[548]

F.42 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. These substantially differ from analogous diversion ratios collected from other sources. We view this as being potentially symptomatic of severe misspecification of the Parties model and/or an unsuitable calibration method.

F.43 Second, even if the Parties market shares constraints were calibrated using observed, rather than fitted tariff shares, we have significant concerns over of the use of the Parties numerical procedure(s) to calibrate the parameters of the RP demand model.

F.44 In principle, the estimator used by the Parties to estimate preferences over tariff attributes using SP data (the first step in the Parties' numerical procedure) is

[547] Parties' response to the CMA's RFI.
[548] Parties' response to the CMA's RFI.

consistent, in the sense that it tends to recover the true value of the underlying parameters provided the SP data is reflective of true customer preferences. However, in this case we have reservations with the survey design used by the parties to collect SP data. As such, our view is that consistent estimates of (scaled) consumer valuations for tariff attributes in the real-world are unlikely to coincide with those estimated from the Parties' survey alone.

F.45 Therefore, it is particularly concerning that the two-step estimation procedure used by the Parties does not allow the estimates of some revealed preference parameters to 'respond' to the information about real-world customers choices that is encapsulated in observed market shares. Nor does it allow them to respond to embedded assumptions on operator's conduct that determine the model's predicted margins.[549]

F.46 Given these concerns, to be able to place any evidentiary weight on the resulting calibration of the RP demand model, we believe it is necessary to show how the output of the Parties numerical procedure is linked, if at all, to the solution of the optimisation problem it purports to solve. The Parties have not been able to show an equivalence nor establish to what, in theory, their bespoke numerical procedure converges.

F.47 In addition to our concerns over the Parties survey, we also have serious reservations about the lack of identification of the Parties' RP demand model and the properties of the bespoke numerical procedure used to calibrate its parameters.

Merger simulations in the quality-focused model

F.48 In the final step of the model, the Parties use the calibrated RP demand model together with choice set data drawn from Pure Pricing data to conduct merger simulations. The Parties implement four merger simulations:[550]

(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).

[549] Train (2009) suggests that both revealed and stated preference data are best used together in a single-step estimator when combining RP and SP models. Train (2009) Discrete Choice Methods with Simulations, Section 7.2.
[550] 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'. The resulting marginal costs are held fixed across all simulations.

F.49 In all cases, the calibrated RP demand model is combined with a static Nash Bertrand pricing model and marginal costs at 'Day 0' are backed out. The resulting marginal costs are held fixed across all simulations.

F.50 Given that Parties consumer choice survey falls short of requirements set out in the CMA's Survey Good Practice and given our concerns over the Parties demand model, we do not place weight on any merger simulations that rely on them as key inputs. Notwithstanding this, we highlight a few additional concerns with the merger simulations based on this model.

F.51 A 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 and supply modelling estimation framework.[551]

F.52 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.53 As such, it is not possible to draw conclusions about the operators' optimal choices of price and quality in a post-merger equilibrium from results of the merger simulation. Therefore, 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.

F.54 This, because the Parties' welfare-gain calculations rely on the output of Scenario 3, 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).[552] Furthermore, our confidence in the validity of the Parties' welfare-gain estimate is further eroded by our significant concerns over the ability of their customer choice survey to provide data that can be used to credibly recover consumers' willingness to pay for different aspects of network quality.

Conclusion

F.55 Given these serious concerns outlined above, our view is that we place no weight on the Parties' customer choice survey, the corresponding estimated and calibrated demand models, or subsequent merger simulations they are used in. Therefore, we do not consider the results of the model to be credible, including the

[551] 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.
[552] Parties' submission, Quality-focused merger simulation model.

claim that the Merger 'will lead to a market-wide welfare gain of £1.8bn per year (in 2030)'.

Capacity-Focused Model

Parties' submission

F.56 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, network capacity and congestion levels 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.[553]

Our assessment

F.57 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 network processing capacity independently of one another, but at the same time.

F.58 Noting that meaningful adjustments of processing capacity occur over a multi-year time horizon, but prices are set at a much higher frequency, our view is that this model is most appropriately used as a tool to help understand how the Merger might affect long-run industry outcomes. Before providing our 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.59 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.

[553] Parties' submission, Overview of modelling approaches and results and Parties' submission, Capacity-focused merger simulation model.

Specifically, consumers are assumed to reduce demand proportionately when they experience congestion. As a result, high intensity data users' demand is more affected by congestion than low intensity users' demand.

F.60 This feature of consumer behaviour is captured in the capacity-focused model by assuming congestion rotates, rather than shifts out the linear (in prices) 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.[554]

F.61 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.[555] However, while adding processing capacity can boost demand by removing congestion, the model assumes it is increasingly costly to do so.[556] This limits the amount of investment in processing capacity chosen by a profit maximising mobile network operator.

F.62 While both features of the model appear to be desirable for a long-run model of the UK mobile industry, we note that the Parties' model excludes the possibility of a quality-enhancing role for investments (eg when additional capacity investments shift out demand by providing higher speed and/or better coverage reliability). The Parties' own analysis suggests that the omission of a quality-enhancing role for investments in their model removes one incentive mechanism for the Parties to increase prices post-Merger.[557] Our view is that while this is a simplifying assumption that aids tractability of their model, given the Parties' own emphasis of the importance of speed and coverage reliability for consumers, it is restrictive.

F.63 In addition to the concerns outlined above, we have some reservations about the structure of the model, its inputs, and detail of its calibration. 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

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[554] 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.
[555] 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.
[556] The model assumes that investment cost increases at a rate $\kappa > 1$ as processing capacity is added.
[557] The effect of a merger on price, investment, profits and consumer welfare in a simplified quality-enhancing investments version of the Parties' modelling framework is simulated in [✂] to parties submission, Capacity-focused merger simulation model. This analysis shows that, compared to a comparable capacity-sharing investment model, price increases are more common in the quality-enhancing investment model - though the effect on consumer welfare is ambiguous.

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 structural 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 criterion (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.

F.65 Our view is that the margins best suited to calibrate the baseline scenario 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 their first contract.[558] In line with this perspective, we do not believe it is appropriate to uniquely characterise the 'baseline' of the Parties' capacity-focused model using 'acquisition margins'.

F.66 As outlined in Chapter 8 and in Appendix E, we note that the margin earned over the subscriber's tenure with an operator is likely to exceed the acquisition margin. Therefore, our current view is that the Parties' characterisation of the 'baseline' scenario of their model (that calibrates the model using acquisition margins) may understate consumer harm from the Merger.

F.67 In line with this perspective, we re-simulated the capacity-focused model's baseline scenario (with and without efficiencies) using subscriber margins, Contribution A margins, and Contribution B margins.[559] We also re-computed the Parties main sensitivity analysis for each of the different margins listed above. Figure F.1 shows the effect of the Merger as percentage change in consumer welfare for the baseline models and the sensitivities.

[558] 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.
[559] Table F.2 shows the margins the CMA has used for this analysis. It further highlights that contributions margins are higher than acquisition margins in this case.

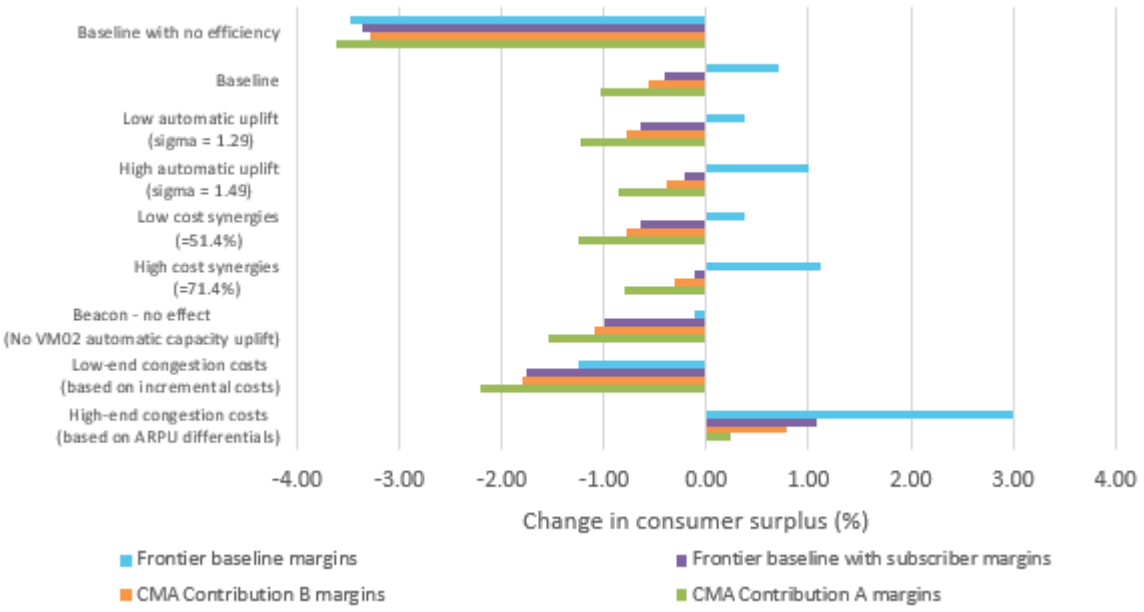
Table F.2: Margins by type and firm

Firm	*Acquisition margin*	*Subscriber margin*	*Contribution B margin*	*Contribution A margin*
3UK	[40-50]%	[50-60]%	[60-70]%	[60-70]%
VUK	[30-40]%	[40-50]%	[40-50]%	[50-60]%
VMO2	[30-40]%	[50-60]%	[50-60]%	[50-60]%
BTEE	[30-40]%	[50-60]%	[60-70]%	[60-70]%

Source: CMA analysis of Parties' data, 3UK, VUK.

F.68 In the baseline scenarios and across almost all sensitivities considered by the Parties, the figure shows that the Merger leads to a reduction in consumer welfare. This suggests that, when calibrated to better match levels of long-run market power, the Parties may not have the incentive to invest enough to offset the harm incurred by higher prices.

Figure F.1: Percentage change in consumer surplus by sensitivity and type of margin



Source: CMA analysis of Parties submission, Capacity-focused merger simulation model.

F.69 In the baseline scenario with no efficiencies, the model predicts that the Parties produce between 4% to 5% less capacity than the sum of VUK and 3UK alone absent the merger (for all the different margin measurements). However, once efficiencies are included in the baseline scenario, the Merged Entity optimally chooses to increase capacity because of the Merger.

F.70 In the Parties' baseline the post-merger increase in investment is 17.8% higher than the sum of VUK and 3UK as standalones.[560] The result is a total uplift in capacity of 64%. The Parties state that, even though the model's conclusions on

[560] Parties submission, Capacity-focused merger simulation model.

investment are independent of the assumptions made in the JBP, this is broadly in line with the JBP's [✂]% minimum increase in capacity by 2029.[561]

F.71 However, when the model is calibrated to match Subscriber, Contribution B or Contribution A margins, the increase in investment is only 16.2%, 15.9% and 15.4% higher than the sum of VUK and 3UK as standalones respectively. The corresponding capacity uplifts are 62%, 61% and 60% – around 3 to 5 p.p. lower the minimum capacity uplift in the JBP. As noted above, consumer welfare is also reduced by the Merger in these scenarios.

F.72 Overall, with a minor change that re-calibrates the model to match equally if not more plausible target long-run margins, the above analysis shows that while the Merged Entity optimally increases investment, it does so by less than stated in its JBP. In addition, as shown in Figure F.1, consumer welfare falls in the baseline and across a range of sensitivity scenarios at these higher margins. Taken together, these findings cast some doubt on the inevitability of the Parties' incentive to fully implement the JBP and/or to increase investment by enough to reduce average quality-adjusted prices.

F.73 In relation to criterion (c), to help further test the robustness of the results of capacity-focused model, we asked the Parties to show how they were related to the assumed functional forms for investment costs and demand and/or provide empirical evidence clearly supporting their use.

F.74 We focus first on the functional form chosen for investment cost. The Parties submit that the functional form and its assumed convexity parameter (κ) are chosen with the purpose of making the capacity-focused model tractable.[562] Given the importance of the investment cost function in the Parties' model 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.[563] 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; and

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[561] Parties submission, Capacity-focused merger simulation model.
[562] The convexity parameter of the investment cost function, (κ), controls the rate at which the incremental costs of eliminating congestion increase with network investment. Only a lower bound on its convexity is theoretically motivated (ie $\kappa > 1$). Parties' response to the CMA's RFI.
[563] Parties' response to the CMA's RFI.

(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 The Parties additionally submitted that the available empirical evidence is not consistent with the Merged Entity's incremental costs increasing as they build up capacity.[564] In particular, they noted that the average incremental cost incurred in upgrading a site during integration is lower when upgrading from a low- to a mid-config site compared to when upgrading from a mid- to a high-config site. This they argue is inconsistent with any convexity and thus the fact their model has some convexity means it should be seen as conservative.

F.77 Regarding the choice of the convexity parameter, the Parties note that there is limited evidence to justify a specific level of convexity.[565,566] As such, 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 baseline scenario.

F.78 To explore the potential impact of assuming higher investment cost convexity in the capacity-focused model, we compared the Parties' and CMA baselines to a sensitivity analysis in which the only difference is that they assume a more convex investment cost function (ie. a higher value of the convexity parameter).[567] Our sensitivity analysis is presented in Table F.3 below.

[564] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 4.36
[565] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 4.37.
[566] The Parties do note that very high values of κ may be implausible. For example, when assuming κ = 9, the cost of increasing capacity by a further 10 percentage points would more than double. Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 4.38.
[567] In their response to Provisional Findings, the Parties extend their sensitivity analysis of the convexity of investment cost function. They report the result starting from a convexity parameter of $\kappa = 3$ up to $\kappa = 9$. We have extended this to $\kappa = 10$ and report the effect on the percentage change in consumer welfare up to 2 decimal places. Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraph 4.38

Table F.3: Percentage change in consumer surplus and uplift by convexity parameter (κ) of investment cost function

Convexity parameter (κ)	*Parties' baseline (Acquisition margins)*	*Parties' baseline with subscriber margins*	*CMA contribution B margins*	*CMA contribution A margins*
Capacity Uplift (%)				
$\kappa = 2$	74	70	70	69
$\kappa = 3$ (baseline)	64	62	61	60
$\kappa = 4$	58	57	56	56
$\kappa = 5$	55	53	53	53
$\kappa = 6$	52	51	51	51
$\kappa = 7$	50	50	49	49
$\kappa = 8$	49	48	48	48
$\kappa = 9$	48	47	47	47
$\kappa = 10$	47	47	46	46
Change in consumer surplus (%)				
$\kappa = 2$	1.17	-0.11	-0.30	-0.78
$\kappa = 3$ (baseline)	0.71	-0.41	-0.57	-1.04
$\kappa = 4$	0.44	-0.59	-0.73	-1.19
$\kappa = 5$	0.26	-0.71	-0.84	-1.30
$\kappa = 6$	0.13	-0.79	-0.92	-1.37
$\kappa = 7$	0.04	-0.86	-0.98	-1.42
$\kappa = 8$	-0.04	-0.91	-1.02	-1.47
$\kappa = 9$	-0.10	-0.95	-1.06	-1.50
$\kappa = 10$	-0.15	-0.98	-1.09	-1.53

Source: CMA analysis of Parties submission, Capacity-focused merger simulation model.

F.79 Table F.3 contains two panels. The top panel shows the predicted post-merger capacity uplift as the convexity parameter is changed in each of the four margin scenarios introduced above. The bottom panel also shows the percentage changes in consumer welfare resulting from the Merger in each case.

F.80 The top panel shows that the capacity uplift implied by post-merger investment by the Merged Entity decreases as the convexity parameter increases. As noted in above, when the convexity parameter is set to its baseline value, $\kappa = 3$, the capacity uplift decreases from 64% to 60% as the margin being targeted in calibration increases from the acquisition margin to the highest contribution margin.

F.81 When the convexity of the investment function is slightly increased by setting $\kappa = 4$, the capacity uplift across margin scenarios in the model is lower still. For the acquisition margin baseline, the optimal post-merger capacity uplift is only 58%. For Subscriber, Contribution A and Contribution B margins baseline scenarios, the optimal capacity uplift is only 56% to 57%.

F.82 This sensitivity analysis highlights that the Merged Entity's post-merger investment behaviour predicted by the model is sensitive to the arbitrarily chosen convexity parameter. Moreover, even for moderate increases in convexity of the investment cost function, the modelled post-merger increase in capacity is substantially below the minimum capacity uplift of [✂]% associated with the full implementation the JBP – in any margin's baseline scenario.

F.83 The bottom panel in Table F.3 shows that consumer welfare also generally decreases as the convexity parameter increases. At the margins that, in our view,

better reflect long-run pre-merger market power (ie. Subscriber, Contribution A and Contribution B margins), the Merger always reduces consumer welfare. Even in the Parties' baseline scenario where investments costs rise more steeply with capacity, the Merger can lead to a reduction in consumer welfare (ie. for $\kappa > 7$).[568]

F.84 Given the lack of evidence in support of the assumed convexity of the investment cost function, we cannot rule out that a more convex investment cost function provides a more appropriate description of reality. If so, we note that, based on the Parties' simulation results:

(a) The Merged Entity's optimal investment often results in a capacity uplift that is substantially below the minimum capacity uplift of [✂]% associated with the full implementation the JBP; and

(b) the consumer welfare projected by the model may understate consumer harm from the Merger.

F.85 Finally, we consider the sensitivity of optimal investment and consumer welfare to changes in the demand system.

F.86 In the baseline scenario of the capacity-focused model, the Parties assume that there is a representative consumer with quadratic utility. The resulting demand system is linear in 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).[569] 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.[570] 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.87 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.

F.88 The Parties submitted that the Constant Elasticity of Substitution (**CES**) would not be suitable due to their restrictive substitution patterns.[571] However the Parties submitted a version of their capacity-focused model with a homogeneous

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[568] The Parties do argue however that such high levels of κ may be implausible (see footnote above).
[569] All features shown to influence consumer decisions in the both the CMA's demand estimation and Parties' demand estimation using stated preference data.
[570] The Parties' response to the Provisional Findings state that the linear model is not necessarily conservative and that the CMA's alternative harm estimates show that linear demand can lead to higher price effects compared to alternatives (ie. logit demand). However, this is incorrect and for the same set of inputs the CMA's analysis in appendix D did show that linear is more conservative that logit. Valletti and Zenger (2020) also discuss the dampening effect of linear demand. Valletti, T. M., & Zenger, H. (2020). Mergers with Differentiated Products: Where Do We Stand? In SSRN Electronic Journal. Elsevier BV. Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraphs 4.22-4.33.
[571] Parties' response to the CMA's RFI.

multinomial logit demand model in their response to the Provisional Findings.[572,573] Table F.4 shows the percentage change in consumer welfare under the Parties baseline case with linear (in prices) demand and under logit demand.

Table F.4: Change in consumer surplus by type of margin, demand model, and sensitivity

Demand model	*Sensitivity*	*Parties' baseline (Acquisition margins)*	*Parties' baseline with subscriber margins*	*Contribution B margins*	*Contribution A margins*
Linear demand	Baseline - no efficiency	-3.48	-3.37	-3.28	-3.61
	Baseline	0.71	-0.41	-0.57	-1.04
Logit demand	Baseline - no efficiency	-5.01	-5.01	-5.00	-5.03
	Baseline	7.67	7.69	7.69	7.65

Source: CMA analysis of Parties submission and Parties' response to the Provisional Findings, 4 October 2024, Annex 4, Table 4.4.

F.89 Across all different types of margins, the effect of using the logit model in place of the original linear demand model is to materially increase consumer harm from approximately -3.5% to -5% when there are no efficiencies. However, when efficiencies are included, the model produces a large increase consumer welfare from 0.7% with linear demand to 7.7% with logit demand.

F.90 In terms of optimal investment, the baseline logit demand scenario with no efficiencies model predicts that the Parties produce 6% less capacity than VUK and 3UK alone absent the Merger (for all margin baseline scenarios). However, once efficiencies are included, the Merged Entity's optimal investment is 19.8% higher than the sum of VUK and 3UK as standalones.[574] The total uplift in capacity of 67% - greater than the JBP's [✂]% minimum increase in capacity by 2029 if it is implemented in full.[575]

F.91 Taken together, the optimal investment behaviour described above and the consumer welfare results shown in Table F.4, highlight that the Parties' model is sensitive to changes in the demand system. While the logit demand system is less responsive to alternative margin assumptions than its linear counterpart, it appears to be more sensitive to the way efficiencies are modelled.

Conclusion

F.92 Based on the discussion above, our view is that, in principle, the capacity-focused model provides a coherent, but restricted framework with which to understand the complex set of incentives faced by operators when they simultaneously choose

[572] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, paragraphs 4.26-4.33. The calibrated homogeneous logit model does not, unlike the CMA's logit demand model allow for consumer heterogeneity.
[573] The Parties additionally calibrated the more convex log-linear demand model pre-Merger. However, they told us that no valid post-Merger solution existed. Parties' response to the CMA's RFI.
[574] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, Table 4.4.
[575] Parties' response to the Provisional Findings, 4 October 2024, Annex 4, Table 4.1.

both price and network quality (here proxied by firms choosing investments that alleviate congestion) over the long-run spanning multiple consumer contracts.

F.93 However, given the restrictive nature of the model and the stylised calibration approach, we do not believe that the Parties' capacity-focused model is well suited to extrapolate and predict actual firm behaviour or the impact of the merger on consumer welfare.

APPENDIX G: Standalone Capacity and Congestion

Introduction

G.1 The Parties submitted that 'the prevailing conditions of competition are not delivering good outcomes for UK consumers',[576] 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.[577]

G.2 In contrast, the Parties submitted that the Merger would 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.'[578] The Parties submitted a model showing that the Merged Entity would have [✂]% greater capacity than the standalone networks by 2029.[579]

G.3 In order to assess the Parties' claims it is necessary to reach a conclusion on levels of network congestion in the Parties' current network and how these might develop in the counterfactual. In this Appendix, we therefore analyse in more detail the likely capacity and congestion levels of the standalone networks as part of our wider assessment 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.

G.4 Our conclusions on these wider points as they pertain to our overall assessment of the competition impact of the Merger are set out in Chapters 14 and 16 of our Final Report.

Background

G.5 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.

[576] Parties' initial submission, 1 May 2024, paragraph 2.1.
[577] Parties' initial submission, 1 May 2024, Section 2.
[578] Parties' initial submission, 1 May 2024, Section 6.
[579] Parties' response to the CMA's capacity uplift query.

G.6 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.[580] 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,[581] equips base stations with a very large number of antenna elements to improve spectral and energy efficiency.[582]

G.7 The effective combination of these factors results in networks with widespread and reliably strong mobile signals. This in turn delivers benefits through higher network performance on a number of factors, in particular good 4G and 5G coverage, faster speeds, and lower latency.

G.8 UK MNOs in aggregate typically have capital expenditure (excluding spectrum acquisition costs) of between £2.5 billion and £3 billion per annum,[583] a substantial proportion of which is spent on maintaining and upgrading their networks.[584]

G.9 The need for continual upgrading of mobile networks has been mainly driven by strong growth of mobile traffic.[585] Ofcom reported average year-on-year growth of 40% from 2017 to 2021.[586] However, Ofcom submitted that 'Since then, growth

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[580] Most recently, Ofcom auctioned licences in the 700 MHz and 3.6-3.8 GHz bands in 2021.
[581] See 5G Systems Development and Deployment (3gpp.org), accessed by the CMA on 13 June 2024.
[582] 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.
[583] 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.
[584] In recent years, significant MNO capex has been devoted to removing Huawei equipment from networks, as a result of the Government's strategy to remove high-risk vendors ("HRVs") from the UK's 5G networks for national security purposes, FMN.
[585] 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.
[586] 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.

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.[…]'.[587]

G.10 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'.[588] 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.[589]

G.11 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[590] and 5G Advanced.[591]

Congestion on the Parties' standalone networks

G.12 As part of our assessment of the competitive impact of the transaction, we have considered the Parties' submissions regarding the likely levels of current and future congestion on their standalone networks in the counterfactual.

G.13 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 [✂].[592]

(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.' [593] [✂]

[587] 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.
[588] Ofcom, response to the CMA's 19 April 2024 letter.
[589] Ofcom, response to the CMA's 19 April 2024 letter.
[590] 5G SA networks have a dedicated 5G core network, rather than linking to a legacy 4G network.
[591] 5G Advanced is a higher-bandwidth, lower-latency version of 5G that will provide improved capability for services such as Extended Reality (**XR**).
[592] Parties' initial submission, 1 May 2024, paragraphs 2.10 and 2.11.
[593] Parties' initial submission, 1 May 2024, paragraph 2.33.

VUK forecasts 'a significant increase in congestion peaking at [✂]% of its sites in [✂].[594]

Measuring congestion

G.14 The Parties' submissions have generally presented analysis of congestion on a per-site basis, ie showing forecasts of the number of congested sites per annum.[595] However, we note that:

(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.15 [✂].[596] [✂] 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 A.1.[597] In addition, 3UK defines each spectrum band in each sector as a 'cell', which in practice [✂].[598] VUK also identifies congestion on [✂].[599]

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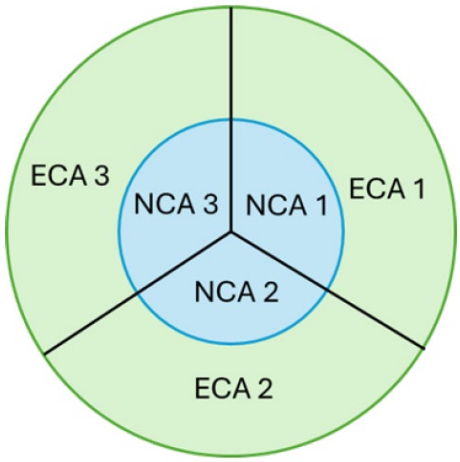
[594] Parties' initial submission, 1 May 2024, paragraph 2.37.
[595] See for example the Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[596] FMN; The Parties put back response (Appendix G: Capacity and Congestion).
[597] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[598] CMA analysis of [✂].
[599] 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.16 As discussed in more detail below, our analysis shows that cell level measures suggest much lower levels of congestion than site level measures. However, the Parties submitted that it is appropriate to treat a site as congested when only part of the cells on a site are congested:

(a) VUK submitted that 'VUK defines a site as congested when [✂]. This is because, where [✂]. [✂].[600]

(b) 3UK submitted that [✂]:[601]

(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.17 We understand that investment decisions are made at site level across the mobile industry. In practical terms, the Parties appear typically to [✂]. However, 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

[600] Vodafone response to the CMA's s109 notice.
[601] CK Hutchison response to the CMA's s109 notice.

current and future network congestion is a limitation on perceived network quality and their ability to compete effectively.[602] In our view, as both measures may have implications for the customer's experience, we consider it appropriate to look at both, not just the measure proposed by the Parties.

G.18 We note that 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 [✂].[603] In addition:

(a) Despite VUK's submissions, we continue to consider that customers in non-congested cells adjacent to congested cells would not 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 and

(c) Despite 3UK's submissions, we do not consider that a more granular assessment based on cells would give an overly optimistic view of congestion and the consumer experience and instead consider it provides a valuable additional metric of network congestion.

G.19 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.[604] We note, however, that the Ofcom Connected Nations table cited by the Parties currently identifies download speed thresholds as 'Good' (2Mbps), 'High' (5Mbps) and 'Very High' (10Mbps) – ie according to Ofcom 'good' performance can be delivered at 2Mbps.[605]

Parties' response to the Provisional Findings

G.20 The Parties submitted that 'By focussing narrowly on cell-level statistics of congestion, ie, the proportion of cells that are congested at any given point, the

[602] See for example FMN.
[603] FMN.
[604] Annex 4 to the Parties' response to the AIS and working papers.
[605] Ofcom's Connected nations UK report 2023, 19 December 2023, table 3.2.

CMA's analysis understates the extent of the impact of congestion on customer experience on the Parties' networks and therefore, ultimately, the importance of best network status'.[606] In particular they submitted that:

(a) The capacity for serving a customer is based on all the carriers (ie spectrum bands) in the geographic sector where the customer is located, rather than the capacity of the cell as defined by a particular spectrum band. In addition, customers may be affected by congestion in adjacent cells from which they could otherwise draw on capacity.[607]

(b) Customers that move in and out of congested cells will receive an inconsistent experience.[608]

(c) 'Having a congested cell indicates that the sector as a whole is highly loaded / utilised (even if not all the cells on the sector are congested at the relevant threshold in the busy hour), and hence that all customers at the sector can expect to experience relatively poor performance.'[609]

(d) '[…] sites that are congested tend to have a disproportionately high number of users, meaning that the percentage of customers affected is higher than the equivalent percentage of sites (and cells) […].'[610]

G.21 Taking these points in turn, we note that:

(a) To the extent that customer congestion on a particular spectrum band can be addressed by uncongested spectrum available at the same location, this will tend to mitigate, rather than increase, the impact on customer experience of a particular cell being congested. If a customer is in an uncongested cell, it is not clear that they would be materially affected by congestion in adjacent cells.

(b) While customers may move between congested and uncongested cells at the same site, they may also move between different sites. It is not clear that the fact that some customers move around favours a site level rather than a cell level analysis.

(c) We recognise that network performance is a complex issue. However, the Parties have made specific submissions about congestion on their network, and we have assessed these submissions, using thresholds for congestion used by the Parties themselves.

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[606] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.5.
[607] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.5 (i).
[608] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.5 (ii).
[609] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.5 (iii).
[610] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.5 (iv).

(d) The evidence we have seen does not support a view that congested sites have a disproportionately large number of users. As we discuss below, congestion is particularly a problem for low-band spectrum, which is more likely than other spectrum bands to be deployed in less densely populated areas. As shown in Table G.2 and Table G.4 below, each of the Parties have more congestion at sites where C-band spectrum has not been deployed than at sites where C-band has been deployed (which tend to be busier locations).

G.22 The Parties also submitted that our comments on speed thresholds (see above) implied that the [✂]Mbps threshold adopted by the Parties' congestion modelling may be too high. The Parties consider that the [✂]Mbps congestion threshold is conservative for a forward-looking assessment.[611]

G.23 It is not the CMA's position that the [✂]Mbps threshold is necessarily too high. We have considered the relevant evidence in order to provide context for different potential speed thresholds. In our assessment below, we have focused on the speed thresholds adopted or presented by the Parties.

3UK standalone network

G.24 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.' [612] 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 subscriber. Historically, this has resulted in significant congestion further limiting 3UK's competitiveness.' [613]

3UK network congestion

G.25 3UK has provided estimates and forecasts of its network congestion levels, as set out in Table G.1, 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 [✂].[614] 3UK submitted that [✂]. [615] 3UK currently has [✂]% C-band

[611] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.6.
[612] Parties' initial submission, 1 May 2024, paragraph 2.10.
[613] Parties' initial submission, 1 May 2024, paragraph 2.13.
[614] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[615] FMN.

5G population coverage[616]and forecasts achieving 5G C-band population coverage on a standalone basis of [✂]% by 2032.[617]

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,

Figure G.2: 3UK congested sites forecast.

[✂]

Source: FMN. [✂]

G.26 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.[618] 3UK submitted that it would face growing congestion without additional spectrum and asked Ofcom to aim to make the 600 MHz band[619] available for mobile use, and to support allocation of the upper 6GHz band for licensed mobile use at WRC-23[620] 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,[621] [✂] and [✂]. 3UK predicted that it would have [✂][622] [✂], under Ofcom's medium traffic growth scenario and with [✂], as shown in Figure G.3.

G.27 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

[616] Parties' submission, Relevant customer benefits.
[617] FMN.
[618] CK Hutchison's internal document.
[619] Currently used for digital terrestrial television (**DTT**).
[620] 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.
[621] 20 MHz of 700 MHz spectrum in 2021 and 20 MHz of 3.4 GHz spectrum in 2018.
[622] 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).

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.28 We have assessed site-level data on congestion from 3UK, as summarised in Table A.2. The first data column shows that of around [✂] sites which are congested at [✂]Mbps, around [✂] are only congested in low band spectrum (typically 800MHz), with [✂] congestion in mid-band (1400MHz to 2600MHz) 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.2: 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.29 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 800MHz (serving the ECA of the site, and 1800MHz (serving the NCA), then if the 800MHz 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.2 above).

G.30 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.3. As the Table shows, three or fewer cells are congested in [✂] out of the [✂] congested sites on 3UK's network.

Table G.3: 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 response to the CMA's s109 notice.

Parties' Response to our Capacity and Congestion Working Paper on 3UK congestion levels

G.31 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 [✂].'[623]

G.32 We discuss 3UK's network quality in a 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).[624]

Parties' response to the Provisional Findings

G.33 The Parties submitted that the Provisional Findings significantly understate 3UK's current and future congestion problem, and in particular that:

(a) An additional c.[✂] 3UK sites experience [✂] congestion, but for less than the minimum [✂] at which congestion is identified.[625]

[623] Annex 4 to the Parties' response to the AIS and working papers.
[624] 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.
[625] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.7(i).

(b) Even when congestion is measured at cell level, [✂]% of 3UK customers are affected by congestion.[626]

(c) The Provisional Findings wrongly attach weight to 3UK's May 2022 submission to Ofcom. In May 2022, 3UK expected [✂] congestion on its network going forward than under its current congestion forecasts, [✂]. 'Any implication that 3UK scaled back its 5G rollout plans after 3UK entered into intensive merger discussions ignores the evidence that a [✂].[627]

(d) 'A contemporaneous BTEE internal document from [✂] states [✂].'[628]

G.34 Taking these points in turn:

(a) As noted above, we have assessed the Parties' submissions in relation to congestion, using thresholds for congestion used by the Parties themselves.

(b) We note that a customer being nominally affected by congestion (in the sense of being in a congested cell) may not necessarily mean that the customer has a negative experience, which we discuss in more detail with reference to the Parties' internal documents below.

(c) Our guidance notes that 'Where internal documents support claims being made by merger firms or third parties that have an interest in the outcome of the CMA's investigation, the CMA may be likely to attach more evidentiary weight to such documents if they were generated prior to the period in which those firms were contemplating or aware of the merger, or if they are consistent with other evidence'.[629] While the Parties have submitted that 3UK had a range of reasons for [✂]. We note that the [✂].

(d) We recognise that the BTEE document referenced by the Parties provides some support for the view that it would [✂] we note that 3UK itself, in internal documents which we discuss below, presented a [✂] [✂] view of its future network investment.

3UK network investment

G.35 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

[626] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.7(ii).
[627] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.8.
[628] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.8(iii).
[629] CMA129, paragraph 2.29.

on its 4G network. This has improved customer experience in localised areas and resulted in [✂].' [630]

G.36 3UK had a total capex of £2.3 billion from 2020 to 2022 [✂].[631] [✂].

G.37 3UK launched its 5G service to mobile customers in February 2020. [✂].[632]

Figure G.4: 3UK's [✂] in planned 5G sites.

[✂]

Source: FMN.

G.38 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 [✂].[633] Our analysis of Opensignal 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.[634]

G.39 An internal 3UK document from February 2022 describes a '4G Congestion Reduction Programme', as shown in Figure G.5.[635] 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.40 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.[636] [✂].

Figure G.6: 3UK progress on 4G Congestion Reduction Programme.

[✂]

Source: Parties response to the CMA's RFI.

[630] FMN.
[631] FMN.
[632] FMN.
[633] Annex 4 to the Parties' response to the AIS and working papers.
[634] Chapter 8, Figure 8.16.
[635] CK Hutchison internal document.
[636] Parties response to the CMA's RFI.

G.41 The Parties submitted that [✂]. They said that [✂]. [✂]. The Parties noted that [✂].[637]

G.42 The Parties subsequently identified [✂].[638] [✂].[639] In line with our guidance, we have therefore considered this as part of the evidentiary weight we attach to these documents.[640] Moreover, as set out in Appendix C we have also seen evidence suggesting that [✂].[641]

5G SA and Advanced 5G

G.43 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'.[642] The Parties submitted that '[✂].[643]

G.44 A November 2022 internal document [✂].[644] This document [✂]. In line with our guidance, we have therefore considered this as part of the evidentiary weight we attach to these documents.[645] The document [✂]. [✂].

Our views on likely future 3UK network investment

G.45 We considered 3UK's recent financial performance and ability to compete on an ongoing basis in Chapter 8. We concluded that 3UK has seen stable recent performance and is currently largely performing in line with many of their budget expectations. We considered that, absent the Merger, it is likely that 3UK would continue to compete largely as it does at the moment.

G.46 However, as discussed at Appendix C, we have also found evidence from 3UK's internal documents that it [✂], and it has been [✂], partly exacerbated by [✂].[646] We found that third party documents also recognise 3UK's challenges of relative size and scale,[647] and some suggest an expectation that its investment activity and momentum may be limited by this (and its capex constraints).[648]

G.47 Since publication of our Provisional Findings, Ofcom submitted that while it recognises that 3UK has shown itself to be innovative in finding ways to generate

[637] Annex 4 to the Parties' response to the AIS and working papers.
[638] CK Hutchison Main Party Hearing Transcript. CK Hutchison's response to s 109 Notice.
[639] FMN.
[640] CMA129, paragraph 2.29(a)
[641] Appendix C, paragraph C5.
[642] FMN.
[643] FMN.
[644] CK Hutchison internal document.
[645] CMA129, paragraph 2.29(a).
[646] Appendix C and Chapter 7.
[647] See Appendix C.
[648] See Appendix C.

additional revenues, it considers that this may not be long lived (as a result of competitors' response and a continued 'scarcity' of capex).[649]

G.48 We continue to believe that – absent the Merger – 3UK would likely continue competing in broadly the same way it does now, given that we have also found that its shareholder is likely to be incentivised to continue supporting it. However, as set out in Chapter 16, we consider that there is likely to be a marked difference between (i) the levels of network investment that 3UK would deliver absent the Merger and (ii) that proposed under the JBP and Network Commitment.

3UK network performance

G.49 A 3UK internal document from March 2022 (see Figure G.7) describes its network performance as [✂].[650] 3UK provided an update of the congestion data [✂] (see Figure G.8).[651]

Figure G.7: 3UK Internal document, March 2022.

[✂]

Source: CK Hutchison internal document.

Figure G.8: Congested hours on 3UK 4G cells.

[✂]

Source: CK Hutchison response to the CMA's RFI.

G.50 A November/December 2022 internal document shows [✂] (see Figure G.9).[652] [✂]. We note that the Parties reported that [✂].[653] In line with our guidance, we have therefore considered this as part of the evidentiary weight we attach to these documents.[654] [✂].

Figure G.9: 3UK internal document, November 2022.

[✂]

Source: CK Hutchison internal document.

G.51 The same document (slides 34-39) compares the current status of the Radio Access Network (**RAN**), including the following:[655]

(a) 'Network current status [✂].

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[649] Ofcom, response to the CMA's 1 October 2024 letter.
[650] CK Hutchison internal document.
[651] 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. (CK Hutchison response to the CMA's RFI.
[652] CK Hutchison internal document.
[653] FMN.
[654] CMA129, paragraph 2.29(a)
[655] CK Hutchison internal document.

(b) Network status – planned end 2024: [✂].

(c) Network status – planned end 2027: [✂].

G.52 A further slide (slide 56) in the same pack summarises 3UK's 'horizons' to achieve a 'strategic vision', including a '[✂], followed by [✂] (Figure G.10).[656]

Figure G.10: 3UK Strategic Vision, November/December 2022.

[✂]

Source: CK Hutchison internal document.

Parties' response to Provisional Findings

G.53 The Parties provided some detailed comments on our discussion of 3UK's internal documents.[657] We recognise that these documents are subject to a degree of interpretation. However, we consider that taken in the round they present a considerably less negative picture of 3UK's future network investment and performance than the Parties have presented to us, and this is particularly true of documents which were generated before the Parties entered intensive merger discussions.

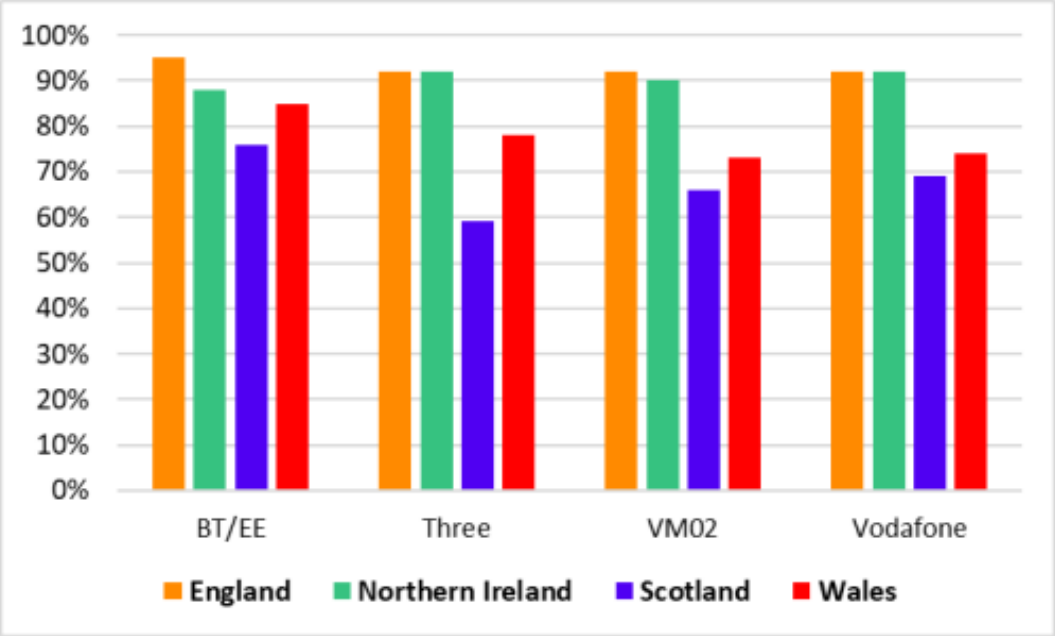
Third-party metrics

G.54 Third-party reports of 3UK's network performance, including 5G coverage, indicate that it broadly compares well with other MNOs.[658]

(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.

[656] CK Hutchison internal document.
[657] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraphs 5.8(iv) and 5.9.
[658] See Three 5G Coverage - Check coverage in your area, accessed by the CMA on 14 June 2024.

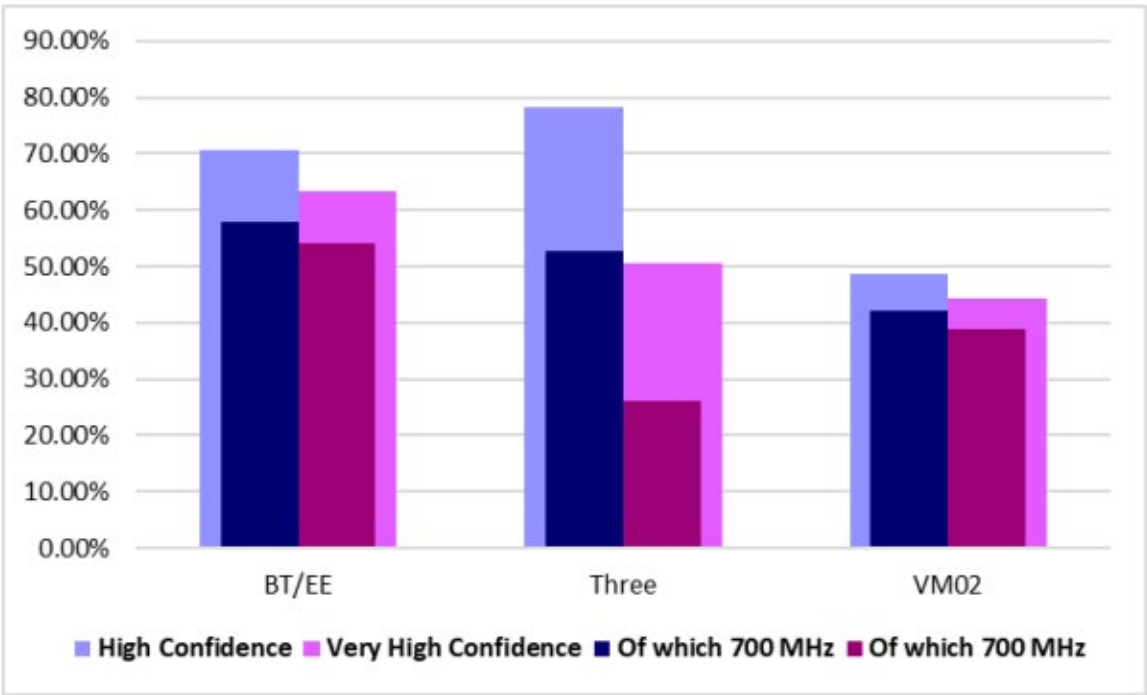
Figure G.11: Differences in 4G geographic coverage in England, Northern Ireland, Scotland and Wales (2023)



Source: Ofcom analysis of MNO predictions (September 2023). Ofcom's Connected nations UK report 2023, 19 December 2023, figure 3.6.

(b) [✂].[659] [✂].

Figure G.12: MNO 5G Outdoor Population Coverage



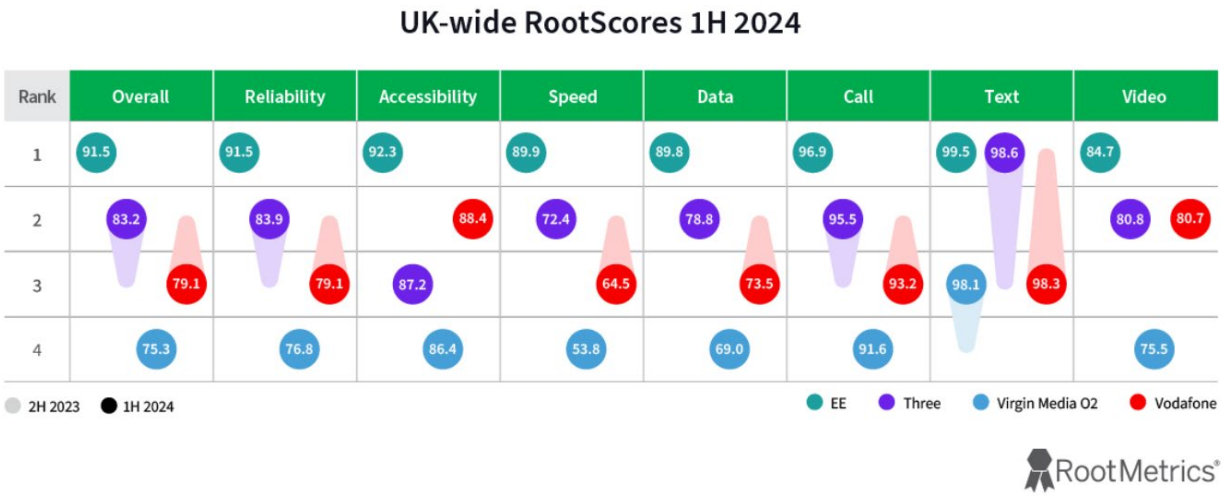
Source: Ofcom analysis of MNO prediction (September 2023). Ofcom's Connected nations UK report 2023, 19 December 2023, figure 3.4.

[659] Source: Ofcom Connected Nations Data.

(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.'[660]

(d) RootMetrics reports that 3UK had the second-best network (after BTEE) on most metrics in the first half of 2024.[661]

Figure G.13: RootMetrics Network Performance scores



Source: RootMetrics, UK Mobile Performance and 5G in Review, August 2024.

G.55 3UK internal documents suggest that it suffers from a relatively poor perception of its network quality, as shown for example in Figure G.14.

Figure G.14: Network perception.

[✂]

Source: CK Hutchison internal document.

G.56 [✂] 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.

Figure G.15: Reasons for leaving 3UK.

[✂]

Source: CK Hutchison internal document.

[660] RootMetrics, UK Mobile Performance and 5G in Review, August 2024, accessed by the CMA on 6 September 2024.
[661] RootMetrics, UK Mobile Performance and 5G in Review, August 2024, accessed by the CMA on 6 September 2024.

Parties' response to Provisional Findings

G.57 The Parties submitted that 3UK continues to suffer from relatively poor network quality leading to relatively high churn. They submitted that in areas where they upgrade their network they see churn levels fall, suggesting that churn is driven by customer experience rather than customer perception.[662] However, the Parties did not comment in detail on the evidence from third party metrics set out above.

3UK standalone network - summary

G.58 3UK's internal documents and its 2022 submission to Ofcom[663] indicate that it has faced significant congestion in recent years [✂]. Congestion appears to be [✂], and also [✂]. The most acute congestion [✂].

G.59 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 on several measures, particularly on speed and data (despite 3UK performing well on 5G).

G.60 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.61 However, as discussed at Appendix C and noted above, we have also found evidence from 3UK's internal documents that it [✂], and it has been [✂], partly exacerbated by [✂].[664] We found that third party documents also recognise 3UK's challenges of relative size and scale,[665] and some suggest an expectation that its investment activity and momentum may be limited by this (and its capex constraints).[666]

G.62 Since publication of our Provisional Findings, Ofcom has confirmed its view to us that – in the context of MNOs' current relative financial performance – it considers 3UK to be subject to greater capital constraints than VUK.[667] As noted above, Ofcom submitted that while it recognises that 3UK has shown itself to be innovative in finding ways to generate additional revenues, it considers that this

[662] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraphs 5.10 and 5.11.
[663] CK Hutchison's internal document.
[664] See Chapter 8 and Appendix C.
[665] See Appendix C.
[666] See Appendix C.
[667] Ofcom, response to the CMA's 1 October 2024 letter.

may not be long lived (as a result of competitors' response and a continued 'scarcity' of capex).[668]

G.63 As noted above, we continue to believe that – absent the Merger – 3UK would likely continue competing in broadly the same way it does now, including on network quality, given that we have also found that its shareholder is likely to be incentivised to continue supporting it. However, as outlined in Chapters 14 and 16, and for the reasons set out in those chapters, we consider that there is likely to be a marked difference between the levels of scale and network quality performance that 3UK would deliver absent the Merger and that proposed under the JBP and Network Commitment.

VUK standalone network

G.64 The Parties submitted that VUK is sub-scale, and unable to generate sufficient returns to fund necessary network investments.[669] 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.[670]

G.65 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 [✂]% [of cells], equating to around [✂]% of sites', noting that [✂]. [671]

G.66 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'.[672]

G.67 However, Frontier Economics' report 'Pro-competitive Effects of the Merger' (PCEP1)[673] presents a more negative forecast for VUK congestion, as shown in Figure G.16. 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 [✂].

[668] Ofcom, response to the CMA's 1 October 2024 letter.
[669] FMN.
[670] FMN.
[671] FMN.
[672] FMN. VUK notes that [✂]. FMN.
[673] The FMN was submitted in January 2024, the PCEP1 in February 2024.

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.68 A Compass Lexecon paper submitted by the Parties, 'Further evidence on network efficiencies and associated customer benefits enabled by the transaction' (**PCEP2**),[674] replicates this VUK congestion forecast from the PCEP1.[675] It does not present figures for the number of subscribers in congested areas but notes that [✂].[676]

G.69 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.70 VUK responded to Ofcom's consultation on Meeting Future Demand for Mobile Data in April 2022.[677] 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.71 We have assessed site-level data on congestion from VUK, as summarised in Table G.4. 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.[678] The

[674] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[675] 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.
[676] Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the Transaction.
[677] Vodafone Response to Ofcom Consultation, April 2022, page 9, accessed by the CMA on 27 June 2024.
[678] 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.4: 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.72 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 [✂].[679] This is supported by a May 2023 internal document, which reports [✂].[680]

G.73 A November 2022 internal document from Vodafone (Europe) reports [✂]. The document indicates that [✂] noting that [✂].[681] As explained in PCEP 1 (paragraphs 69 and 73), cell congestion of around [✂]% translates into approximately [✂]% sites being congested.

G.74 As noted above, a May 2023 VUK document reports cell congestion at [✂]% in [✂]. It forecasts [✂].[682] 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.75 The November 2022 Vodafone (Europe) document mentioned above considers whether to allow [✂] and/or [✂], with the aim of saving on [✂].[683] It notes that:

(a) [✂].'[684] As indicated by this document, Vodafone [✂].

(b) [✂].

(i) [✂].

[679] FMN.
[680] Vodafone internal document.
[681] Vodafone internal document. The Parties submitted that 'the [✂]% Europe congestion refers to cells, not sites'.
[682] Vodafone internal document.
[683] Vodafone internal document.
[684] Vodafone internal document.

(ii) [✂].[685]

(iii) [✂].

(c) [✂].

(d) [✂].

(e) [✂].

(f) [✂].

G.76 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.77 A November 2021 VUK document considers network congestion [✂]. [✂].[686] The document notes that, [✂].[687] [✂].[688]

G.78 Similarly, a November 2022 document reports that [✂].[689] The document notes that [✂].[690]

G.79 An October 2023 Vodafone (Europe) strategy document notes that on the network side there will be a focus on (among other things) [✂].[691]

Parties' response to our Capacity and Congestion Working Paper on VUK congestion levels

G.80 In their response to our Capacity and Congestion Working Paper, the Parties said that VUK would face [✂]. [692] The Parties added that 'Whilst the forecast level of congestion varies somewhat, in line with traffic forecasts, [✂].' [693] They said that variations in the baseline level of congestion have only [✂].[694]

G.81 However, as noted above, VUK and Vodafone (Europe) internal documents, indicate [✂].[695] VUK congestion rates appear [✂], and we have not seen

[685] Vodafone submitted that 'as explained in response to [✂]RFI [✂], 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'. Vodafone email.
[686] Vodafone internal document.
[687] Vodafone internal document.
[688] [✂] (Vodafone internal document). [✂]. Vodafone email.
[689] Vodafone internal document
[690] Vodafone internal document
[691] Vodafone internal documnet.
[692] Annex 4 to the Parties' response to the AIS and working papers.
[693] Annex 4 to the Parties' response to the AIS and working papers.
[694] Annex 4 to the Parties' response to the AIS and working papers.
[695] 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.

evidence from internal documents that VUK anticipates an unmanageable level of congestion in the coming years.

Parties' response to the Provisional Findings

G.82 The Parties submitted that the Provisional Findings significantly understate the negative impact that capacity constraints are having on VUK's customer experience, and in particular that:

(a) While VUK uses cell-level congestion as 'a simple, universal KPI' to measure congestion, the Parties consider that site-level statistics are a more appropriate measure of the impact of congestion on customer experience.[696]

(b) While VUK uses [✂] Mbps as a speed threshold for measuring congestion, today this speed is insufficient for many applications.[697]

(c) Traffic management measures such as speed caps on unlimited data plans 'ultimately impede VUK's ability to compete effectively'.[698]

(d) VUK's average 4G speeds 'have steadily declined despite VUK's significant investments in capacity'.[699]

G.83 Taking these points in turn:

(a) We have considered the Parties' submission in relation to site level vs cell level congestion above.

(b) We recognise that the speed threshold VUK uses for congestion management may no longer be appropriate in the future and that 3UK uses a higher speed threshold.

(c) As noted above, traffic management measures are likely to apply to a very small subset of heavy users. Moreover, a VUK internal document indicates that [✂], suggesting that VUK is unlikely to be at a competitive disadvantage from introducing traffic management.

(d) The evidence the Parties present for [✂] 4G speeds is an unsourced slide from an internal document which shows average 4G speeds from January 2019 to July 2023, [✂]. [✂].[700] In our view it is difficult to rely on this as evidence of an ongoing decline in VUK's 4G speeds resulting from a lack of investment.

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[696] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.12(i)(a).
[697] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.12(i)(b).
[698] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.13(a).
[699] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.13(c) and Figure 5.1.
[700] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, Figure 5.1.

G.84 The Parties have provided detailed comments on our discussion of VUK's internal documents.[701] We recognise that these documents are subject to a degree of interpretation. However, we consider that taken in the round they present a considerably less negative picture of VUK's future network investment and performance than the Parties have presented to us, and this is particularly true of documents which were generated before the Parties entered intensive merger discussions. In particular, we note that:

(a) In relation to the Vodafone (Europe) document from November 2022 discussed above, the Parties submitted that this document [✂]. However, while [✂]. Moreover, as noted above the report notes, of European markets in general, that [✂].[702]

(b) While the VUK/Vodafone (Europe) documents [✂], our position is not that VUK could adopt such measures without a negative impact on customer experience. Rather we have discussed these documents to provide a more detailed view of the relationship between such thresholds and customer experience.

VUK network investment

G.85 The Parties submitted that 'VUK's [✂]. VUK's [✂].[703] However, Ofcom told us that it does not consider that VUK is subject to capital constraints to the same extent as 3UK.[704]

G.86 The Parties presented an analysis of VUK 5G rollout plans by Frontier Economics (Figure G.18), [✂].

Figure G.18: VUK number of 5G high band sites: forecast and actuals

[✂]

Source: Parties' initial submission.

G.87 We note that, while this Figure shows that [✂]. [✂].

G.88 Vodafone submitted that [✂]. [✂].[705]

G.89 The Parties' PCEP1 submission states that 'VUK estimates that to address this [forecast] congestion, it would need to spend [✂].[706]

[701] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraphs 5.13 to 5.19.
[702] Vodafone internal document.
[703] FMN.
[704] Ofcom, response to the CMA's 1 October 2024 letter.
[705] FMN.
[706] Parties' submission, The pro-competitive effects of the Vodafone/Three merger.

G.90 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 £[✂] 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. [✂].[707] The £[✂] million which the PCEP1 states would be needed [✂] equates (in simple terms) to around £[✂] per annum, equivalent to a [✂]% uplift in its 2022 capex budget ([✂]) or around [✂] needed to [✂].[708]

G.91 A November 2022 [✂].[709] [✂]. The Parties submitted that '[✂]'.

G.92 An October 2023 [✂]:

(a) [✂];

(b) [✂];

(c) [✂]; and

(d) [✂].[710]

G.93 These documents indicate that [✂].

G.94 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, [✂].[711]

G.95 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 £[✂] for RAN expenditure, with an assumed additional [✂] for core expenditure.[712] 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.96 The Parties submitted that VUK has started to build a 5G SA network, principally in London, Manchester, Glasgow and Cardiff. The Parties submitted that [✂].[713] Branded '5G Ultra', the service was announced as 'the UK's first 5G Standalone

[707] FMN.
[708] FMN.
[709] Vodafone internal document.
[710] Vodafone internal document.
[711] 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 RF).
[712] Parties' response to RFI 18, dated 17 July 2024, paragraphs 23.3 and 23.4.
[713] FMN.

mobile network for consumers'.[714] 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.'[715] We note that this description, and the description above of [✂], suggest that VUK [✂].

Parties' response to the Provisional Findings

G.97 The Parties submitted that [✂]. They said that [✂] and that [✂]. They noted that October 2022 and October 2023 documents referred to [✂] and to [✂].[716]

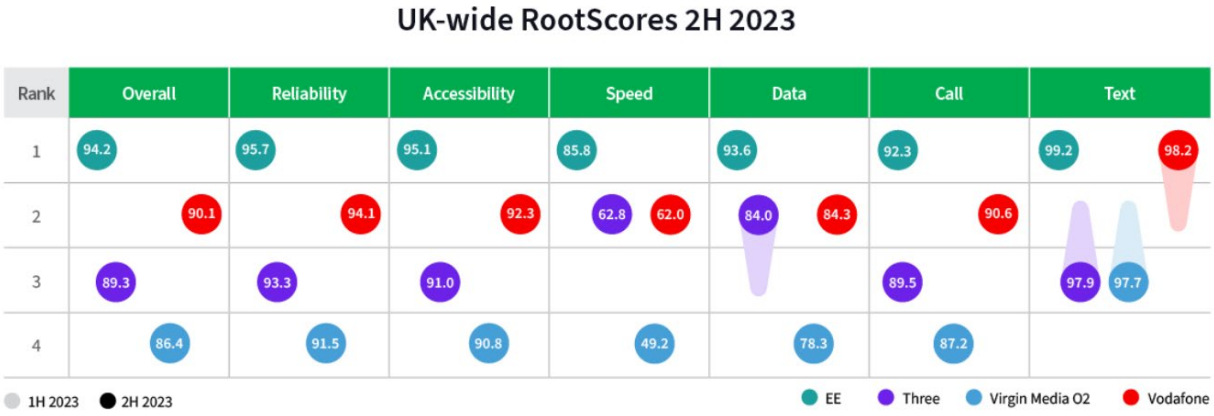
G.98 We recognise that the [✂]. However, we remain of the view that the internal documents discussed above indicate that VUK's [✂]. It is natural that documents discussing [✂]. In addition, we note that the documents cited by VUK are dated at or after the time it entered into intensive merger discussions. In line with our guidance, we have therefore considered this as part of the evidentiary weight we attach to these documents.[717]

VUK network performance

G.99 RootMetrics reported VUK as having the second-highest scoring network after BTEE in the second half of 2023. As shown in Figure G.19, 3UK replaced VUK at second place in the first half of 2024.[718] 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).

[714] Vodafone press release, Vodafone launches 5G Ultra, the UK's first 5G Standalone mobile network for consumers, 23 June 2023, accessed by the CMA on 27 October 2024.
[715] Vodafone, 5G Ultra: Everything You Need To Know, June 2023, accessed by the CMA on 27 October 2024.
[716] Parties' response to the Provisional Findings, 4 October 2024, Annex 3, paragraph 5.21. The Parties also said (paragraph 5.22) that limited 5G device penetration would limit the impact of 5G BR. We note that (a) this does not apply to the mid-band deployment of 5G BR and (b) this limitation would also apply to nationwide 5G SA.
[717] CMA129, paragraph 2.29(a).
[718] 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.' RootMetrics, accessed by the CMA on 28 August 2024.

Figure G.19: RootMetrics Network Performance scores, 2H 2023



Source: Rootmetrics, UK mobile performance review 2H 2023, accessed by the CMA on 28 August 2024.

G.100 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.'[719]

G.101 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.

Parties' response to the Provisional Findings

G.102 The Parties submitted, in the context of RootMetrics, Umlaut and Ofcom Connected Nations scores that 'second best positions have limited benefits from a commercial and marketing perspective – it is the best network claim that matters. […] BTEE has benefitted from UK best network claim for more than 12 years […]'.[720]

G.103 We note that in a four-player market it cannot be the case that any firm which is not the best network cannot be an effective competitor.

[719] Accenture, The 2024 mobile network test in the UK, accessed by the CMA on 2 September 2024.
[720] Parties' response to the Provisional Findings, 4 October 2024, paragraph 5.24.

VUK standalone network - summary

G.104 VUK's congestion levels currently appear to be at manageable levels, affecting around [✂]% of cells on its network, across [✂]% of sites. We also note that Ofcom does not consider that VUK is subject to capital constraints to the same extent as 3UK.[721]

G.105 As with 3UK, [✂].[722] 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.

G.106 With regard to third party measures, 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.

G.107 Internal documents indicate that [✂]. [✂].

Conclusions on capacity and congestion in standalone networks

G.108 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.

G.109 As regards the individual networks:

(a) [✂] generally and is performing strongly overall on third party metrics. However, Ofcom has confirmed its view to us that – in the context of MNOs' current relative financial performance – it considers 3UK to be subject to greater capital constraints than VUK and may face a continued 'scarcity' of capex (funding);[723] and

(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.110 As set out above, internal documents suggest that the main commercial motivations for managing/addressing congestion are (a) [✂], and (b) [✂].

G.111 We continue to believe that – absent the Merger – both 3UK and VUK would likely continue competing in broadly the same way as they do now, including on network

[721] Ofcom, response to the CMA's 1 October 2024 letter.
[722] See Table G.4.
[723] Ofcom, response to the CMA's 1 October 2024 letter.

investment and quality, and in particular, levels of network capacity and congestion. However, as outlined in Chapters 14 and 16 and for the reasons set out in those chapters, we consider that there is likely to be a marked difference between the scale and network quality performance that 3UK and VUK would deliver absent the Merger and (ii) that proposed under the JBP and Network Commitment.

Glossary

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 5 June 2024, VUK and VMO2 agreed to extend and enhance their existing mobile network sharing agreement
Beacon 4.1 Agreements	On 5 June 2024, VUK and Telefónica UK Limited, VMO2's parent company, entered into the Beacon 4.1 Long Form Amendments and a Spectrum Transfer Agreement pursuant to which VUK has agreed to transfer spectrum assets to VMO2. This is the latest iteration of the Beacon arrangements
BTEE	BT Group plc
BTL	Below the line (in this context, 'below EBIT', largely equivalent to operating profit)
CA03	Communications Act 2003
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
the **claimed 5G SA RCB**	The Parties claimed RCBs from accelerated UK Advanced 5G and 5G SA cases
the **claimed FWA RCB**	The Parties claimed RCBs from improved FWA offering
the **claimed improved mobile connectivity RCB**	The Parties claimed RCBs from improved mobile connectivity
CMA	Competition and Markets Authority
CMA62	CMA Retail Merger Guidance (CMA62)
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	MBNL's change management process
Commencement Regulations	The Digital Markets, Competition and Consumers Act 2024 (Commencement No. 1 and Savings and Transitional Provisions) Regulations 2024
Connected Nations	Ofcom's Connected Nations dataset
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 Vodafone (through its subsidiary Vantage Towers) and VMO2.
CWP	Consolidated Works Programme
DMCCA 2024	Digital Markets Competition and Consumers Act 2024
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
FCS	Federation of Communication Services
Final Report	This report and its appendices

FMC	Fixed-mobile convergence
FMN	Final Merger Notice
The **FMEV Threshold**	The fair market enterprise value threshold
FPM	Future pricing mechanism
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
Hybrid PAYG tariffs	PAYG tariffs that do not involve credit checks, or a minimum contract period and any use outside the inclusive allowance is deducted from a pre-pay credit balance. However, with these tariffs customers may set up a recurring card payment and choose an inclusive allowance of calls, text, and data that refreshes automatically each month, similar to a PAYM subscription
H1'24	The first half of FY24
IMD	Index of Multiple Deprivation
IoT	Internet of things
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
LRP	Long range plan
MAGs	Merger Assessment Guidelines (CMA129)
MBNL	Mobile Broadband Network Limited, BTEE and 3UK's network sharing arrangement
the **MBNL Arrangements**	T-Mobile and 3UK entered into a Cooperation Agreement, Transition Agreement, Facilities and Network Sharing Agreement, and an Interpretation Agreement
the **MBNL JV**	the Mobile Broadband Network Limited joint venture (see MBNL)
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 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
MRCs	Minimum revenue commitments
MRG	Minimum revenue guarantee
MSP	Multiple Site Provider
MVNA	Mobile Virtual Network Aggregator
MVNE	Mobile Virtual Network Enabler
MVNO	Mobile Virtual Network Operator
NDA	Non-disclosure agreement
NetCo	A network level joint venture
the **Network Commitment**	A legally binding commitment to undertake the network investment programme proposed by the Parties over the next 8 years across the UK
the **Network Commitment Package**	The Network Commitment and time limited protections
the New Business Plan	MBNL's new business plan for 2024 to 2033 agreed in 2024 by 3UK and BTEE
NPS	Net promoter score
NPV	Net present value

NSA	Non-standalone
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	Pre-paid, or pay as you go
PAYM	Post-paid or pay monthly
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.
PCEP2	Parties' submission, Further evidence on network efficiencies and associated customer benefits enabled by the transaction
PD	Ofcom Provider Data
Protected Tariffs	The tariffs to be included in the Pricing Cap Commitment and the Social Tariffs Commitment , together
Pricing Cap Commitment	A commitment to maintain prices for value-focussed customers on all main brands
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
RCBs	Relevant customer benefits
REEs	Rivalry-enhancing efficiencies
Remedies Notice	The CMA's Notice of Possible Remedies dated 13 September 2024
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
SME	Small and medium enterprise
Social Tariffs Commitment	The commitment to maintain social tariffs
SoHo	Small office / home office
SRN	The Shared Rural Network scheme
STA	The Spectrum Transfer Agreement under Beacon 4.1
TaaS	Telecoms as a Service
Terms and Conditions Commitment	The commitment to maintain terms and conditions of existing customers

Time Limited Protections	The Time Limited Retail Customer Protections and the Wholesale Access Terms. Together
Time Limited Retail Customer Protections	The pricing cap commitment and social tariff commitment, with Protected Tariffs
T-Mobile	T-Mobile (UK) Limited
TTWA	Travel to work areas produced by the ONS
UK	United Kingdom
Unwind Polygons	Areas where VUK and VMO2 have unwound active sharing in London and 22 other major cities in the UK.
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
Vulnerable Customers Commitment	The commitment to exclude vulnerable customers in financial difficulty from mid-contract price rises
WACC	Weighted average cost of capital
the **Wholesale Access Terms**	Our proposed measures (covering both the reference offer with pre-agreed wholesale terms and the extension of existing contract terms for the Parties' MVNOs)
the **wholesale market**	the supply of wholesale mobile telecommunications services in the UK
the **Wholesale Reference Offer**	The Parties proposed terms
WTA06	Wireless Telegraphy Act 2006
WTP	Willingness to pay
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