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Deriving ALFs from LSVs – A Response to Ofcom's 2024/25 Consultation

A NERA report prepared on behalf of Virgin Media O2

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Project Team

Tomas Haug
Niko Czaplicki
Philip vom Baur
Jonathan Schellenberg

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NERA
Friedrich Ebert Anlage 49
Messeturm
Frankfurt, Germany 60308
www.nera.com

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Executive Summary

In its Consultation on Annual Licence Fees ("ALFs") for the 900 MHz, 1800 MHz, and 2100 MHz spectrum, published on 13 December 2024 ("2024/25 Consultation"), Ofcom presents its methodology and calculations regarding the selection of a discount rate for annualisation to convert lump sum values ("LSVs") into ALFs. Ofcom employs a similar methodology for estimating the discount rate as it did in the previous decision in 2021 ("2021 Decision"), which takes a cost of debt estimate based on observed debt yields and adjusts this figure by adding a risk-sharing premium. Applying this methodology, Ofcom finds that the real post-tax discount rate has increased from 0.1% in its 2021 Decision to 1.7% in its current 2024/25 Consultation resulting in a corresponding increase in the annualisation rate from 5.34% to 6.38%.

Virgin Media O2 has engaged NERA to assess Ofcom's approach to determining the annualisation rate for the calculation of ALFs. In this report, we outline several flaws and inconsistencies within Ofcom's method of estimating the annualisation rate in the 2024/25 Consultation.

First, Ofcom disregards the conceptual relationship between capital market conditions and LSVs. The discount rate used by MNOs in determining the value of spectrum and placing bids in auctions is dependent on the capital market environment at the time of the auction. An increase in the discount rate leads to a decrease of the value of spectrum if all other inputs remain the same. It follows that if the capital market conditions defining the associated change in discount rates, auction results would be expected to change, too.

Between 2021 and 2024 the interest rate environment in the UK as well as in Europe underwent a fundamental shift, with the UK Bank Rate increasing from below 1% to more than 5%. Ofcom's benchmark auctions (from which Ofcom derives the LSVs) predominantly took place in a capital market environment with low interest rates. Without adjusting auction results for an increase in the MNO's discount rates, Ofcom overestimates the current market value of spectrum.

Hence, this fundamental connection between LSVs and discount rate should be recognised in determining ALFs. Ofcom can tackle this issue by either modifying the LSV to account for changes in the capital market environment or by altering the annualisation rate, i.e. the discount rate used to convert the LSV into an ALF.

Second, we identified several inconsistencies in Ofcom's derivation of the constituent parameters of the real post-tax discount rate:

- **Ofcom underestimates expected CPI:** Ofcom uses the Bank of England's 2% inflation target as an estimate for expected inflation to derive the 10Y real discount rate in the lower and upper polar case. We find that Ofcom's assumption on expected CPI does not align with current market-based evidence on expected inflation over the next ten years, is inconsistent with Ofcom's determination of the inflation risk premium and does not reflect the asymmetry in realised inflation, which means that realised inflation on average will be above the BoE's 2% target. Hence, we consider that inflation expectations should be set consistently with the inflation risk premium and reflect the range of expected inflation between 2.45% (based on UK gilts) and 2.8% (based on inflation surveys / forecasts).
- **Ofcom's estimate of a CPI inflation risk premium is inconsistent with its inflation expectations:** Based on Ofcom's own estimates for breakeven inflation and expected RPI/CPIH,

we find a CPI inflation risk premium in the range of 64bps to 70bps. This is 24bps to 30bps higher than Ofcom's current estimate.

- **Upper polar case is biased upwards due to the inclusion of unsystematic risk within Ofcom's WACC:** Ofcom aims to estimate the upper polar case based on the forward looking WACC reflecting the systematic risk of an UK MNO. While Ofcom explains that it is the systematic risk that matters in the upper polar case, its calculation of the WACC contradicts this principle as Ofcom incorporates unsystematic risk into its WACC calculation through the cost of debt. Eliminating unsystematic risk reduces Ofcom's mid-point of the real post-tax WACC by 0.3 percentage points to 3.0%.

Correcting for Ofcom's inconsistencies in determining the constituent parameters, we find that the real post-tax discount rate lies in a range between 0.68% and 1.22% depending on the assumption about future CPI (see Table 1). Based on Ofcom's assumptions on the ALF period and the tax adjustment factor, we calculate a range between 5.82% and 6.12% for the annualisation rate, with a mid-point of 5.97%.

Table 1: Corrected Estimate of Current Annualisation Rate Equals 5.97%

Parameter	NERA - Low Inflation	NERA - High Inflation
Lower Polar Case	0.70%	0.16%
Upper Polar Case	2.79%	2.24%
Risk Sharing Factor	25%	25%
Real Post-Tax Discount Rate	**1.22%**	**0.68%**
ALF Period	20	20
Tax Adjustment Factor	1.093	1.093
Annualisation Rate	**6.12%**	**5.82%**
Annualisation Rate (Mid-point)	**5.97%**	

Source: NERA analysis.

1. Introduction

Virgin Media O2 has engaged NERA to assess Ofcom's Consultation on Annual Licence Fees ("ALFs") for the 900 MHz, 1800 MHz, and 2100 MHz spectrum, published on 13 December 2024 ("2024/25 Consultation")[1]. This report evaluates Ofcom's methodology and calculations regarding the selection of a discount rate of annualisation for converting lump sum values ("LSVs") into ALFs. It does not consider the distinct issue of whether Ofcom's LSVs accurately represent the market value of licences for the 900 MHz, 1800 MHz, and 2100 MHz spectrum. This report is prepared for Virgin Media O2 to be included in its submission in response to the 2024/25 Consultation.

Ofcom employs a similar methodology for estimating the discount rate as it did in the previous decision in 2021("2021 Decision").[2] It uses a cost of debt estimate based on observed debt yields and adjusted this figure by adding a risk-sharing premium. We have identified several flaws and inconsistencies within Ofcom's method of estimating the discount rate of annualisation in the 2024/25 Consultation. This report proceeds as follows:

- Chapter 2 summarises Ofcom's approach to estimating the discount rate for the calculation of ALFs.
- Chapter 3 discusses potential solutions to the inconsistency in Ofcom's current approach, which arises from its failure to reflect shifts in the capital market environment in the determination of LSVs, despite considering it in the determination of ALFs.
- Chapter 4 assesses further inconsistencies in Ofcom's discount rate determination, particularly with respect to expected CPI and the corresponding inflation risk premium.
- Chapter 5 presents an updated calculation of the discount rate, incorporating the adjustments suggested in this report.

2. Ofcom's Calculation of the Discount Rate for Annualisation

In this chapter, we provide an overview of the methodology applied by Ofcom for estimating the ALFs with a particular focus on the estimation of the discount rate for annualisation. We compare the estimation approach in the 2024/2025 Consultation to the estimation approach of the 2021 Consultation and present the resulting discount rates.

2.1. Approach to Calculating ALFs

Ofcom generally allocates spectrum licences via competitive auctions. However, for certain spectrum bands, for which the original licence period has ended (typically after 20 years), Ofcom charges ALFs instead of re-allocating licenses for spectrum via competitive bidding processes.[3]

1 Ofcom (13 December 2024), Review of Annual Licence Fees.

2 Ofcom (13 December 2021), Annual licence fees for 2100 MHz spectrum.

3 Ofcom currently charges ALFs for the mobile spectrum bands 900 MHz, 1800 MHz and 2100 MHz

Ofcom aims to set ALFs such that they reflect the forward-looking value of spectrum to promote its efficient use. In principle, mobile network operators ("MNOs") should therefore be indifferent between paying ALFs and bidding in a competitive auction. In other words, charging ALFs over a period of 20 years should result in the same net present value of discounted cash flows as a lump sum payment following a competitive bidding process.

To estimate ALFs, Ofcom starts by deriving a LSV separately for each of the spectrum bands. The LSV represents Ofcom's estimate of the value of a 20-year licence for 1 MHz within the respective spectrum band. Ofcom uses past auction results as historical market values of spectrum and updates these values with CPI to reflect current market values (i.e. an LSV for each spectrum band). In a second step, Ofcom determines the annualisation rate to convert LSVs into annual payments. The annualisation rate is chosen so that MNOs are indifferent between paying the LSV today or paying ALFs over 20 years. In the third and final step, Ofcom calculates the ALF payment by inflating the value of the annual payments by CPI for subsequent years.

Figure 2.1 below summarises Ofcom's approach to determine ALFs in mathematical terms.

Figure 2.1: Calculation of ALFs Based on LSV

$$ALF_t = LSV * TAF * \underbrace{\left[\frac{r}{1-(1+r)^{-t*}}\right] * \left[\frac{1}{(1+r)}\right]}_{\text{Annualisation rate}} * \left[\frac{CPI_t}{CPI_{t0}}\right]$$

Source: Ofcom (13 December2024), Review of Annual Licence Fees.

2.2. Estimation of the Annualisation Rate

Ofcom adopts the same methodology for estimating the annualisation rate as it did in the 2021 Decision. The formula for the annualisation rate (see Figure 2.1 above) is based on three parameters: the length of the period over which Ofcom spreads the LSV for the purpose of calculating ALFs ("ALF Period"), the estimated real post-tax discount rate, and the tax adjustment factor. Based on the 2024/25 Consultation values for the three parameters, Ofcom calculates an annualisation rate of 6.38%, which is more than 1 percentage point higher than the annualisation rate of 5.34% in its 2021 Decision (see Table 2.1).

Table 2.1: Calculation of the Annualisation Rate

Parameter	2021 estimate	2024 estimate
ALF Period	20 years	20 years
Real Post-Tax Discount Rate	0.1%	1.7%
Tax Adjustment Factor	1.058	1.093
Annualisation Rate	**5.34%**	**6.38%**

Source: Ofcom (13 December 2024), Review of Annual Licence Fees, Table 5.1 and Table 5.2.

The key parameter in the calculation of the annualisation rate is the estimate of the real post-tax discount rate. Ofcom derives the real post-tax discount rate as the weighted average of a lower polar case (based on the cost of debt) and an upper polar case (based on the WACC). Ofcom distinguishes

between a lower and an upper polar case as ALFs are not necessarily fixed over a 20-year period but can be adjusted in the case of material misalignment with current market conditions:

- For the lower polar case, Ofcom assumes that there is no risk of an adjustment of the ALFs within the 20-year period. The ALF therefore most closely resembles a 20-year fixed coupon debt instrument. Ofcom therefore uses the MNO's cost of debt as the appropriate discount rate in the lower polar case.
- In the upper polar case, Ofcom assumes that ALF payments would vary in line with the future after-tax cashflows of the MNOs. In this case, the cash flow stream under the ALF is fully exposed to the underlying systematic risk. Ofcom therefore uses the MNO's WACC as the appropriate discount rate in the upper polar case.
- In the case that there is a positive likelihood of future changes to the ALFs within the 20-year period, Ofcom requires MNOs to cover parts of that risk via a risk-sharing mechanism. Following the reasoning of previous ALF reviews, Ofcom assumes that the upper polar case should be weighted with 25% and the lower polar case should be weighted with 75% to determine the appropriate annualisation rate. Ofcom uses the term risk-sharing adjustment to describe the weight of the upper polar case in deriving the annualisation rate.

Based on current estimates for an adjusted cost of debt (lower polar case), a MNOs' WACC (upper polar case) and a risk sharing adjustment of 25%, Ofcom calculates a real post-tax discount rate of 1.7% (see Table 2.2). This is 1.6 percentage points higher than the real-post-tax discount rate of 0.1% in the 2021 Decision.

Table 2.2: Real Post-Tax Discount Rate for Annualisation

Parameter	Formula	2021 estimate (%)	2024 estimate (%)
Lower polar case	A	-1.0	1.2
Upper polar case	B	3.6	3.3
Risk sharing adjustment (Weight on upper polar case)	C	25	25
Real post-tax discount rate for annualisation	**D = A + C * (B-A)**	**0.1**	**1.7**

Source: Ofcom (13 December 2024), Review of Annual Licence Fees. Ofcom (13 December.2021), Annual licence fees for 2100 MHz spectrum.

2.2.1. Estimation of the real post-tax discount rate in the lower polar case (cost of debt)

As a starting point for the real post-tax discount rate in the lower polar case, Ofcom estimates the nominal cost of debt of a UK MNO based on the 12-month average of BBB corporate debt yields. Ofcom then adjusts this cost of debt by an inflation risk premium and a liquidity premium and transforms the adjusted nominal, pre-tax rate into a post-tax real cost of debt.

The adjusted post-tax real cost of debt in the 2024/25 Consultation rises by 2.2 percentage points compared to its 2021 Decision (see Table 2.3). This increase is largely attributed to the rise in nominal interest rates. However, part of this increase is mitigated by a heightened inflation risk premium.

Table 2.3: Lower Polar Case

Parameter	2021 estimate (%)	2024 estimate (%)
Pre-tax nominal cost of debt	1.7	4.95
Adjustment for inflation risk	0.1	0.4
Adjustment for liquidity risk	0.3	0.3
Adjusted pre-tax nominal of debt	**1.3**	**4.25**
Tax rate	24.9	25
Adjusted post-tax nominal of debt	**1.0**	**3.2**
CPI forecast	2.0	2.0
Adjusted post-tax real cost of debt (lower polar case)	**-1.0**	**1.2**

Source: Ofcom (13 December 2024), Review of Annual Licence Fees. Ofcom (13 December 2021), Annual licence fees for 2100 MHz spectrum.

2.2.2. Estimation of the real post-tax discount rate in the upper polar case (WACC)

In the upper polar case, Ofcom determines the post-tax real WACC of a UK MNO to capture the underlying systematic risk of the MNO's business.

The post-tax real WACC in the 2024/25 Consultation decreases by 0.3 percentage points compared to Ofcom's 2021 Decision (see Table 2.4). This decrease is largely driven by a fall in the asset beta, partially set off by an increase in the cost of debt.

Table 2.4: Upper Polar Case

Parameter	Estimates 2021 (%)	Estimates 2024/25 (%)
Nominal RFR	0.6	4.05
Nominal EMR	8.8	8.8
Nominal ERP	8.2	4.7
Debt beta	0.10	0.10
Asset beta	0.62	0.30 - 0.46
Gearing	45	60 - 75
Equity Beta	1.05	0.9 - 1.0
Pre-tax nominal cost of equity	12.3	11.1 - 11.8
Pre-tax nominal cost of debt	1.7	4.95
Corporate tax rate	24.9	25
Pre-tax nominal WACC	**7.5**	**6.5 - 7.7**
CPI forecast	2.0	2.0
Post-tax nominal WACC	5.6	4.9 - 5.8
Post-tax real WACC	**3.6**	**2.8 - 3.7 (Midpoint: 3.3)**

Source: Ofcom (13 December 2024), Review of Annual Licence Fees. Ofcom (13 December 2021), Annual licence fees for 2100 MHz spectrum.

3. Ofcom Ignores that Shifts on Capital Markets Affect LSVs and Thereby Overestimates ALFs

Ofcom's approach to determining ALFs is based on the premise that the parties should be indifferent between payment for the spectrum in the form of participating in an auction with a lump sum payment or payment of the ALF. In this chapter, we explain the relationship between discount rate and LSV (Chapter 3.1), show that Ofcom's current approach leads to an overestimation of LSVs which in turn leads to an overestimation of ALFs (Chapter 3.2), and finally explain how adjustments to the annualisation rate—instead of adjusting LSV directly—can provide an alternative solution to determining appropriate ALFs (Chapter 3.3).

3.1. The Value of Spectrum Is Dependent on the Discount Rate

As described in Chapter 2, Ofcom uses two key inputs to determine the ALF:

- the LSV, which is derived from historical auction results adjusted for inflation; and
- the annualisation rate, which reflects the financing conditions in the current capital market environment through the upper and lower polar case discount rates.

Ideally, the LSV would be based on comparable auction results close to the date of determining the ALF, and therefore also close to the date of setting the discount rate. However, spectrum auctions only take place infrequently. In the current consultation, for example, the UK 700 MHz from 2021 auction is used as an important benchmark for determining 900 MHz LSV.[4] Ofcom defines that its *"starting point, consistent with our previous ALF decisions, is that all else equal, the value of spectrum is likely to remain constant in real terms over time"*.[5]

Auction results depend on the business prospects of the associated spectrum with bidders typically relying on a net present value-based ("NPV"-based) assessment to inform bid values. A typical NPV-based calculation would consider the expected future cash flows associated with the spectrum discounted at an appropriate rate.

In other words, changes in expected cash flows lead to fluctuations in auction results. Ofcom has recognised this critical relationship, which is one of the key reasons it has decided to undertake a review of ALFs in 2024.[6] As part of the ongoing consultation, changes in expected cash flows were also addressed in a previous NERA report.[7] Consequently, this report does not comment further on whether Ofcom's LSVs accurately reflect the expected cash flows of spectrum licences.

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4 Ofcom explains that the *"most recent available UK evidence for the value of sub-1 GHz mobile spectrum is the 2021 auction of the 700 MHz band"*. Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, para. 4.7.

5 Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, para. 3.49.

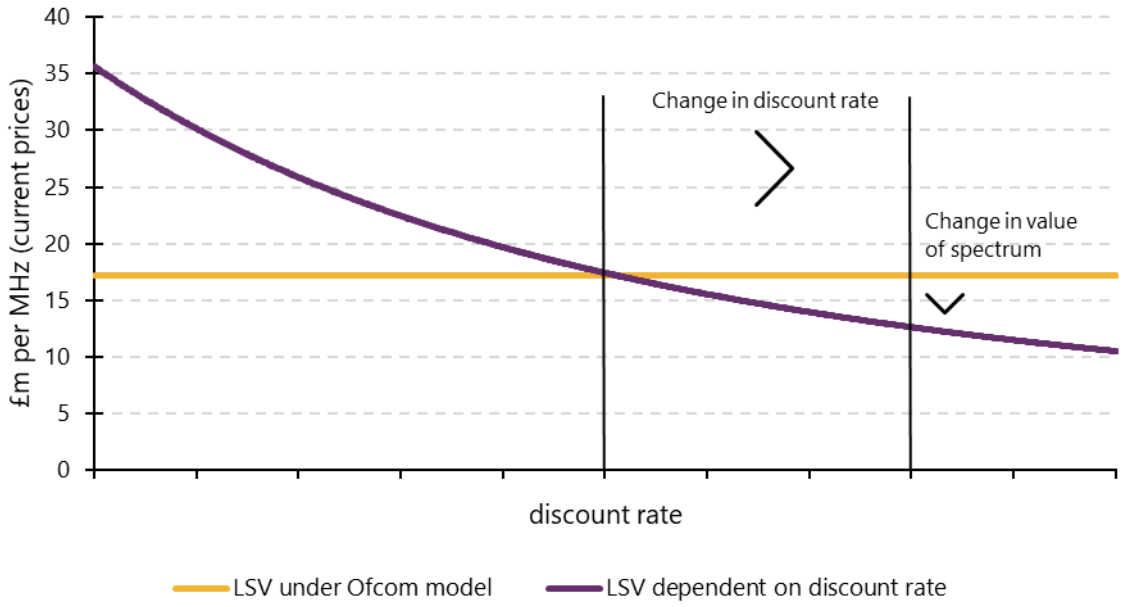
6 Ofcom states that it is open to *„reviewing the levels of ALFs if stakeholders provided evidence on the market value of spectrum that would support such a review*." See Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, para. 2.6. Upon request from BT to review the ALFs currently being charged for the 1800 MHz spectrum, Ofcom *„consider[s] that the evidence suggests that a fee review is justified"*. Ofcom (23 July 2024), Ofcom launches review of spectrum licence fees.

7 Marsden et. al (30 September 2024), UK 900 MHz, 1800 MHz & 2100 MHz Annual Licence Fees.

However, not only cash flows do have an impact on the NPV associated with spectrum but also the MNO's discount rate. An increase in the discount rate means that the MNO's opportunity costs of funding investments in spectrum increase as other investments, e.g. government bonds, get more attractive.[8] In consequence, the expected return of an investment in spectrum will need to increase to cover for the higher financing costs. In other words, an increase in the discount rate leads to a decrease of the value of spectrum if all other inputs remain the same. It follows that if the capital market conditions defining the associated change in the discount rate, auction results would be expected to change, too (even if cash flows otherwise stay the same).

We illustrate the interdependency between the MNO's discount rate and the value of spectrum in Figure 3.1. A change in the capital market environment, illustrated by an increase in the discount rate, coincides with a decrease in the value of spectrum.

Figure 3.1: Illustration of Changes in LSV Dependent on Discount Rate



Source: NERA illustration.

In Table 3.1 we illustratively assess how a change in the discount rate from 0.1% to 1.7% would impact the NPV associated with cash flows from spectrum. Assuming an illustrative and flat cash flow profile of £100 per year over 20 years, the increase in the discount rate by 1.6 percentage points leads to a 13.6% decrease in the NPV (from £1,981 to £1,712).

[8] Damodaran (2016) describes that for investors, the financing cost is *„an opportunity cost in the sense that it is the rate of return that they would expect to make in other investments of equivalent risk"*. See Damodaran (2016), The Cost of Capital: The Swiss Army Knife of Finance, p.3.

Table 3.1: Illustrative Impact of Discount Rate Changes on NPV

		2025	2026	2027	...	2044
"Old" capital market environment						
Discount rate		0.1%				
Cash flow		100	100	100	...	100
Discount factor		1.00	1.00	1.00	...	1.02
PV of cash flow		100.0	99.9	99.8	...	98.1
NPV	**1,981**					
"New" capital market environment						
Discount rate		1.7%				
Cash flow		100	100	100	...	100
Discount factor		1.00	1.02	1.03	...	1.38
PV of cash flow		100.0	98.3	96.7	...	72.6
NPV	**1,712**					

Source: NERA illustration.

In summary, the discount rate used by MNOs in determining the value of spectrum and placing bids in auctions is directly connected to the capital market environment at the time of the auction. If cash flows are assumed to remain the same, a higher discount rate leads to a lower market value of spectrum. This fundamental connection should be recognized in determining ALFs.

3.2. Under Its Current Approach Ofcom Overestimates LSVs by not Correcting for the Shift on Capital Markets

Between 2021 and 2024 the interest rate environment in the UK as well as in Europe underwent a fundamental shift. As Figure 3.2 below shows, the Bank of England's benchmark Bank Rate moved in a very narrow corridor between 0.1% and 0.75% between March 2009 and May 2022.[9] In December 2021, the Bank of England began increasing the rate from its lowest value of 0.1% until it reached 5.25% in mid-2023. Since then, there has been little movement in the Bank Rate, which stands at 4.5% per cent as of February 2025.

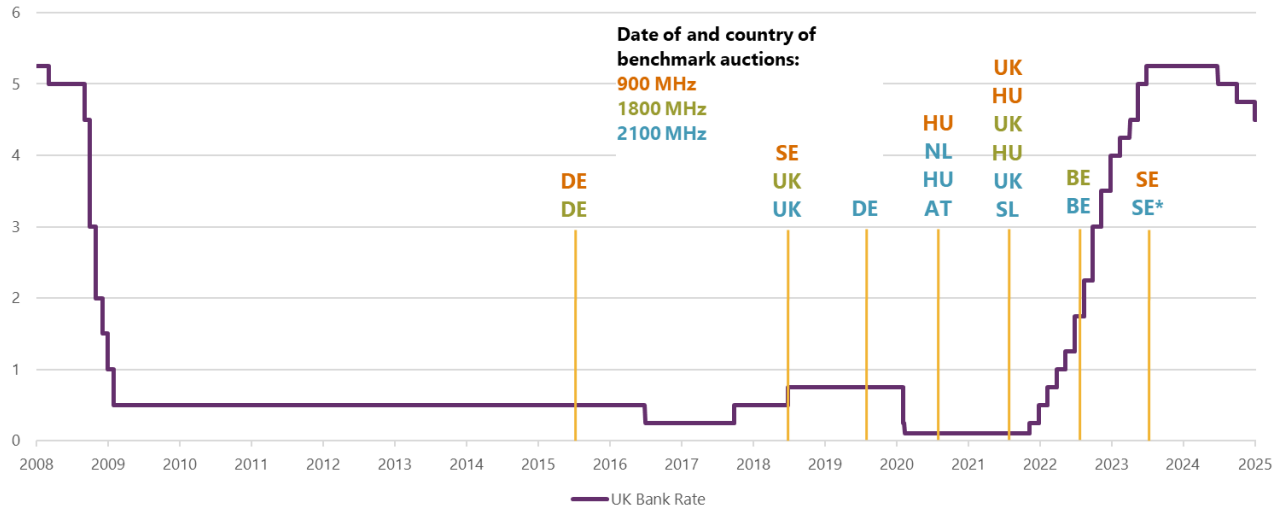
Figure 3.2 also shows the date and country of the key benchmark auctions considered in Ofcom's 2024/25 Consultation.[10] Ofcom generally uses recent auction results from the UK as well as international benchmarks. Out of the six UK auctions considered in the 2024/25 Consultation, the most recent happened in March 2021, i.e. before the shift in the capital market environment. In Figure 3.2, we highlight the auctions that played an important role in setting the LSVs in the 2024/25

[9] Bank of England (6 February 2025), What is Bank Rate?. (Link)

[10] We report the dates of the national and international benchmark auctions in the respective spectrum band. We do not show the high and low spectrum band auctions that Ofcom uses to make auctions comparable across countries.

Consultation.[11] It is apparent that only one of these originated from a time with an interest rate environment comparable to today's market conditions (the Swedish auction in 2023). For the 900 MHz and 1800 MHz LSVs all auctions that played an important role in determining the final values came from before 2023, i.e. a time pre-dating the current high-interest rate environment.

Figure 3.2: Benchmark Auctions Mostly During Old Interest Rate Environment



Sources: Bank of England, Ofcom Consultation. Note: Ofcom limits the weight placed on the Swedish 2100 MHz auction in 2023, which resulted in substantially lower values than other benchmark auctions.

Ofcom's current LSVs reflect the low interest-rate environment that prevailed from 2009 to 2021, which, assuming no change in cash flows, leads to higher market values. The observed shift in the capital market environment and the associated increase in the discount rate render Ofcom's *"starting*

[11] Ofcom's approach to benchmark auctions is to generally consider recent UK auctions alongside *"other relevant evidence, which includes auctions on other European countries"*. With respect to UK auctions, Ofcom explains that the *"three most recent auctions of mobile spectrum are relevant evidence for determining the market values"* with more weight being placed on the UK 2018 and 2021 auctions than the 2013 auction. Ofcom also categorises auctions in Tiers 1 to 3 to indicate the relevance of the respective benchmark.

For the 900 MHz spectrum, Ofcom reports auction results from the UK 700 MHz auction in March 2021 and the UK 800 MHz auction in March 2013. It also considers international benchmarks from Germany, Hungary and Sweden in its post-2015 Tier 1 list as well as from Austria, Croatia, Germany, Ireland and Sweden in its pre-2015 Tier 1 list. These are primarily used to form an idea of whether 700 MHz and 900 MHz auction results are comparable. Ofcom's ultimately proposed benchmark value, however, is directly based on the 2021 UK 700 MHz auction.

For the 1800 MHz spectrum, Ofcom considers six auction results from the UK. Out of these, Ofcom uses the April 2018 3.4 GHz auction and the March 2021 700 MHz auction to determine a range for the 1800 MHz spectrum. Ofcom also considers benchmarks from Belgium, Germany and Hungary in its post-2015 Tier 1 list and from Austria, Czech Republic, Denmark, Germany, Italy and Sweden in its pre-2015 Tier 1 list. In its analysis, Ofcom relies in particular on the post-2015 auctions to narrow down the range and determine the 1800 MHz spectrum value.

For the 2100 MHz spectrum, Ofcom considers the same six auction results from the UK. Out of these, Ofcom uses the April 2018 3.4 GHz auction and the March 2021 700 MHz auction to determine a range for the 2100 MHz spectrum. Ofcom also considers benchmarks from Belgium, Germany, Hungary, Slovenia, Austria, the Netherlands and Sweden in its Tier 1 list. In its analysis, Ofcom determines a narrow range between £12.0 and £12.5 million based on the post-2015 benchmarks and then uses the pre-2015 benchmarks to set a value at the lower end of the range.

In Figure 3.2 we only show relevant UK auctions and relevant post-2015 benchmarks, given that Ofcom placed the most weight on these in deriving LSVs. See Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, Chapter 3, 4 and Annex 7.

point"—assuming that *"all else equal, the value of spectrum is likely to remain constant in real terms over time"* —invalid.[12] This is because the fundamental premise that all input factors remain constant is no longer applicable. Therefore, to accurately determine LSVs that reflect the value of spectrum under the new capital market conditions, it is necessary to make downward adjustments to the historical auction values to account for the impact of higher discount rates.

Figure 3.2 also demonstrates that this was not a problem in previous ALF determinations, e.g. in 2021, 2018, and 2015. This is because in between 2009 and 2022, the UK bank rate moved in a very narrow band, meaning that no capital market-driven disconnect between observed auction values and LSVs would arise.

In the 2024/25 Consultation, Ofcom does not address the impact of changes in the capital market environment between the respective auction dates and the date of ALF determination. Ofcom's reliance on LSVs that are assumed to be constant in real terms omits the impact of the changed capital market environment and therefore leads to an overestimation of LSVs.

3.3. Adjustments to the Discount Rate Can Mitigate Inconsistencies in Ofcom's Approach

In Chapter 3.1 and Chapter 3.2, we outline how the capital market environment affects the value of spectrum and how the increase in the discount rate leads to an overestimation of LSVs. In this chapter, we explore the role of the annualisation rate and whether an adjustment of the annualisation rate can compensate for the observed disconnect in the discount rates.

In contrast to the estimation of LSVs, Ofcom relies on data reflecting the current capital market environment in estimating the annualisation rate for the ALF calculation, implying an overall inconsistent treatment of the discount rate: Ofcom implicitly relies on outdated discount rates (reflecting the low rate environment in and before 2021) when estimating the LSV but on current rates (reflecting today's higher rate environment) when it comes to annualisation. Consequently, the resulting fees exceed market values.

This disconnect must be addressed. Ofcom can do so by either modifying the LSV to account for changes in the capital market environment or by altering the annualisation rate used to convert the LSV into an ALF. In its consultation document from December 2024, Ofcom did not adjust for the impact that changes in the capital market environment have had on LSVs. VMO2 advised us that they will propose changes to Ofcom's methodology that will account for changes in the capital market environment. But absent indication that Ofcom will accept such changes, we will explore the viability of the second option, which addresses the disconnect by altering involves the annualisation rate.

Table 3.2 builds on the illustrative cash flow example discussed in Chapter 3.2 above, assuming that the auction benchmark used to derive the ALF is not adjusted for changes in the capital market environment, i.e. the "outdated" NPV of £1,981 is used to calculate ALFs, rather than the "updated" NPV of £1,712. It shows how—assuming a flat cash flow profile over 20 years—an adjustment of the discount rate for annualisation can fully eliminate the discrepancy in NPVs and thereby make the

[12] Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, para. 3.49.

MNO indifferent between paying an upfront lump sum reflecting the current market value of spectrum or paying annual fees.[13]

Table 3.2: Illustration of Cash Flows and NPV Neutrality When Adjusting the Discount Rate

			2025	2026	2027	...	2044
"Old" capital market environment							
Discount rate			0.1%				
Cash flow			100	100	100	...	100
Discount factor			1.00	1.00	1.00	...	1.02
PV of cash flow			100.0	99.9	99.8	...	98.1
NPV		**1,981**					
"New" capital market environment							
Discount rate			1.7%				
Cash flow			100	100	100	...	100
Discount factor			1.00	1.02	1.03	...	1.38
PV of cash flow			100.0	98.3	96.7	...	72.6
NPV		**1,712**					
NPV associated with ALF payments using current discount rate							
LSV		1,981					
Discount rate (current)		1.70%					
ALF @ 1.7%		116					
Discount factor			1.00	1.02	1.03	...	1.38
PV of ALF			- 115.7	- 113.8	- 111.9	...	- 84.0
NPV	**-**	**1,981**					
NPV associated with ALF payments using old discount rate							
LSV		1,981					
Discount rate (old)		0.10%					
ALF @ 0.1%		100					
Discount factor			1.00	1.02	1.03	...	1.38
PV of ALF			- 100.0	- 98.3	- 96.7	...	- 72.6
NPV	**-**	**1,712**					

Source: NERA illustration.

Table 3.2 also demonstrates that relying on an LSV that was derived under outdated capital market conditions with low interest rates in combination with a current, high discount rate for annualisation leads to an overestimation of ALFs. In our example, this approach results in an NPV of £1,981. In contrast, the current market value of spectrum in our example amounts only to £1,781.

We thus conclude that an adjustment to the discount rate presents a viable alternative to directly addressing the shift in the capital market environment in the LSVs. In our view, the adjustment of the discount rate should reflect the capital market environment of the auctions that played an

[13] When relaxing the assumption on the distribution of cash flows from a flat profile to include annual variability, the NPV between ALF based on the old discount rate and current LSV is no longer identical. However, the adjustment of the discount rate still reflects an improvement as compared to Ofcom's current suggestions, especially when taking into account that the expected real cash flow profile of spectrum is relatively flat, as it does not depend on any large one-off investment.

important role in estimating the LSV used by Ofcom unless Ofcom accounts directly for the change in environment in determining the LSV.

Table 3.3 summarises our results. Under its current approach, Ofcom uses an inconsistent approach that does not appropriately account for the change in capital market environment and its impact on discount rates. By not adjusting LSVs for the change in the capital market environment whilst applying a discount rate based on the current capital market environment, it overestimates the market value of spectrum, which in turn leads to an overestimation of the ALFs. We find that Ofcom has two options to estimate ALFs consistently: either by adjusting the LSV to reflect the lower value of spectrum in the current capital market environment, or by adjusting the annualisation rate to reflect the capital market environment prevalent at the time of the respective benchmark auctions.

Table 3.3: Summary of Different Approaches to Setting ALFs Consistently

	Ofcom Approach	**Adjusting LSVs**	**Adjusting Annualisation Rate**
LSV	Old Discount Rate	Updated Discount Rate	Old Discount Rate
Annualisation Rate	Updated Discount Rate	Updated Discount Rate	Old Discount Rate
Impact	**ALF overestimated**	**ALF consistent**	**ALF consistent***

**Result may diverge from adjusting LSVs due to different cash flow profiles (see footnote 13).*

4. A Critique of Ofcom's Derivation of its Constituent Discount Rate Parameters

In this chapter, we address several flaws and inconsistencies in Ofcom's estimation of the annualisation rate. Chapter 4.1 discusses Ofcom's estimation of expected CPI, Chapter 4.2 the inflation risk premium, and Chapter 4.3 the approach to estimating the WACC in the upper polar case.

4.1. Ofcom Underestimates Expected CPI

Ofcom relies on expected CPI to derive the real discount rate for annualisation. Ofcom uses the Bank of England's 2% inflation target as an estimate for expected inflation to derive the 10-year real discount rate in the lower and upper polar case.[14] Ofcom thereby ignores that whilst the Bank of England's inflation target serves as an anchor for long-term inflation expectations, expectations on average inflation over the next ten years may diverge substantially from the target, especially in times of high short-term inflation expectations. Indeed, our analysis demonstrates that the inflation target of 2% does not reflect prevailing inflation expectations as of February 2025.

Figure 4.1 summarises the most recent survey data on inflation expectations and key inflation forecasts from public authorities, both of which exceed the target inflation rate of 2% substantially:

- **Inflation Surveys**
  - Bank of England / Ipsos: The Bank of England's inflation survey conducted in November 2024 shows that the median inflation expectation by households equals 3% in the short run (1 year) and 3.4% in the long run (5 years).[15]
  - Citigroup / YouGov: Citigroup's inflation survey conducted in January 2025 quantifies household inflation expectations at 3.5% in the short run (1 year) and 3.7% in the long run (5-10 years)[16]
- **Inflation Forecasts**
  - Bank of England: The forecast from the most recent Monetary Policy Report (06 February 2025) projects that CPI rises to 3.7% in Q3 2025. Thereafter, the projected inflation gradually decreases towards the inflation target of 2% until the end of the projection period in Q1 2028.[17]
  - Office for Budget Responsibility: The forecast estimates an increasing CPI until Q3 2025 with a peak inflation rate of 2.68%. Subsequently, the projected inflation converges towards the inflation target of 2% until the end of the projection period in Q1 2030.[18]

[14] Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, p. 55, 59.

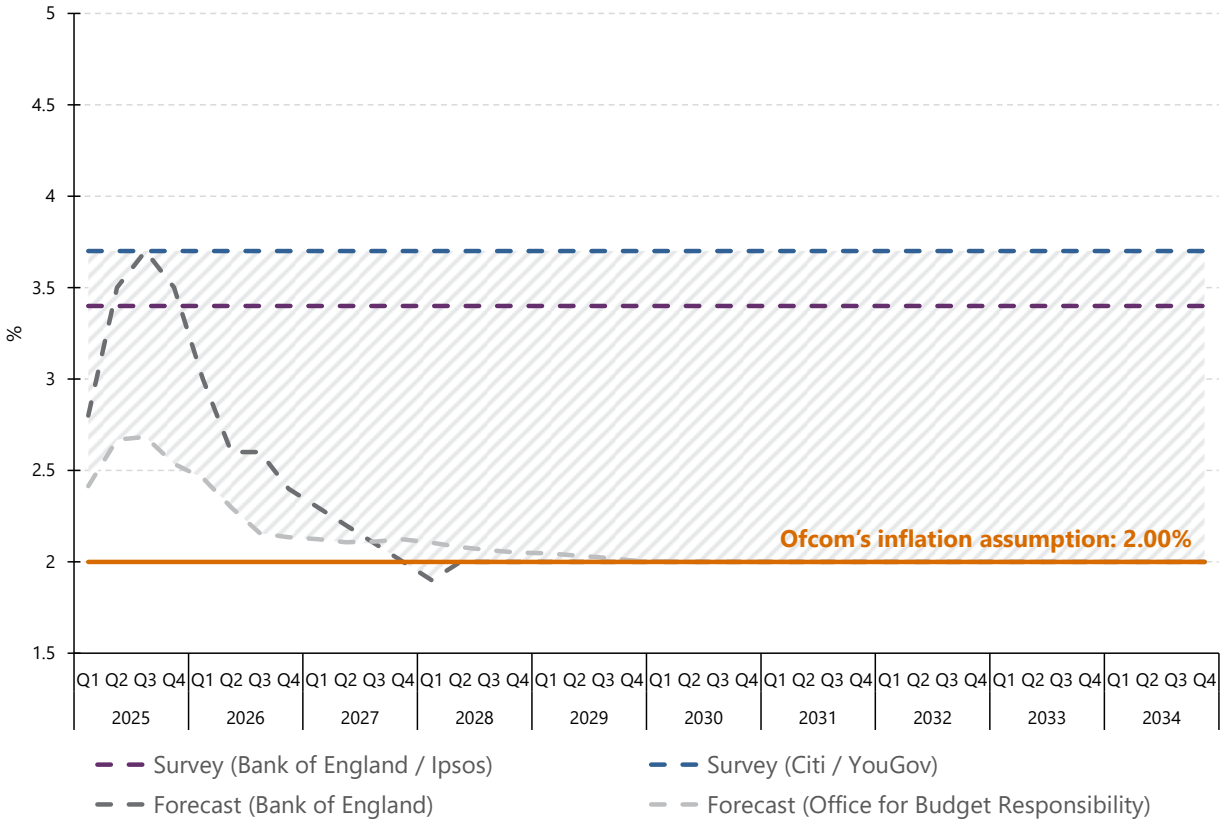
[15] BoE (13 December 2024), Bank of England/Ipsos Inflation Attitudes Survey - November 2024.

[16] Bank of England (06 February 2025), Monetary Policy Report, p. 50.

[17] Bank of England (06 February 2025), Monetary Policy Report, p. 14.

[18] Office for Budget Responsibility (21 February 2025), CPI based on October 2024 economic and fiscal outlook. (Link)

Figure 4.1: CPI Expectations vs Ofcom's Inflation Assumption



Note: We extend the period of the inflation forecasts assuming that inflation is back at the BoE's 2% CPI target at the end of the projection periods. Sampling periods of surveys: November 2024 (Bank of England) and January 2025 (Citi/YouGov).
Source: NERA analysis based on Bank of England / Ipsos, Citigroup / YouGov, Bank of England, and Office for Budget Responsibility data.

Under the assumption that CPI will be equal to 2% after the end of the projection period in the BoE and OBR inflation forecasts, we derive a 10-year CPI expectation of 2.8% as an average across the four data points presented above.

By relying on an estimate of expected inflation, which is well below current market evidence on expected inflation, Ofcom risks to overestimate the real discount factor that is used to set ALFs.

Ofcom's estimate for expected inflation is also internally inconsistent. When determining the inflation risk premium, Ofcom starts with the 10-year breakeven inflation of 3.6% as of October 2024.[19] Breakeven inflation contains both a compensation for expected inflation as well as a compensation for the perceived risk that outturn inflation might deviate from inflation expectations (i.e. an inflation risk premium):

$$Breakeven\ Inflation\ (10Y) = Exp.Inflation\ (10Y) + Inflation\ Risk\ Premium \quad (1)$$

Market-based measures of breakeven inflation can either be derived directly from inflation linked-swaps or as the difference in yields of nominal and index-linked gilts. Both index-linked gilts and

[19] Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, p.54.

inflation-linked swaps are currently linked to RPI. In 2030, RPI is expected to be replaced by CPIH (CPIH represents CPI including owner occupier housing costs).[20] The Office for Budget Responsibility ("OBR") estimates that RPI is, on average, approximately 0.9 percentage points higher than CPI.[21] In contrast, when comparing CPI with CPIH, the OBR estimates that CPIH surpasses CPI by an average difference of only 0.4 percentage points.[22]

Hence, with the switch from RPI to CPIH indexation by 2030 for index-linked gilts and inflation-linked swaps, market participants expect to receive a lower compensation for inflation from 2030 onwards. This lower inflation compensation is already reflected by current yields of index-linked gilts and inflation-linked swaps. Compared to a hypothetical inflation-linked swap based on CPI, we assume that a 10-year maturity inflation-linked swap based on RPI/CPIH emitted at the beginning of 2025 contains an inflation premium of 0.65 percentage points.[23]

Under Ofcom's assumption that the RPI inflation risk premium is equal to c. 50 basis points ("bps"),[24] market-based evidence on expected CPI derived from breakeven inflation leads to an estimate of 2.45% (see Table 4.1), which is substantially above Ofcom's 2% assumption for expected inflation.

Table 4.1: Market-based Evidence on Expected CPI

Variable	Formula	Value (%)
Breakeven Inflation (10-year Maturity)	A	3.60
RPI Inflation Risk Premium	B	0.50
Long-term wedge between RPI/CPIH and CPI	C	0.65
Expected CPI	**D = A – B – C**	**2.45**

Source: NERA analysis based on Ofcom and OBR.

This also means that Ofcom in its current estimate of annualisation rate uses two different values for expected CPI. Crucially, if Ofcom were to consistently rely on an expected CPI of 2%, the inflation risk premium would have to increase (see Chapter 4.2).

Finally, we find that outturn CPI of the past ten years was equal to 3.01% and thus substantially above the BoE target of 2% (see Table 4.2 below). The result is driven by two years with exceptionally high inflation of 9.1% and 7.3% in 2022 and 2023. These years also illustrate the asymmetric risk inherent in future inflation realisations: even if the central bank maintains a credible commitment to return to

20 HM Treasury (25 Nov 2020), A Response to the Consultation on the Reform to Retail Prices Index (RPI) Methodology.

21 See Office for Budget Responsibility (October 2024), Economic and fiscal outlook, p. 38. Using OBR's long-term RPI-CPI wedge of 0.9pp is conservative. Kaminska et al. (2018) find a long-term RPI-CPI wedge of only 0.66pp. See Kaminska et al. (2018), What do the prices of UK inflation-linked securities say on inflation expectations, risk premia and liquidity risks?, Journal of Banking & Finance, 88, 76-96.

22 See Office for Budget Responsibility (October 2024), Economic and fiscal outlook, p. 39. Again, using OBR's long-term CPIH-CPI wedge of 0.4pp is conservative. In its recent RIIO-3 decision, Ofgem only applies a CPIH-CPI wedge of 0.11pp and even uses CPI as a proxy for CPIH. See Ofgem (18 July 2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, p.59.

23 We assume that for index-linked gilts and inflation-linked swaps emitted in 2025, market participants expect to receive RPI for a period of five years and CPIH for a period of five years after the switch from RPI to CPIH-indexation in 2030. We calculate the premium of 0.65 percentage points as (5 * 0.9 + 5 * 0.4)/10 = 0.65.

24 Ofcom "*suggests an RPI inflation risk premium could be above 50 basis points*". Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, p. 54.

target in the medium term, the probability of realisations of inflation substantially above target is larger than the probability of realisations of inflation substantially below target.

Table 4.2: Historical CPI from 2015 to 2024

Year	CPI Rate (%)
2015	0.00
2016	0.70
2017	2.70
2018	2.50
2019	1.80
2020	0.90
2021	2.60
2022	9.10
2023	7.30
2024	2.50
Average	**3.01**

Source: NERA analysis based on Office for National Statistics.

In summary, Ofcom's current determination of the inflation expectations at 2% is flawed for at least three reasons:

- It does not align with current inflation surveys and inflation forecasts over the next ten years.
- It is inconsistent with Ofcom's determination of the inflation risk premium – either the inflation risk premium or the expected inflation parameter needs to be adjusted upwards.
- It does not reflect the asymmetry in realised inflation, which means that realised inflation on average will be above the BoE's 2% target.

We consider that inflation expectations should be set consistently with the inflation risk premium and reflect the range of expected inflation between 2.45% (based on UK gilts) and 2.8% (based on inflation surveys / forecasts).

4.2. Ofcom's Estimate for a CPI Inflation Risk Premium is Too Low and Inconsistent with Inflation Expectations

To make MNOs indifferent between participating in an auction and paying upfront or paying ALFs, Ofcom's approach should produce an NPV of ALFs equal to the auction result. At the point of determination, this equality can only hold true in expectation as Ofcom adjusts the ALF based on outturn inflation which generally differs from the inflation expectations at the time of the LSV determination. Thus, the equality between the hypothetical auction result and the NPV of ALFs may not hold from an ex-post perspective.

To compensate MNOs for this risk, Ofcom allows for an inflation risk premium that it deducts from the real discount rate in the lower polar case. In the 2024/25 Consultation on ALFs, Ofcom has proposed a premium of 40 basis points.

Ofcom relies on a September 2023 speech of Bank of England Monetary Policy Committee member Catherine Mann who calculates inflation risk premia as the difference between breakeven inflation and survey-based inflation expectations, finding an RPI inflation risk premium of 90 bps in 2023.

Ofcom applies a similar approach in determining the RPI inflation risk premium. It calculates the RPI inflation risk premium as the difference between the breakeven inflation rate of 3.6% and a longer-term RPI forecast that "*appear[s] to average below 3%*".[25] On this basis, Ofcom "*suggests an RPI inflation risk premium could be above 50 basis points*".[26]

As CPI was less volatile than RPI in the past, Ofcom assumes that the CPI inflation risk premium might be below the RPI inflation risk premium in the future and thus considers an assumption of 40 basis points to be "*reasonable*".[27]

There are two shortcomings in Ofcom's analysis:

- First, as described in Chapter 4.1 above, the breakeven inflation rate is no longer based solely on RPI. Ofcom itself describes that RPI is expected to align to CPIH from 2030 onwards.[28] Hence, it would be inconsistent to subtract a forecast of pure RPI from a breakeven inflation, which is based on a mix of RPI and CPIH. Ofcom has OBR forecasts for RPI until 2030 and forecasts of CPIH after 2030 at hand, but seemingly does not apply these forecasts properly in the derivation of the inflation risk premium. Assuming that expected RPI is equal to 3.1% in the period from 2025 to Q1 2030 and expected CPIH from 2030 onwards is equal to 2.5%, we find that the corresponding expected inflation rate to the 10-year maturity breakeven inflation is equal to 2.8% rather than the 3.1% used by Ofcom.[29] Based on a breakeven inflation of 3.6% and a RPI/CPIH expectation of 2.8%, we calculate a RPI/CPIH inflation risk premium equal to 80 basis points.
- Second, CPIH has a lower volatility than RPI. It is thus not correct to adjust the RPI/CPIH inflation risk premium based on the difference in volatility between RPI and CPI. Instead, the lower volatility in CPIH compared to RPI needs be considered in the downward adjustment of the RPI/CPIH inflation risk premium into a CPI inflation risk premium.

To derive the downward adjustment for the RPI inflation risk premium, Ofcom compares the volatility of RPI and CPI, finding that the latter is c. 20% lower than RPI volatility. In line with this finding, Ofcom also reduces the RPI inflation risk premium by c. 20% from c. 50bps to 40 bps.[30] We therefore

25 Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, p.54.

26 Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, p. 54.

27 Ofcom seems to rely on observed volatility in monthly RPI and CPI in the period from January 1998 to September 2024 to make this downward adjustment of the RPI inflation risk premium. See Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, p. 54.

28 Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, FN 72.

29 We calculate the 2.8% inflation expectation as an arithmetic mean between RPI and CPIH for the period from 2025 to 2034 (i.e. (5 * 3.1% + 5 * 2.5%) / 10 = 2.8%. Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, FN 72.

30 Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, p. 54.

estimate that the adjustment of the inflation risk premium should be at most 20% of the updated RPI inflation risk premium, which is 16bps.[31] Alternatively, if the difference between RPI and CPI inflation risk premium does not change with the absolute value of the risk premium, an adjustment should not exceed 10bps.

Based on Ofcom's estimates for breakeven inflation (3.6%), expected RPI/CPIH (2.8%) and the assumed difference in volatility of RPI/CPIH and CPI of at most 10bps to 16bps, we thus find a CPI inflation risk premium in the range of 64bps to 70bps (see Table 4.3 below).[32]

Table 4.3: CPI Inflation Risk Premium

Parameter	Formula	Value
Breakeven Inflation	A	3.6%
Weighted RPI/CPIH Expectations	B	2.8%
RPI/CPIH Inflation Risk Premium	**C = A – B**	**0.8%**
Correction for Volatility Difference to CPI	D	0.10-016%
CPI Inflation Risk Premium	**E = C - D**	**0.64-0.70%**

Source: NERA analysis.

4.3. Upper Polar Case Is Biased Upwards Due to the Inclusion of Unsystematic Risk within Ofcom's WACC

Consistent with its previous ALF decisions, Ofcom estimates an upper polar case based on the forward looking WACC *"reflecting the systematic risk of a UK MNO"*.[33] Ofcom explains that it is the systematic risk that matters in the upper polar case. According to Ofcom, in a hypothetical scenario where ALF payments were set up in a way that they varied in line with the future after-tax cash flows of the licensee, e.g. through some form of revenue sharing arrangement between the MNO and the government, the government would be *"fully exposed to the underlying systematic risk"*. [34]

The key parameter that determines systematic risk within the standard Capital Asset Pricing Model ("CAPM") framework is the asset beta. In its 2021 Decision, Ofcom established an asset beta of 0.62. In the 2024/25 Consultation, Ofcom revises this figure down to a range of 0.30 to 0.46. In a hypothetical scenario without market frictions and taxes, Ofcom could have calculated systematic risk solely based on these asset beta values.

[31] Assuming that the RPI/CPIH inflation risk premium is equal to 80 basis points, and it is appropriate to apply the maximum downward adjustment of 20% to derive the CPI inflation risk premium, we calculate a maximum downward adjustment 16 basis points.

[32] We calculate the CPI inflation risk premium as the difference between the RPI/CPIH inflation risk premium of 80 basis points and the downward adjustment for higher volatility of 10 to 16 basis points. As a result, we find a range of 64 to 70 basis points for the CPI inflation risk premium. As CPIH even has a lower volatility than CPI since January 1989, we consider a downward adjustment of 10 basis points and a resulting CPI inflation risk premium of 70 basis points to be reasonable.

[33] Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, para A5.28.

[34] Derived from Ofcom's equity beta range of 0.9-1.0, debt beta of 0.1 and gearing of 75% and 60%, respectively. Calculated as (asset beta – debt beta * gearing) / (1 – gearing).

In this context, it is important to note that the WACC is generally unaffected by a company's capital structure. This principle is a cornerstone of the Modigliani-Miller theorem, formulated by Nobel Prize winners Franco Modigliani and Merton Miller. According to this theorem, the post-tax vanilla WACC, which includes the post-tax cost of equity and the pre-tax cost of debt, remains constant regardless of changes in gearing or leverage. Ofcom has recognised this principle in the 2021 Decision:[35]

"We could have used an all-equity WACC in the upper polar case. We are interested in estimating the government's exposure to systematic risk, which is a function of business risk and is independent of capital structure."

In 2021, Ofcom further commented that using an all-equity WACC or WACC based on cost of debt and cost of equity each weighted with an empirically observed gearing factor did not matter for the determination of the MNO's cost of capital: [36]

„We assume some debt financing in the WACC simply to reflect that in practice MNOs have some debt in their capital structure. The all-equity WACC is also 3.6% (to one decimal point)."

However, this is no longer the case with the updated asset beta and gearing values in the 2024/25 Consultation. Specifically, Ofcom's post-tax vanilla WACC (i.e., a WACC that is not influenced by taxes) increases with higher levels of gearing. This anomaly, which is shown in Table 4.4, arises because Ofcom incorporates unsystematic risk into its WACC calculation through the cost of debt, thereby affecting the overall WACC despite the theoretical independence suggested by the Modigliani-Miller theorem. The fact that a portion of unsystematic risk is included in Ofcom's debt premium is also evident in Ofcom's decision regarding the lower polar case, where it subtracts a liquidity premium from the debt premium. Liquidity is generally regarded as largely uncorrelated with the business cycle, and therefore considered unsystematic in nature.

35 Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, fn. 147.

36 Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, fn. 147.

Table 4.4: Ofcom's WACC Dependent on Gearing Assumption

Gearing	**(%)**	**0**	**…**	**55**	**60**	**65**	**70**	**75**	**80**
Tax	(%)	25	…	25	25	25	25	25	25
Risk free rate	Nominal (%)	4.05	…	4.05	4.05	4.05	4.05	4.05	4.05
ERP	(%)	4.75	…	4.75	4.75	4.75	4.75	4.75	4.75
Asset beta	(Number)	0.30	…	0.30	0.30	0.30	0.30	0.30	0.30
Debt beta	(Number)	0.1	…	0.1	0.1	0.1	0.1	0.1	0.1
Equity beta	(Number)	0.3	…	0.54	0.60	0.67	0.77	0.90	1.10
Cost of equity	Nominal, post-tax (%)	5.48	…	6.64	6.90	7.24	7.69	8.33	9.28
Cost of equity	Nominal, pre-tax (%)	7.3	…	8.8	9.2	9.7	10.3	11.1	12.4
Cost of debt	Nominal, pre-tax (%)	4.95	…	4.95	4.95	4.95	4.95	4.95	4.95
WACC	**Nominal, vanilla (%)**	**5.48**	…	**5.71**	**5.73**	**5.75**	**5.77**	**5.79**	**5.82**

Source: NERA analysis.

At the same time, in the 2024/25 Consultation, Ofcom reaffirms its ambition to define the upper polar case based on an MNO's systematic risk:[37]

"[W]e propose to base our estimate of the upper polar case on the forward-looking WACC reflecting the systematic risk of a UK MNO. This is consistent with how we define the upper polar case, which is that, hypothetically, if the ALF payments were set up in such a way that they varied in line with the future after-tax cash flows of the licensee [...] the government would be fully exposed to the underlying systematic risk."

This is in line with its 2021 decision, where Ofcom also stated that it uses a CAPM-based estimate of the cost of capital to reflect systematic risk borne by investors:[38]

"In the capital asset pricing model (CAPM), which we use to estimate the cost of capital, the risk premium above the risk-free rate reflects the compensation required by investors for bearing systematic risk."

Accordingly, if Ofcom were to consider only systematic risk in its WACC determination, the debt spread of 0.9% would need to be adjusted to account for the portion attributable to unsystematic risk. In Ofcom's assessment, with a debt beta of 0.1 and an ERP of 4.75%, the systematic component of the debt premium amounts to 0.475% (or 5.48% for the nominal cost of debt). As shown in Table 4.5, by including only the systematic risk premium the resulting vanilla WACC would be independent of capital structure, aligning with the principles established by Modigliani and Miller.

37 Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, para A5.28.

38 Ofcom (13 December 2024), Review of Annual Licence Fees – Proposal for revised Annual Licence Fees for 900, 1800 and 2100 MHz spectrum, para A4.40.

Table 4.5: Correcting Ofcom's WACC: Independent on Gearing Assumption

Gearing	**(%)**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**
Tax	(%)	25	25	25	25	25	25	25	25
Risk free rate	Nominal (%)	4.05	4.05	4.05	4.05	4.05	4.05	4.05	4.05
ERP	(%)	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75
Asset beta	(Number)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Debt beta	(Number)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Equity beta	(Number)	0.46	0.50	0.54	0.60	0.67	0.77	0.90	1.10
Cost of equity	Nominal, post-tax (%)	6.25	6.43	6.64	6.90	7.24	7.69	8.33	9.28
Cost of equity	Nominal, pre-tax (%)	8.3	8.6	8.8	9.2	9.7	10.3	11.1	12.4
Cost of debt	Nominal, pre-tax (%)	4.53	4.53	4.53	4.53	4.53	4.53	4.53	4.53
WACC	**Nominal, vanilla (%)**	**5.48**	**5.48**	**5.48**	**5.48**	**5.48**	**5.48**	**5.48**	**5.48**

Source: NERA analysis.

In the following Table 4.6, we correct Ofcom's WACC calculation to include only systematic risk.

Table 4.6: Ofcom's WACC Corrected for Unsystematic Risk

Parameter	Unit	2024/25 Consultation (Ofcom)		Unsystematic Risk (NERA)	
Inflation	(%)	2.0	2.0	2.0	2.0
Tax	(%)	25	25	25	25
Risk free rate	Nominal (%)	4.05	4.05	4.05	4.05
ERP	(%)	4.75	4.75	4.75	4.75
Asset beta	(Number)	0.30	0.46	0.30	0.46
Debt beta	(Number)	0.1	0.1	0.1	0.1
Gearing	(%)	75	60	75	60
Equity beta	(Number)	0.9	1.0	0.9	1.0
Cost of equity	Nominal, post-tax (%)	8.3	8.8	8.3	8.8
Cost of equity	Nominal, pre-tax (%)	11.1	11.8	11.0	11.8
Cost of debt	Nominal, pre-tax (%)	4.95	4.95	4.53	4.53
WACC	Nominal, pre-tax (%)	6.5	7.7	6.2	7.4
WACC	Nominal, post-tax (%)	4.9	5.8	4.6	5.6
Mid-point	Nominal, post-tax (%)	5.3		5.1	
WACC	**Real, post-tax (%)**	**2.8**	**3.7**	**2.6**	**3.5**
Mid-point	**Real, post-tax (%)**	**3.3**		**3.0**	

Source: NERA analysis.

Correcting for systematic risk reduces Ofcom's mid-point of the real post-tax WACC to 3.0% (reduction of 0.3 percentage points).

5. Correcting for Ofcom's Flaws and Inconsistencies Produces a Lowers Discount Rate for Annualisation

In this chapter, we provide our corrected estimates of the post-tax real discount factor in the lower and upper polar case as well as the resulting corrected annualisation rate.

As explained in Chapter 4.1 we consider a range for the expected CPI. On the lower end, we assume a CPI expectation of 2.25% based on currently observed breakeven inflation and our updated inflation risk premium.[39] On the upper end, we estimate expected CPI based on CPI forecasts and surveys, which results in a CPI expectation of 2.8%.

Based on our range of inflation estimates we also calculate a range for the upper and lower polar cases as well as for the resulting annualisation rate. In this chapter, we first discuss the resulting estimates for the lower polar case (Chapter 5.1), second for the upper polar case (Chapter 5.2), and finally the range for the annualisation rate (see Chapter 5.3).

5.1. Correcting the Lower Polar Case

For the lower polar case, we base our estimates of the adjusted real post-tax cost of debt on our correction of the CPI inflation risk premium to 70 basis points from Ofcom's estimate of 40 basis points and an upward adjustment of the CPI expectations. Depending on the assumption on CPI expectations (2.25% or 2.8%), we find an adjusted post-tax, real cost of debt between 0.16% and 0.70% (see Table 5.1).

Table 5.1: NERA – Lower Polar Case

Parameter	NERA - Low Inflation	NERA - High Inflation
Pre-tax nominal cost of debt	4.95%	4.95%
Adjustment for inflation risk	0.7%	0.7%
Adjustment for liquidity risk	0.3%	0.3%
Adjusted pre-tax nominal cost of debt	**3.95%**	**3.95%**
Tax rate	25%	25%
Adjusted post-tax nominal cost of debt	**2.96%**	**2.96%**
CPI forecast	2.25%	2.8%
Adjusted post-tax real cost of debt	**0.70%**	**0.16%**

Source: NERA analysis.

In case Ofcom does not implement the suggested changes to the CPI inflation risk premium but instead decides to keep the current estimate 40 basis points, the CPI forecast in our low inflation

[39] We calculate CPI expectations in the low inflation scenario based on breakeven inflation and the methodology described in Chapter 4.1: Subtracting the updated inflation risk premium of 70 basis points (see Chapter 4.2) and a wedge between RPI/CPIH and CPI expectations of 65 basis points from the breakeven inflation of 3.6%, we find that the resulting CPI expectation is equal to 2.25% (i.e. 3.6% - 0.7% - 0.65% = 2.25%).

scenario would have to be adjusted upwards from 2.25% to 2.45%. We provide values for the resulting real post-tax discount rate in the lower polar case in this alternative scenario in Table 5.2.

Table 5.2: NERA – Alternative Lower Polar Case

Parameter	NERA - Low Inflation	NERA - High Inflation
Pre-tax nominal cost of debt	4.95%	4.95%
Adjustment for inflation risk	0.4%	0.4%
Adjustment for liquidity risk	0.3%	0.3%
Adjusted pre-tax nominal cost of debt	**4.25%**	**4.25%**
Tax rate	25%	25%
Adjusted post-tax nominal cost of debt	**3.19%**	**3.19%**
CPI forecast	2.45%	2.80%
Adjusted post-tax real cost of debt	**0.72%**	**0.38%**

Source: NERA analysis.

5.2. Correcting the Upper Polar Case

For the upper polar case, we start with a nominal post-tax WACC with a mid-point of 5.1% as calculated in Chapter 4.3 (see Table 4.6). As Ofcom uses a range for equity beta and gearing, our nominal post-tax WACC ranges from 4.6% to 5.6%. Correcting for inflation expectations reduces the mid-point of the real post-tax WACC: assuming inflation expectation of 2.25% yields a mid-point of 2.79%; and assuming inflation expectation of 2.8% yields a mid-point of 2.24% (see Table 5.3).

Table 5.3: NERA – Upper Polar Case

Parameter	NERA - Low Inflation		NERA - High Inflation	
Nominal, post-tax WACC	4.6%	5.6%	4.6%	5.6%
CPI forecast	2.25%	2.25%	2.8%	2.8%
Real, post-tax WACC	**2.30%**	**3.28%**	**1.75%**	**2.72%**
Mid-point (real, post-tax WACC)	**2.79%**		**2.24%**	

Source: NERA analysis.

5.3. Correcting the Annualisation Rate

Taking the weighted averages of the lower and upper polar case relying on Ofcom's Risk Sharing Adjustment of 25%, we find that the real post-tax discount rate lies in a range between 0.68% and 1.22% depending on the assumption about future CPI (see Table 5.4). Based on Ofcom's assumptions on the ALF period and the tax adjustment factor, we calculate a range between 5.82% and 6.12% for the annualisation rate, with a mid-point of 5.97%.

Table 5.4: Corrected Estimate of Current Annualisation Rate

Parameter	NERA - Low Inflation	NERA - High Inflation
Lower Polar Case	0.70%	0.16%
Upper Polar Case	2.79%	2.24%
Risk Sharing Factor	25%	25%
Real Post-Tax Discount Rate	**1.22%**	**0.68%**
ALF Period	20	20
Tax Adjustment Factor	1.093	1.093
Annualisation Rate	**6.12%**	**5.82%**
Annualisation Rate (Mid-point)	**5.97%**	

Source: NERA analysis.

6. Conclusion and Recommendations

In this report, we have outlined several flaws and inconsistencies within Ofcom's method of estimating the annualisation rate in the 2024/25 Consultation. We conclude that Ofcom should update its approach to:

- Recognize the underlying relationship between auction results and the capital market environment, either through adjusting the LSVs or through adjusting the annualisation rate to reflect the market conditions at the time of the respective auctions; and
- Consistently estimate the discount rate in the upper and lower polar case by:
  - Consistently reflecting current CPI expectations and the current inflation risk premium in the lower polar case; and
  - Focusing on systematic risk in determining the WACC in the lower polar case.

Correcting for Ofcom's inconsistencies in determining the constituent parameters, we find that the current real post-tax discount rate lies in a range between 0.68% and 1.22% depending on the assumption about future CPI (see Table 6.1). Based on Ofcom's assumptions on the ALF period and the tax adjustment factor, we calculate a range between 5.82% and 6.12% for the annualisation rate, with a mid-point of 5.97%.

Table 6.1: Corrected Estimate of Current Annualisation Rate

Parameter	NERA - Low Inflation	NERA - High Inflation
Lower Polar Case	0.70%	0.16%
Upper Polar Case	2.79%	2.24%
Risk Sharing Factor	25%	25%
Real Post-Tax Discount Rate	**1.22%**	**0.68%**
ALF Period	20	20
Tax Adjustment Factor	1.093	1.093
Annualisation Rate	**6.12%**	**5.82%**
Annualisation Rate (Mid-point)	**5.97%**	

Source: NERA analysis.

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NERA
Friedrich Ebert Anlage 49
Messeturm
Frankfurt, Germany 60308
www.nera.com

Geschäftsführer:
Tomas Haug, Dr. Emmanuel Llinares, Nick Studer, Dr. Lawrence Wu
Registergericht München
Handelsregister-Nr. HRB 150661