6th June 2024

BEREC Report on WACC parameter calculations according to the European Commission's WACC Notice of 6th November 2019

(WACC parameters Report 2024)

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Executive Summary

In this fifth[1] BEREC Weighted Average Cost of Capital (WACC) parameters Report BEREC calculates the WACC parameters following the non-binding Commission's WACC Notice on the calculation of the cost of capital for legacy infrastructure in the context of the Commission's review of national notifications in the EU electronic communications sector of 6th Nov. 2019[2]. The cost of capital is the core element of any regulatory pricing decision NRAs take. The Notice aims to ensure a consistent calculation of the WACC by national regulatory authorities (NRAs) thereby contributing to the development of the internal electronic communications market.

As the Commission's Notice has not changed, BEREC is following the same methodology (incl. 'technical choices') as in last year's Report providing utmost continuity.

BEREC applied three general principles:

- Follow the Notice as closely as possible, which mainly refers to the methodologies to be used for the estimations;
- Be transparent, using publicly available data where possible or using data which is widely used and accepted in the financial markets, which refers to the data sources to be used for the estimations;
- Explain every step of the calculation and proceed in a straightforward manner, which refers to the calculations as such.

For each of the parameters of the WACC formula (using the Capital Asset Pricing Model (CAPM) approach) the Report sets out:

- the application of the methodologies according to the WACC Notice,
- the assumptions and choices made,
- the data and data sources used,
- the steps of the calculations,
- the results.

By explaining precisely and transparently how the results were derived NRAs will be able to follow the BEREC calculation steps from start to end and to fully understand the logic of the

[1] The four previous BEREC WACC parameters Reports are available on the BEREC website, www.berec.europa.eu, BEREC WACC parameters Report 2020 (BoR (20) 116); BEREC WACC parameters Report 2021 (BoR (21) 86); BEREC WACC parameters Report 2022 (BoR (22) 70), BEREC WACC parameters Report 2023 (BoR (23) 90).

[2] https://digital-strategy.ec.europa.eu/en/library/commission-publishes-notice-calculation-cost-capital-legacy-infrastructure

calculation process so that they can replicate the results shown in the WACC parameters Report. This ensures that NRAs are confident that the results are robust and were derived using state of the art professional standards as well as following the Notice as closely as possible taking into account also best regulatory practices where the Notice provides for NRAs' flexibility.

All results were cross checked and verified to ensure that no methodological mistakes have been made, no questionable data has been used and no calculation errors have occurred, so that BEREC was able to exclude any systematic bias. Only after these checks were carried out, BEREC was satisfied that the results were correct and NRAs will be confident to use them in their own WACC calculations.

The following Table provides a summary of the structure of the WACC parameters Report, BEREC's calculations and (references to) the results derived from it.

Table 1 Summary of the structure of the BEREC WACC parameters Report 2024 with references to result tables

Chapter	**Parameter**	**Results**	**Reference (Table)**
Chapter 1	Introduction WACC formula		
Chapter 2	RFR	RFR for each EU member state	Table 2
Chapter 3	Peer group	BEREC Peer Group 2024 comprising 14 companies	Table 3
Chapter 4	Debt premium, Cost of debt	Debt premium, Cost of debt for each of the 14 companies of the BEREC Peer Group	Table 4
Chapter 5	Equity beta, Gearing, Asset beta	Equity beta, Gearing, Asset beta for each of the 14 companies of the BEREC Peer Group	Table 6
Chapter 6	ERP	EU-wide ERP	Table 10 + 11
Chapter 7	Summary	All WACC parameters as calculated by BEREC	Table 12 + 10

A complexity of the Notice and the WACC parameters Report is the calculation of an EU-wide ERP (equity risk premium). Based on the calculations described in Chapter 6 BEREC

considers that the appropriate value of the single EU-wide ERP is **5.95 % (AM).** As the same methodology as last year was used, the minor increase from 5.92 % in 2023 to **5.95%** in 2024 is attributable to factual developments. The data for 2023 shows a reduction of the premium in the historical series even if the value is higher than the average. This is in line with the stabilization of the economic conditions in comparison to previous years and returning to a "normal" situation with an equity market that is outperforming the corresponding bond market.[3]

Since 2021, BEREC estimates additionally a separate EU/EEA-ERP for exclusive use by Nkom (Norway), ECOI (Iceland) and AK (Liechtenstein)[4].

The BEREC peer group comprises 14 companies this year as Telenet was delisted after having been acquired by Global Liberty and no new peer fulfilled the requirements.

In section 7.2 (Taxes and inflation) BEREC has expanded on the temporarily increased inflation rate and how to deal with it within the framework of the Notice. BEREC refers to its statements in the BEREC Opinion on the Draft Gigabit Recommendation (BoR (23) 83) as well as to the new Gigabit Connectivity Recommendation (EU) 2024/539 of 6th February 2024 (see below).

BEREC publishes the estimated WACC parameter values and NRAs are assumed to take into account those parameter values when carrying out their own calculations for their national regulatory decisions, but they do have some flexibility within this framework to take account of national specificities. BEREC observes that over time most NRAs follow the Notice and use the BEREC parameter values in their national decisions.

For reference by NRAs the Report is to be published before 1st July 2024 when the Commission applies it according to the Notice when reviewing NRA's notifications in the EU electronic communications sector.

BEREC has taken utmost care to develop this Report according to the best knowledge and technical expertise of its members. Nevertheless, improvements may be necessary in the future yearly update where deemed appropriate.

1. General introduction

This Report contains the results of the calculations run by BEREC to estimate the parameters of the Weighted Average Cost of Capital (WACC) according to the non-binding Commission Notice on the calculation of the cost of capital for legacy infrastructure in the context of the Commission's review of national notifications in the EU electronic communications sector[5] and

[3] Cf. for a more detailed analysis Ch. 6.5 below and the UBS Global Investment Returns Yearbook 2024 Summary Edition, published at Global Investment Research & Insights | UBS Global, available here: Global Investment Returns Yearbook 2024 | UBS Global.

[4] As no data is available for Liechtenstein, the separately estimated EU/EEA-ERP includes only data for Norway and Iceland.

[5] OJ 2019/C 375/01 of 6th Nov. 2019, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019XC1106(01)&from=EN – the Notice.

the Commission Staff Working Document (SWD)[6] accompanying the WACC Notice which describes the methodologies in more detail. Acc. to para. 6 of the Notice the scope is limited to the WACC calculation for legacy infrastructure.[7]

The following introductory chapter describes the tasks assigned to BEREC by the Notice and the general principles BEREC follows in fulfilling these tasks as assigned acc. to section 7[8] of the Notice.[9] The goal of this Report – according to the tasks – is to enable NRAs to make use of the results of the calculations when setting the WACC in their national regulatory decisions.

For this purpose it is important that the Report is as clear and as detailed as possible in describing each step of the calculation in such a manner that each NRA can replicate the results and thus rely fully on the robustness of BEREC's calculations. The Report therefore explains for each of the parameters estimated:

- the application of the methodologies according to the WACC Notice,
- the assumptions and choices made,
- the data and data sources used,
- the steps of the calculations,
- the results.

By explaining precisely and transparently how the results were derived NRAs can be confident that they meet state-of-the-art professional standards and that BEREC followed the Notice as closely as possible taking into account also best regulatory practices where the Notice provides for NRAs' flexibility as well as drawing on the explanations of the SWD.

At the end of the introduction the structure of the Report will be outlined for a better understanding and easy reference.

Also, for an easy reference, the standard **WACC formula** as used in the WACC Notice[10] is shown hereafter:

$$WACC = R_E \times \frac{E}{D+E} + R_D \times \frac{D}{D+E}$$

$$R_E = RFR + ß \times ERP$$

$$R_D = RFR + \text{Debt Premium}$$

$$WACC = [(\frac{E}{D+E}) \times (RFR + ß \times ERP)] + [(\frac{D}{D+E}) \times (RFR + \text{Debt Premium})],$$

[6] SWD (2019) 397_final, https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=62834, the SWD.
[7] Legacy infrastructure means infrastructure of an SMP operator not subject to a Next Generation Access (NGA) premium.
[8] See section 1.1. below
[9] BEREC is not taking any view regarding the Notice in this Report. BEREC provided input during the Commission's public consultation in 2018, cf. BEREC Position Paper – Input to the Commission's WACC consultation 2018, BoR (18) 67, publ. in Oct. 2018, https://berec.europa.eu/eng/document_register/subject_matter/berec/opinions/8257-berec-position-paper-input-to-the-commission8217s-wacc-consultation-2018.
[10] As set out in section 2 of the WACC Notice.

Where

R_E = the cost of equity (to be estimated using the Capital Asset Pricing Model (CAPM);

ß = beta;

ERP = the equity risk premium;

R_D = the cost of debt;

RFR = the risk-free rate;

Debt Premium = the additional return that lenders require from a company with a given credit risk, over and above the RFR;

E = the value of equity, with $\frac{E}{D+E}$ being the share of equity in the company value (D+E);

D = the value of debt, with $\frac{D}{D+E}$ being the share of debt in the company value (D+E); the share of debt in the company value is also called *gearing (g)*;

V = the value of the company, which is equal to the sum of debt and equity (V = D+E).

This is the fifth Report that is being produced by BEREC. BEREC has taken utmost care to develop this Report according to the best knowledge and technical expertise of its members based on their longstanding experience of applying regulatory principles[11] when setting the WACC in pricing decisions which are reported every year in a specific chapter of the BEREC Regulatory Accounting in practice Report.[12]

As the Commission's Notice has not changed, BEREC is following the same methodology (incl. 'technical choices') as in last year's Report. This implies that changes in the results are due to factual developments, i. e. reflect market and other developments.

1.1. BEREC's tasks according to the WACC Notice

BEREC's tasks are described in para. 64 – 67 of section 7 of the Notice "Role of BEREC and the Commission in the calculation of WACC parameters". Acc. to section 7 BEREC in close collaboration with the Commission estimates the WACC parameters consistent with the approach described in the Notice. BEREC will estimate and publish the values on an annual basis for the parameters reflecting general economic conditions and the company-specific parameters for the selected peer group.

The parameters reflecting general economic conditions described in section 4 of the Notice consist of the **RFR** which will be estimated for each EU member state and a **single EU-wide**

[11] For the regulatory principles see below section 1.2.1.

[12] For an overview of current NRAs' practices when setting the WACC cf. to the latest BEREC Regulatory Accounting in practice Report, WACC chapter (ch. 5), BoR (23) 196, publ. in Dec. 2023 https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-regulatory-accounting-in-practice-2023

ERP. The single EU-wide ERP follows from the assumption of ultimately reaching an integrated EU capital market (cf. para 38 Notice).

The company-specific parameters described in section 5 of the Notice consist of the following parameters: **equity beta, gearing, debt premium**, and the **cost of debt** (R_D), the latter being calculated indirectly as the sum of the **domestic RFR** and the **debt premium**. Given that the calculation of the cost of debt includes the *domestic* RFR the debt premium must also be estimated using (besides the relevant corporate bonds) corresponding government bonds of the *home country*[13] of the company as a benchmark in order to avoid inconsistencies. This assumes an investor taking a "home country" approach or, in the context of the Notice, an EU rather than a global investor's perspective. The company-specific parameters will be estimated for each company of the peer group.

BEREC prepares a list of companies suitable for the **peer group** by following the criteria for selecting the peer group as outlined in para. 44 of the Notice. BEREC estimates the equity beta, gearing, debt premium and cost of debt for each company included in the list. Acc. to para. 67, BEREC also describes factors that may justify the removal of one or more companies from the "BEREC peer group" to take into account national specificities.

When estimating the parameters BEREC takes into account the assumptions common to several WACC parameters as described in section 3 of the Notice, namely the length of the averaging period and the averaging method. This ensures "internal consistency" of the estimations. Also, to be consistent throughout all parameters, the cut-off date is set at 1st April 2024 for this Report.

BEREC publishes the estimated WACC parameter values and NRAs are assumed to take into account those parameter values when carrying out their own calculations for their national regulatory decisions, but they do have some flexibility within this framework to take account of national specificities. The Report is due to be published before 1st July 2024.

1.2. The new Gigabit Connectivity Recommendation

In this paragraph some elements, introduced in the recent Gigabit Recommendation on WACC, are reported. More specifically the new Gigabit Recommendation[14] explicitly states that the "applicable WACC" when mentioned is set in accordance with the methodology established in the Notice and the corresponding annual BEREC Report.[15] The Commission specifically notes as well that the "applicable WACC" is also the base for the VHCN project specific WACC that can include a specific risk premium on top of the applicable WACC. In the revised Staff Working document the relevance of the principles in the Notice for the estimation of the "applicable WACC" has been reiterated. The applicable WACC is a solid base for the estimation of any Rate of Return: "*When*

[13] In a few exceptional cases, government bonds of a country with the same credit rating as the home country were used as a proxy (see Ch. 4).
[14] Gigabit Connectivity Recommendation (EU) 2024/539 of 6th February 2024, OJ of 19 Febr. 2024
[15] "This staff working document takes as the base the applicable WACC set in accordance with the methodology established in the Notice" p. 108 of the Staff Working Document (https://digital-strategy.ec.europa.eu/en/library/recommendation-regulatory-promotion-gigabit-connectivity).

discussing any premium for rewarding investments into VHCNs, this staff working document takes as the base the applicable WACC set in accordance with the methodology established in the Notice". The applicable WACC remains related to the legacy product and independent of any risk premium that can be applied on top of the applicable WACC, for VHCN services where relevant.

In the Gigabit Recommendation in the section "Adequately rewarding the investment risk on new VHCN projects" some elements have been introduced on the applicable WACC estimation in point 64-66 relevant in the application of the Notice:

"64. Where NRAs consider price control obligations to be appropriate, ***they should allow the undertaking an efficient rate of return on capital employed****, taking into account investment-specific risks.*

65. ***When establishing the applicable WACC, NRAs should ensure that it reflects current macroeconomic parameters. If the applicable WACC does not sufficiently take into account prevailing economic conditions, the NRA should consider updating the applicable WACC, thus ensuring the correct macroeconomic parameters in the foundation of the project-specific WACC for new investments.***

66. ***When applying the rate of capital costs, NRAs should ensure that inflation is not double counted, as it could have already been taken into account within the costing methodology implementation.****"*

In this perspective all the principles already provided in the Notice are still applicable and more attention on the general efficiency principle of the WACC calculation with respect to the current macroeconomic conditions is addressed.

1.3. General principles

The work of BEREC is guided by the following three main principles:

- Follow the Notice as closely as possible, which mainly refers to the methodologies to be used for the estimations;
- Be transparent, using publicly available data where possible or using data which is widely used and accepted in the financial markets, which refers to the data sources to be used for the estimations;
- Explain every step of the calculation and proceed in a straightforward manner, which refers to the calculations as such.

The three principles are set out in the following sections. Taken together they serve to ensure a robust result on which NRAs can rely.

1.3.1. Follow the Notice as closely as possible

Following the Notice as closely as possible ensures that BEREC uses the methodologies of the Notice (and detailed in the SWD), i.e. BEREC is doing what it is asked to do. By applying the methodologies foreseen in the Notice BEREC contributes to a consistent application of the regulatory framework thus promoting a competitive internal market for electronic communications networks and services. More specifically, BEREC thus contributes to NRAs using a consistent calculation method for estimating the WACC by NRAs.

In this regard it is important to recall that in line with the objectives of the EU Framework, the Notice is based on four regulatory principles laid down in para. 8: (i) consistency in the methodology; (ii) predictability; (iii) promotion of *efficient* investment taking into account the risk incurred; and (iv) transparency of the method to determine the reasonable rate of return avoiding unnecessary complexity. When calculating the WACC NRAs equally observe these regulatory principles[16].

With regard to the methodological approach the Notice follows the financial market theory known as the Capital Asset Pricing Model (CAPM)[17]. This methodological approach to estimate the cost of equity is based on a number of assumptions. Generally, the application of any methodology requires making assumptions and choices to reflect the concrete situation and specific purpose of the calculation.[18] In particular this is true for the estimation of WACC parameters, which is a very complex multi-dimensional process that in some instances imply that trade-offs must be solved one way or the other.

Thus, BEREC also had to make some 'technical' choices to be able to apply the methodologies foreseen in the Notice in a meaningful and consistent manner to reach robust results applicable by all NRAs. When making choices BEREC used the margin left in the Notice mindfully to stay in line with the Notice and financial market theory in these cases. Where these choices are made, they are made objectively and the reasons are explained in detail. BEREC followed the best regulatory practice stemming from the application of the CAPM which all NRAs already currently use when calculating the WACC.[19]

1.3.2. Be transparent, using public data where possible

The second principle relates to the ensuring that only reliable data is used for the estimations. The choice of the data sources used must be made transparent and explained clearly. Whenever possible, preference was given to the use of publicly available data, in particular official EU data sources such as Eurostat and the ECB.

[16] Cf. also BEREC Position Paper – Input to the Commission's WACC consultation 2018, BoR (18) 67, publ. in Oct. 2018.
[17] Cf. Chapter 5 below for a description.
[18] In this case to estimate WACC parameter values reflecting the cost of capital (SMP) operators face across the EU when investing in telecoms infrastructure for the WACC calculations of NRAs.
[19] Cf. BEREC Regulatory Accounting in practice Report, ch. 5, BoR (23) 196, publ. in Dec. 2023

However, the estimation of certain parameters required specific financial market data, namely long term historic data series from Morningstar[20] necessary to estimate the single EU-wide ERP and data derived from the Bloomberg financial system[21] to estimate certain company specific parameters. Both data sources are widely used and accepted by financial market players. Access to this data has to be procured by the BEREC Office to be able to estimate the parameters and publish the results of the calculations based on this specific data. Being proprietary the data as such cannot be published. In order to be able to rely on this type of data BEREC needs to be sure it understands exactly how the data was compiled. BEREC therefore requested and received explanations from the providers on how the data was compiled and aggregated.

1.3.3. Explain every step of the calculation and proceed in a straightforward manner

The third principle relates to the calculation process as such. To ensure that all NRAs can easily understand and replicate the results of the BEREC calculations, every step of the estimation of each of the parameters is explained in detail and in a straightforward manner. Thus, NRAs will be able to follow the BEREC calculation steps from start to end and to fully understand the logic of the calculation process. This ensures that NRAs are confident that the results are robust and were derived using state of the art professional standards.

All results were cross checked and verified to ensure that no methodological mistakes have been made, no questionable data has been used and no calculation errors have occurred, so that BEREC was able to exclude any systematic bias. Only after these checks were carried out, BEREC was satisfied that the results were correct and NRAs will be confident to use them in their own WACC calculations.

1.4. Structure of the Report: parameter by parameter following the WACC formula

The introduction closes with a short overview of the structure of the report which largely follows the structure of the Notice which itself follows the WACC formula:

$$\text{WACC} = \left[\left(\frac{E}{D+E}\right) \times (\text{RFR} + ß \times \text{ERP})\right] + \left[\left(\frac{D}{D+E}\right) \times (\text{RFR} + \text{Debt Premium})\right].$$

Chapter 2 describes the estimation of the RFR.

[20] Morningstar provides a soft copy of the latest DMS data set (which itself is compiled by Dimson/Marsh/Staunton (DMS) and published yearly in hard copy by UBS/London Business School as the *UBS Global Investment Returns Yearbook*)., published at: Global Investment Research & Insights | UBS Global). For the calculations in this BEREC Report the 2024 version with data from 1900 through to 2023 was used, i.e. the data source is Dimson/Marsh/Staunton, Global Investment Returns Database 2023 (distributed by LBS Inc.) acquired by BEREC Office for BEREC.

[21] BEREC Office acquired for BEREC access to the Bloomberg financial system, which is henceforth referred to as Bloomberg. This year, BEREC was able to make more extensive use of Bloomberg, therefore the data quality has further improved.

Chapter 3 sets out the peer group and provides criteria that NRAs can use to remove peer group members to take account of national specificities.

In Chapter 4 the debt premium and the cost of debt is calculated for each member of the peer group.

In Chapter 5 the beta and gearing are estimated for each member of the peer group.

Chapter 6 contains the calculation of the single EU-wide ERP and also the separate EU/EEA ERP (for exclusive use by Nkom, ECOI and AK) which is a key parameter and certainly the most complex to calculate. Therefore, it is placed at the end of the Report.

Chapter 7 summarises all results in an overview table for easy reference. Furthermore, this chapter also touches upon taxes and inflation (section 6 of the Notice). It also contains a short section comparing the results of the 2024 and the 2023 WACC parameters Report.

2. RFR

2.1. Definition and data source used

The risk-free rate (RFR) is the rate of return an investor would expect to gain from investments in financial instruments that theoretically do not carry any risk of default, such as a government bond. However, even the safest investments might carry some risk of default.

In the CAPM the risk free rate is a parameter used to calculate the cost of equity and the cost of debt:

Cost of equity = Risk Free Rate + ß x Equity Risk Premium

Cost of debt = Risk Free Rate + Debt Premium

The established practice by most NRAs in the past has been to calculate the risk free rate by using yields on 10-year domestic government bonds. This practice has continued because NRAs increasingly follow the methodology outlined in the Notice.[22]

BEREC's calculation of the risk free rate is based on data retrieved from Eurostat as the official publicly available source for EU data[23] and referred to in para. 36 of the Notice. The Eurostat dataset is described as follows: "Long term government bond yields are calculated as monthly averages (non-seasonally adjusted data). They refer to central government bond yields on the secondary market, gross of tax, with a residual maturity of around 10 years. The bond or the bonds of the basket have to be replaced regularly to avoid any maturity drift. This definition is used in the convergence criteria of the Economic and Monetary Union for long-term interest rates, as required under Article 121 of the Treaty of Amsterdam and the Protocol on the convergence criteria".[24]

2.2. Methodology with reference to Notice

BEREC uses yields on domestic 10-year government bonds for each Member State to calculate the risk free rate. The approach of using long-term bonds, which are less volatile than shorter-term bonds, is in line with the longer-term nature of investments in electronic communications networks. Moreover, it follows the Notice since the Commission underlines that the use of domestic government bonds, together with a consistent methodology, will ensure that differences in risk

[22] BEREC Report, Regulatory Accounting in Practice 2023, Chapter 5.2.1 Risk Free Rate, Figure 9 Methodology used to estimate RFR (fixed market), BoR (23) 196, where WACC methodologies and parameter values are recorded for 32 NRAs.
[23] Online data code: TEIMF050, Eurostat Data Source IRT_LT_MCBY_M.
[24] https://ec.europa.eu/eurostat/databrowser/view/teimf050/default/table. Also see further information on long-term interest rate statistics and convergence criteria for EU Member States in the Eurostat metadata.

free rates capture specific country-risks and reflect differences in financing conditions within the Member States.[25]

Eurostat provides the following description of how it derives this data: Long term government bond yields are calculated as monthly averages (non seasonally adjusted data). They refer to central government bond yields on the secondary market, gross of tax, with a residual maturity of around 10 years. The bond or the bonds of the basket have to be replaced regularly to avoid any maturity drift. .[26] The European Central Bank (ECB) provides the underlying data in line with their prescribed methodology.[27] The rates/yields are calculated as monthly arithmetic averages based on daily data provided by National Central Banks' official rates. Daily values are obtained from real trade, in line with the requirements stipulated by the ECB, with the benchmark bond, or imputed values from prior trades when no transactions with the benchmark bond have been made. The monthly values are calculated as an unweighted arithmetic average of daily yields.

The yield to maturity serves as a nominal long-term interest rate without any adjustments for coupon effects, taxes, or inflation. The rates are not subject to seasonal adjustments.[28] The risk free rates have not been adjusted for any quantitative easing programs in line with the Notice[29].

The averaging period BEREC uses for calculating each country-specific risk free rate is **five-years** and is based on monthly data retrieved from Eurostat. This is in line with the Notice on the calculation of the cost of capital, which highlights that this approach would strike the right balance between predictability and efficiency.[30]

2.3. Assumptions and choices made

The data used by BEREC has been retrieved from a reliable, publicly available official source (Eurostat). The Eurostat reference area for this data are EU member states. In the past, Estonia had not issued any 10-year government bonds that comply with the definition of long-term interest rates for convergence purposes until May 2023. Neither had the ECB been able to identify any suitable proxy indicator that could be used as an alternative. Consequently, Eurostat has harmonised the data series for all the Member States apart from Estonia until June 2020, when such data became available for Estonia[31].

[25] Cf. Notice and SWD.
[26] See: Eurostat Data set "Long term government bond yields" (online data code TEIMF050) Explanatory text.
[27] See ECB background information on the full monthly time series of long-term interest rate data on.www-ecb.europa.eu
[28] See European Central Bank, Convergence Report, June 2022, section 6.5.
https://www.ecb.europa.eu/pub/convergence/html/ecb.cr202206~e0fe4e1874.en.html
[29] Section 4, para. 36.
[30] Notice, para 27.
[31] Due to the five year averaging period data for Estonia cannot be completely based on Eurostat data

To remedy this lack of data for Estonia BEREC had applied the same Risk Free Rate to Estonia as was applied to another EU country with similar country characteristics and credit rating in order to derive monthly yields for long term government bonds until such time as they became available, i. e. until May 2020.[32]

Eurostat does not collect corresponding data for Iceland and Norway. Therefore, data for Iceland and Norway have been derived by BEREC using benchmark bonds with 10 years residual maturity. The choice of bonds to be included has been derived from Bloomberg[33].

2.4. Calculation steps – description of how the result is derived

The determination of the Risk Free Rate per country is based on data published by Eurostat[34] and calculating a five-year arithmetic average of this data from 1st April 2019 to 31st March 2024.[35]

A country credit rating reflects the interest premium on private loans or government bonds due to the underlying risk associated with the country in question. Thus, from the perspective of an investor, it represents a risk premium. The level of the risk premium is dependent e. g. on the general economy, political stability and credit worthiness of the country. These factors are considered by Rating Agencies such as Fitch, Moody's and Standard & Poor's for establishing the country risk rating. The rating usually corresponds with the credit rating for the country's government bonds. The five-year average has been evaluated considering comparable returns in term of credit rating along the time series.

Moody's credit rating was used for this purpose.

2.5. Results

A **Risk Free Rate** based on a five year arithmetic average (April 2019 to March 2024) has thus been determined for each EU member state.

[32]For details on BEREC's past approach see BoR (21) 86, Section 2.4.
[33] Via the Bloomberg Terminal, providing financial market data. Also refer to Annex 1
[34] Source Eurostat Data set Long term government bond yields 2019M04 to 2024M03, last updated on 26.04.2024.
[35] Notice, paragraphs 27 and 29.

Table 2 Country Economic Factors and Risk Free Rates

Country Code	Country	Country Credit Rating[36]	GDP per capita[37]	HICP (Harmonised Consumer Price Index)[38]	Risk Free Rate 5 year arithmetic average[39]
AT	Austria	AA1	107,38	134,13	1.03
BE	Belgium	AA3	116,91	131,05	1.08
BG	Bulgaria	BAA1	175,41	137,05	1.39
HR	Croatia	BAA2	-	129,74	1,87
CY	Cyprus	BAA2[40]	119,16	114,46	1.90
CZ	Czechia	AA3	124,92	150,90	2.77
DK	Denmark	AAA	125,58	118,70	0.81
EE	Estonia	A1	142,70	153,20	1.49
FI	Finland	AA1	108,58	119,64	1.02
FR	France	AA2	111,06	122,65	1.05
DE	Germany	AAA	111,76	128,00	0.60
EL	Greece	BA1[41]	95,26	118,13	2.42
HU	Hungary	BAA2	152,81	165,12	4.74
IE	Ireland	AA3	189,55	118,90	1.08
IT	Italy	BAA3	107,54	121,80	2.33
LV	Latvia	A3	165,92	144,67	1.40
LT	Lithuania	A2	167,53	150,27	0.97
LU	Luxembourg	AAA	100,62	124,55	0.88
MT	Malta	A2	153,07	119,23	1.67
NL	Netherlands	AAA	115,31	130,09	0.80
PL	Poland	A2	175,17	146,60	3.66
PT	Portugal	A3[42]	116,49	121,26	1.45
RO	Romania	BAA3	193,79	148,44	5.31
SK	Slovakia	A2	135,37	142,00	1.31
SI	Slovenia	A3	129,50	127,04	1.26
ES	Spain	BAA1	112,33	122,93	1.51
SE	Sweden	AAA	118,90	128,48	0.96
IS	Iceland	A2	118,43	125,88	4.67[43]
NO	Norway	AAA	113,48	134,40	2.11

[36] Moody's via Bloomberg (Moody's country credit ratings are comparable to S&P's country credit ratings).

[37] Eurostat, GDP aggregates per capita, online data code: NAMQ_10_PC, Q4 2023 (extracted on April 26, 2024), Index 2010 = 100, per capita. Data for BE, BG, CY, DE, EL, HU, LU, NL, PL, PT, RO, ES are provisional. Data for IS is estimated. Data for Croatia is not available. Further information on content and estimation see Eurostat Explanatory Texts (metadata). Data extracted on 24/04/2023 16:03:43 from [ESTAT].

[38] Eurostat HICP All items; online data code TEICP000, M3 2024, (extracted on April 26, 2024), Index 2015 = 100; see for the concept and methodology of the HICP (Harmonised index of consumer prices) which is calculated by Eurostat, here: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Harmonised_index_of_consumer_prices (https://ec.europa.eu/eurostat/statistics-

Remarks on results

Current 10 year government bonds yields may differ from the values shown in Table 2 since the methodology for determining the Risk Free Rate, following the Notice, is based on a five-year arithmetic average of national government bond yields for the period 1st April 2019 to 31st March 2024. The recent trend of increasing government bond yields reflects current macroeconomic developments, i.e. the increased interest rates as a measure by Central Banks to combat inflation in Europe. However, the long-term 5 year ECB inflation forecast (which, following the Notice, is used to calculate real WACC) suggests an inflation rate levelling out on a lower than the current level, i.e. close to the ECB goal of 2 %, which in turn will influence interest rates accordingly. More recent inflation developments across Europe support this trend[44].

The following table illustrates the low interest period over the years 2020 (when the first BEREC WACC parameters Report was published) to 2023. The yield trend from 2020-2021 was decreasing (average of -0.29 %), the decrease slowing in 2021-2022 (-0.17 %) and increasing for the second time after a first clear average increase of 0.32 % in 2022-2023 to an even stronger average increase of 0.45 % from 2023-2024.

explained/index.php?title=Glossary:Harmonised_index_of_consumer_prices_(HICP); and its use by the ECB here: https://www.ecb.europa.eu/stats/macroeconomic_and_sectoral/hicp/html/index.en.html. Data extracted on 24/04/2023 16:27:21 from [ESTAT].

[39] BEREC average based on Eurostat Long term government bond yields 2019 M042019M04 to 2024 M032024M03, data for Estonia (also see section 2.3), Iceland and Norway derived by BEREC from Bloomberg data. Also refer to the table in Annex 1.

[40] Updated by Moody's on 29.09.2023

[41] Updated by Moody's on 15.09.2023

[42] Updated by Moody's on 17.11.2023

[43] There has been a miscalculation in the five year arithmetic average (3.76) reported for Iceland in BoR (23) 90 due to an erroneous time line. The correct value should have read 4.34. The time line for the current report has been corrected accordingly.

[44] Also see the ECB's HICP inflation forecast for shorter time periods as well as the five year prognosis: https://www.ecb.europa.eu/stats/ecb_surveys/survey_of_professional_forecasters/html/table_hist_hicp.en.html

Table 2 (a) RFR evolution over time (2020 – 2024)

Country Code	Country	BoR (20) 116	BoR (21) 86	BoR (22) 70	BoR (23) 90	BoR (24) 102	Δ 2021 ('20-'21)	Δ 2022 ('21-'22)	Δ 2023 ('22-'23)	Δ 2024 ('23-'24)
AT	Austria	0.46	0.26	0.20	0.54	1.03	-0.20	-0.06	0.34	0,49
BE	Belgium	0.57	0.36	0.30	0.62	1.08	-0.21	-0.06	0.32	0,46
BG	Bulgaria	1.41	0.97	0.62	0.76	1.39	-0.44	-0.34	0.14	0,63
HR	Croatia	2.53	1.95	1.43	1.56	1,87	-0.58	-0.52	0.13	0,31
CY	Cyprus	2.58	1.92	1.33	1.61	1.90	-0.66	-0.60	0.28	0,29
CZ	Czechia	1.16	1.27	1.64	2.32	2.77	0.11	0.37	0.68	0,45
DK	Denmark	0.32	0.10	0.07	0.36	0.81	-0.22	-0.03	0.29	0,45
EE	Estonia	1.09	0.97	0.50	0.93	1.49	-0.12	-0.47	0.43	0,56
FI	Finland	0.44	0.24	0.19	0.53	1.02	-0.20	-0.05	0.34	0,49
FR	France	0.57	0.37	0.30	0.59	1.05	-0.20	-0.07	0.29	0,46
DE	Germany	-0.17	-0.03	-0.09	0.17	0.60	-0.20	-0.07	0.26	0,43
EL	Greece	5.67	4.04	2.73	2.49	2.42	-1.63	-1.31	-0.24	-0,07
HU	Hungary	2.96	2.73	2.84	3.97	4.74	-0.23	0.11	1.13	0,77
IE	Ireland	0.75	0.50	0.40	0.70	1.08	-0.25	-0.10	0.3	0,38
IT	Italy	1.96	1.82	1.70	2.05	2.33	-0.14	-0.12	0.35	0,28
LV	Latvia	0.67	0.45	0.40	0.84	1.40	-0.22	-0.06	0.44	0,56
LT	Lithuania	0.59	0.35	0.26	0.45	0.97	-0.24	-0.09	0.19	0,52
LU	Luxem-bourg	0.29	0.12	0.03	0.39	0,88	-0.17	-0.08	0.36	0,49
MT	Malta	1.09	0.90	0.85	1.20	1.67	-0.19	-0.05	0.35	0,47
NL	Nether-lands	0.37	0.15	0.05	0.33	0.80	-0.22	-0.10	0.28	0,47
PL	Poland	2.93	2.62	2.51	3.15	3.66	-0.31	-0.11	0.64	0,51
PT	Portugal	2.16	1.71	1.12	1.16	1.45	-0.45	-0.59	0.04	0,29
RO	Romania	4.06	4.05	4.23	4.98	5.31	-0.01	0.18	0.75	0,33
SK	Slovakia	0.66	0.47	0.37	0.75	1.31	-0.19	-0.11	0.38	0,56
SI	Slovenia	0.94	0.60	0.45	0.77	1.26	-0.34	-0.15	0.32	0,49
ES	Spain	1.30	1.01	0.84	1.09	1.51	-0.29	-0.17	0.25	0,42
SE	Sweden	0.49	0.34	0.31	0.56	0.96	-0.15	-0.03	0.25	0,40
IS	Iceland	-	4.39	4.14	3.76	4.67	-	-0.25	-0.38	0,91
NO	Norway	-	1.38	1.45	1.73	2.11	-	0.07	0.28	0,38
Average trend (Arithmetic mean of ΔYoY)							**-0.29**	**-0.17**	**0.32**	**0.45**

3. Peer group

3.1. Definition and data source used

The peer group is defined by selecting the companies that fit the Commission criteria – see section 5.3.2.3 of the Staff Working Document together with subsequent clarifications issued by it.

The data source used to check if a company is listed on a stock exchange is Bloomberg.

3.2. Criteria from the Notice and subsequent clarifications

BEREC has closely followed the criteria in the Notice and the Staff Working Document when deciding on which companies to include in the peer group. The Staff Working Document lists the following criteria for selecting the companies that should be included in the peer group.[45]

The companies in the peer group:

- are listed on a stock exchange and have liquidly traded shares;
- own and invest in electronic communications infrastructure;
- have their main operations located in the Union;
- have an investment grade (credit rating BBB/Baa3 or above); and
- are not, or have not been recently, involved in any substantial mergers and acquisitions.

Clarifications issued by the European Commission

In addition, in 2021 the European Commission provided the following clarifications[46]:

1. Companies that are based in the European Economic Area ("EEA") and that meet the criteria are eligible for inclusion in the peer group. It is appropriate that companies (with headquarters) located in the EEA be considered for inclusion in the peer group if they meet the criteria listed in the Staff Working Document.

2. Companies are also assessed as to the level of their operations in the EU/EEA before inclusion in the peer group.

The European Commission also clarified that one of the aims in developing the peer group is that companies that are actively operating in the EU/EEA and meet the criteria are considered for inclusion in the peer group. Companies that possibly meet the criteria but have limited operations in the EU/EEA must be analysed further to assess if it is appropriate to include them. A simple application of the criteria could result in companies being added to the peer group from outside the EU/EEA who have limited operations in the EU/EEA, which would not

[45] See section 5.3.2.3 of Staff Working Document (SWD)
[46] These are discussed further in Annex 5.

ensure ***consistency*** as set out in the SWD[47]. Therefore, and generally, it is important that the criteria are not applied mechanically but with a view to the objective of getting a fair representation of European operators with legacy infrastructure when considering whether or not to add companies to the peer group. This will ensure that companies who are outside of the EU/EEA but possibly meet various criteria are not automatically included within the peer group without further analysis.

National Specificities

BEREC has further assessed the criteria concerning national specificities and maintains its approach that two criteria require further refinement:

1. Companies have their main operations located in the EU/EEA

A strict application of this criterion without consideration of national specificities could result in the exclusion of companies that generate a substantial proportion of their turnover in the EU/EEA. BEREC considers that, over the five-year period on which the parameters are calculated, where:

(a) a company's headquarters are located in the Union and therefore major strategic decisions are taken within the EU/EEA; and

(b) a substantial proportion of a company's revenue is generated within the EU/EEA.

These companies should qualify to be included in the peer group.

In addition, this will allow the home country (domestic) debt premium to be estimated for a wider range of companies. As a result, NRAs will have a wider selection of companies/countries that are closer to their national specificities. However, this will also have to be compared to an overall assessment of the criteria when compared to the level of operations in the EU/EEA.

2. Companies have an investment grade credit rating (BBB/Baa3 or above)

A review of the company credit rating at a particular point in time could result in certain companies being included in one period's peer group and excluded from the next in cases where they do not have an investment grade rating. BEREC considers that it is more appropriate to consider the investment grade status of a company over a five-year period and that if a company has had an investment grade rating in four of the five years it would qualify under this criterion. The choice of a five-year averaging period is also consistent with the averaging periods for the WACC parameters presented in the Notice[48].

As a conclusion from the above considerations, it follows that if a company meets four of the five criteria (as modified) it is considered appropriate for inclusion in the peer group. However, it is mandatory that a company meet criterion 1 "*are listed on a stock exchange and have*

[47] See section 5.3.2.2 of the SWD.
[48] Notice, para. 27.

liquidly traded shares" as a prerequisite for inclusion, as otherwise no equity market data is available.

BEREC also considers that NRAs, in order to reflect national specificities should, where necessary, amend the companies included in the peer group by selecting those that are most reflective of their national specificities. In accordance with paragraph 67 of the Notice this may involve removing companies from the peer group (but not adding any that do not meet the criteria as set out above).

Where possible, NRAs should maintain a peer group that is as wide as possible using the companies in Table 3 being representative of the national specificities.

According to para. 67 and in order to avoid "arbitrary" choices BEREC considers it justified to remove peer group members from the list primarily for the following reasons:

(a) Certain companies in the peer group may not reflect the size of the SMP operator in the particular member state. For example, it may be inappropriate to include a very large company in the peer group if its scale is significantly greater than the SMP operator or the member state itself has a relatively small population[49];

(b) Competition conditions within the electronic communications sector, and in particular infrastructure-based competition, may vary between member states increasing risk for both SMP and OAO operators (access seekers and wholesalers).[50] For example, the presence of a significant cable operator could present particular competitive conditions in one member state that may be absent from another;

(c) The share of regulated vs non-regulated revenues of peer group members may vary. Indeed, as mentioned by the Brattle report[51], regulated telecommunication activities could be seen to be less sensitive to changes in the economy than those of an average firm with non-regulated activities;

(d) The scope of segments of activity (i.e. mainly mobile, mainly fixed, mainly TV, combined, etc.) of certain companies in the peer group may differ significantly from the SMP's types of business to an extent of not being representative.

BEREC has applied these criteria as well as taking into account national specificities in preparing the list of companies included in the peer group of this edition. It has also examined whether or not, based on the five criteria, there are additional companies that could be added to the peer group.

[49] The size of an operator could be based on Market Capitalisation. However, the use of a country specific size premium is not considered appropriate.

[50] See Digital decade dashboard, DESI 2023 dashboard for the Digital Decade - Digital Decade DESI visualisation tool (europa.eu), Digital infrastructure

[51] See Brattle report "Review of approaches to estimate a reasonable rate of return for investments in electronic communications networks in regulatory proceedings and options for EU harmonization" a study for the Commission (2016), p50: https://op.europa.eu/fr/publication-detail/-/publication/da1cbe44-4a4e-11e6-9c64-01aa75ed71a1/language-en.

Recent investment activity

During the review of data for the 2024 WACC parameters Report, BEREC has observed varying levels of investment activity being undertaken by peer group members[52]. As a result of this it is providing further analysis on criterion 2 and criterion 5.

Criterion 2[53]

A review of the data would indicate that criterion 2 remains relevant to all members of the peer group. All peer group members continue to own and invest in legacy electronic communications infrastructure.[54]

Criterion 5[55]

BEREC considered M&A activities of the members of the peer group.

In October 2023 Liberty Global acquired 100% of Telenet[56]. As Telenet is no longer listed on a stock exchange it no longer qualifies as being a member of the peer group and has, therefore, been removed from the list.

While there have been some other transactions over the period, the majority of it relates to investment in fibre networks or the sale of tower infrastructure, international carriers, or even other businesses, rather than being directly related to legacy infrastructure. Fibre investment and tower infrastructure are not subject to the Notice.

BEREC is of the view, therefore, that apart from the removal of Telenet Group Holdings N.V. ("Telenet") from the list no adjustment to the peer group is required due to mergers and acquisitions activity. No new companies have been added to the list.

3.3. Updates in the 2024 WACC parameters Report

BEREC has reviewed companies against the criteria as set out in the SWD and subsequent clarifications issued by the European Commission.

Based on BERECs analysis with the removal of Telenet there are now 14 members of the peer group compared to 15 in 2023.

[52] This includes mergers and acquisitions, investment and disinvestment
[53] […] own and invest in electronic communications infrastructure
[54] The ratio of capital expenditures to sales for 2023 range from 9.2% (Tele2) to 27.1% (Digi Communication) for the companies in the peer group. The average capital expenditures to sales for the peer group is 17.2%. Source: Bloomberg.
[55] […] are not, or have not been recently, involved in any substantial mergers and acquisitions
[56] Liberty Global acquires 100% of Telenet following simplified squeeze-out - Liberty Global

3.4. Result: BEREC peer group 2024

Therefore, based on both the criteria and national specificities the **BEREC peer group 2024** is shown in Table 3.

Table 3 BEREC peer group 2024

Company	Country	S&P rating as of April 2023	Rating last reviewed by S&P	Stock Symbol
Deutsche Telekom AG	DE	BBB+	19 May 2023	DTE GR
DIGI Communications N.V.	RO	BB-	26 March 2024	DIGI BVB
Elisa Oyj	FI	BBB+	26 March 2024	ELISA FH
Koninklijke KPN N.V.	NL	BBB	27 March 2024	KPN NA
NOS	PT	BBB-	28 March 2024	NOS PT
Orange S.A.	FR	BBB+	21 Nov. 2023	ORA FP
Proximus S.A.	BE	BBB+	18 Jan. 2024	PROX BB
Tele 2 AB	SE	BBB	23 Nov. 2023	TEL2B SS
Telecom Italia	IT	B+	09 Nov. 2023	TIT_MI
Telefónica	ES	BBB-	20 Dec. 2023	TEF SM
Telekom Austria AG[57]	AT	A-	12 Apr. 2024	TKA AV
Telenor	NO	A-	16 May 2023	TEQ
Telia Company AB	SE	BBB+	25 June 2023	TELIA SS
Vodafone Group plc	UK	BBB	10 July 2023	VOD LN

STOXX Europe Total Market Telecommunications index

When assessed against the STOXX Europe Total Market Telecommunications index[58], which lists all possible candidates for a peer group that would be representative of the European Telecommunications Market, the BEREC peer group would represent about 63 %[59] by market capitalisation of the STOXX Europe Total Market Telecommunications index (the representativeness of the peer group is increasing, compared with last year).

[57] The previous credit rating for Telekom Austria was undertaken on 25 October 2022 and it was rated A-. There has been no change to the Telekom Austria credit rating

[58] https://www.stoxx.com/index-details?symbol=BTEP.

[59] STOXX Europe Total Market Telecommunications index includes not only telecom operators, but also tower operators, ICT providers, satellite operators, etc.

4. Debt premium and cost of debt

4.1. Definition and data source used

The cost of debt is defined as the interest or financial cost paid by a company on its debt. It can be expressed as the sum of the risk-free rate and a debt premium:

Cost of debt = Risk Free Rate + Debt Premium

The debt premium is the additional return lenders or investors require for a company above the risk free rate. The level of the debt premium depends to a large degree upon the perceived credit risk and credit rating. The debt premium can be estimated by using the yields on corporate bonds above the interest rate on long-term government bonds. The debt premium is calculated as:

Debt premium = Cost of debt - Risk Free Rate

In order to calculate the debt premium BEREC assesses, in line with established practice, the yield on long-term corporate bonds above the risk free rate. Although BEREC strives to use the same averaging period (five years) and maturity (ten years) as for the calculation of the risk free rate, the secondary market for corporate bonds has different characteristics compared to the market for government bonds. Companies issue corporate bonds in order to raise capital, but given that market conditions vary over time they are not necessarily issued with a regular frequency, they could use different currencies in order to respond to investor interest, and some companies use the bond market to a less extent as they use other sources to obtain capital.

The data source used for the calculation of the debt premium is Bloomberg. Bloomberg is extensively used in the financial and corporate sector.

4.2. Methodology with reference to Notice

Deducting from corporate bond yields the risk free rate with similar maturity and the same currency is the established method to calculate the debt premium. It is in line with the Notice, which states to add the domestic risk free rate to the debt premium.

Altogether, BEREC estimates the debt premiums for the companies in the peer group from which NRAs can select the appropriate value for their SMP or regulated operator (having regard to its characteristics) and adds this to the estimated domestic RFR to derive the cost of debt.

4.3. Assumptions and choices made

In calculating the debt premium and cost of debt, BEREC has made some assumptions in order to carry out its designated task:

- Considering that the capital market is global, companies use different currencies when they issue corporate bonds according to their needs, market characteristics, and

investor interest. However, the calculations of the debt premium is limited to corporate bonds that have been issued in the domestic currency, which primarily is EUR, apart from a few exceptions, in order to be able to match domestic long term government bonds. Inflation-linked bonds have been excluded in order to keep consistency in the results.

- The five-year averaging window, where available, will cover the period from April 2019 to March 2024, while the maturity year of the bonds must be within the period from April 2030 - March 2038. BEREC has chosen this maturity period of the bond for the following reasons:
    - Striving to be as close as possible to a 10-year residual maturity.
    - Avoiding excluding too many corporate bonds.
    - Assuming a bias for the longer maturities rather than for the shorter ones in order to balance the fact that the yield curve by maturity period shows an exponentially decreasing rather than a linear form[60].

The above takes into consideration that companies issue corporate bonds depending upon demand for capital and market conditions, which vary over time. Consequently,

- it is not possible to apply a strict five-year averaging window for all bonds as they have been issued at different times resulting in different periods with a maximum of five years for calculating the average bond yields.

Based on the above-mentioned criteria, BEREC has included as many corporate bonds as possible issued by the peer group companies. However, some companies only have few traded corporate bonds, only a single one or even none, which means that the underlying data sample varies between the different companies in the peer group[61].

All things considered, BEREC concludes that this approach is in line with the Notice.

4.4. Calculation steps – description of how the result is derived

BEREC has retrieved data for the corporate bonds from Bloomberg. The following steps have been undertaken:

[60] https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/euro_area_yield_curves/html/index.en.html

[61] DIGI, Elisa, NOS and Telekom Austria have not issued any bond which meets the criteria set in the section 4.3. The bonds with a maturity date which is closer to the period April 2030 - March 2038 mature in February 2028, January 2029, March 2027 and December 2026, respectively. Elisa´s bond is included in the calculations since its deviation from the criteria is not that large as in the case of DIGI, NOS and Telekom Austria and to keep the peer group representativeness as broad as possible.

1) Identify corporate bonds that have been issued in the domestic currency by the companies in the peer group, which maturity date is within April 2030 - March 2038, and which are traded on the secondary market.

2) Identify government bonds that match each corporate bond, that have been issued by the respective governments, which maturity date is within April 2030 - March 2038, and which are traded on the secondary market. This facilitates the establishment of pairs of bonds consisting in a corporate bond compared with a domestic government bond. Additionally, in most cases only sovereign bonds with an averaging time window equal or larger than the comparable corporate bond were considered in order to calculate the debt premiums in all dates since the date corporate bonds were issued.

3) Provide a description of each bond pair, both the corporate and government bonds, with the following details:

    a. ticker, which is the label and identifier for each bond which is used in the secondary market, including information about when the bond matures,

    b. date when the bond was issued,

    c. currency used for the corporate bond and its nominal value,

    d. coupon, which is the annual interest payment a bond holder receives from the issuer until the bond matures,

    e. ISIN (International Securities Identification Number), which is an identification number for the corporate bonds.

4) Retrieve data from Bloomberg for the maximum period 1st April 2019 up to 31st March 2024 based on weekly data for identified corporate bonds and benchmark government bonds for the following parameter

    - Mid Yield to Maturity (*YLD_YTM_MID* in Bloomberg), which is the yield of a fixed income security that will solve for the mid-price when valuing the security to maturity. It is the total return anticipated on a bond if the bond is held until it matures. Yield to maturity is considered a long-term bond yield and is expressed as annual return, which could be described as the internal rate of return (IRR) of an investment in a bond if the investor holds the bond until maturity, with all payments made as scheduled and reinvested as the same rate.

      Bloomberg provides a weekly value for the mid yield to maturity for each bond, which facilitates for BEREC for each pair to deduct the value of the government bond from the value of the corporate bond on a weekly basis. This gives a debt premium on a weekly basis.

5) Subsequently, BEREC calculates for each company the arithmetic average of the debt premiums of the identified bond pairs on a weekly basis. Then, the debt premium for each company is calculated as an arithmetic average of the previously described weekly average during the 5-years averaging window. All of this depends on the availability of corporate bonds that fulfill the above listed criteria.

On the whole, this calculation results in the debt premium for each company in the peer group as input for calculating the cost of debt:

Cost of debt = Risk Free Rate + Debt Premium.

In order to make the calculation complete the domestic risk free rate taken from Table 2 is added, which gives the cost of debt for each company.

BEREC now also shows for information purposes averages of the peer group, however there is no obligation for NRAs to use these averages.[62]

4.5. Results

The results are presented in Table 4.

Table 4 Debt premium and Cost of debt

Company	Debt premium (basis point)	Domestic RFR	Cost of debt
Deutsche Telekom AG	132	60	192
DIGI Communications N.V.	-	531	-
Elisa Oyj	90	102	192
Koninklijke KPN N.V.	116	80	196
NOS	-	145	
Orange S.A.	83	105	188
Proximus S.A.	90	108	198
Tele 2 AB	150	96	246
Telecom Italia	234	233	466[63]
Telefónica S.A.	47	151	198
Telekom Austria AG	-	103	-
Telenor	119	211	331[63]
Telia Company AB	137	96	234[63]
Vodafone Group plc	136	180[64]	316
Weighted Average (information only)[65]	118		
Arithmetic Average (information only)	121		

[62] For calculation details see Chapter 5 and Annex 3.
[63] Due to rounding issues, the sum of the debt premium and domestic RFR is not exactly the value shown in the cost of debt for Telecom Italia, Telenor and Telia.
[64] Domestic RFR for UK
[65] The market cap has been calculated in Euro considering a five year average based on weekly prices of the shares (consistent with BEREC's approach to calculate five year averages). See Annex 3 for details.

Remarks on results

The calculations of the debt premium are in line with the Notice and follow the same criteria as those of the 2023 WACC parameters Report.

Given that the mid yield to maturity of the corporate bonds have been compared with the mid yield to maturity of the domestic government bonds, this may not fully reflect the international investor perspective and will be dependent on how the capital market assesses the value of the government bonds. This means that the debt premiums for international companies based on high RFR countries are significantly lower compared with what would have been if the calculations had been based on benchmark bonds regularly used by Bloomberg, this is, German government bonds.

The approach excludes corporate bonds issued in non-domestic currencies the results could not exactly show how companies are raising capital on the international market. This does not apply for the Swedish companies Tele2 and Telia Company and for the Norwegian Telenor. The three companies have not issued corporate bonds in the domestic currency (SEK or NOK). Since Norway and Sweden have the same Moody´s credit rating as Germany (AAA), those corporate bonds (Tele2, Telia and Telenor) have been compared to German government bonds.

In addition, it must be borne in mind that some of the peer companies like DIGI Communications, Elisa, NOS, Tele2, Telecom Italia, Telekom Austria and Vodafone do not have or have only a very limited number of traded corporate bonds (one or two) meeting the criteria. The cost of debt is slightly reduced due to time window and peers update (i.e. smaller number of available corporate bonds).

5. Beta and gearing

5.1. Definition and data sources used

According to Capital Asset Pricing Model (CAPM) the cost of equity considers that a particular relation holds between the level of risk of a company and the level of risk within the whole economy. The level of systematic risk[66] due to macro-economic conditions related to the increment of the interest rates as well as risk related to the demand, affecting all companies in the economy, is described by the relation:

[66] Systematic Risks are non-diversifiable market risks in contrast to non-systematic risk relating to the risk associated with individual shares. CAPM serves to measure the systematic risk.

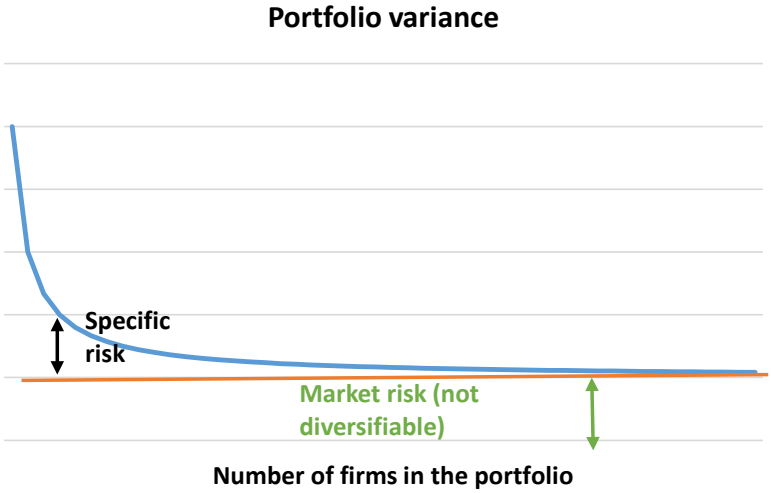
Cost of equity (R_E) = Risk free rate (RFR) + beta_Equity x Equity risk premium (ERP) (1)

The idea behind the CAPM model is that, in a competitive market, the expected risk premium in an asset varies with respect to the risk free rate in direct proportion to "beta". The beta is the measure of the risk contribution of an individual security to the risk of a well-diversified portfolio. Stocks with betas between 0 and 1 tend to move in the same direction of the market as a whole, but not as far. Stocks with betas greater than 1.0 tend to amplify the overall movements of the market.[67]

Formally the risk of a portfolio is described by the variance of the return and covariance of the return between each security included. If the number of the stocks (N) included in the portfolio increases with equal proportion of capital invested in each security, the level of the risk of the portfolio measured as the variance of the portfolio itself becomes mainly proportional to the covariance of the stocks between each other and not on the variance of each security included (Figure 2). If ideally the average covariance of a portfolio becomes equal to 0 all risks by holding a sufficient number of securities will be eliminated. Unfortunately, common stocks move together, not independently, so a market risk is the one that cannot be diversified. So, the risk of a well-diversified portfolio depends on the market risk of the securities included in the portfolio. The market risk is proportional to the average beta included in the market portfolio. Formally this can be understood calculating the variance of the portfolio that is equal to:

$$\text{Portfolio variance} = \sum_{i=1}^{N} \sum_{j=1}^{N} x_i x_j \sigma_{ij} \qquad (2)$$

Figure 1 Portfolio variance



Where x_i x_j are the proportions of the resources allocated for each security, and σ_{ij} the covariance between the stocks "i" and "j" included in the portfolio. In other words, the

[67] Brealey, Myers, Allen, "Principles of corporate finance", 11th Edition (2014).

contribution of stock "i" to portfolio risk is equal to the relative size of the holding (x_i) times the average covariance between stock 1 and all the stocks in the portfolio.

To evaluate the relative contribution to the portfolio risk of each security we need to divide the average covariance with the portfolio variance. This ratio formally describes the relative contribution to the risk of the portfolio and it is exactly the beta:[68]

$$\beta_i = \frac{\sigma_{i,m}}{\sigma_m^2} \qquad (3)$$

Where $\sigma_{i,m}$ is the covariance of the stock with respect to the market portfolio and σ_m^2 the variance of the market portfolio itself.

Generally, the higher the value of the beta, the higher the uncertainty about the returns on a firm's equity with respect to the reference market considered.

Companies with high equity betas tend to have high business risk and/or high financial risk such as:

- Non-diversified businesses with revenues, earnings and cash flows that are highly sensitive to economic factors;
- Highly geared, capital intensive businesses that have a large proportion of fixed operating costs (increasing the volatility of operating and net cash flows);
- Early stage or start-up ventures.

The average beta of the market should be equal to one and this can be effectively addressed considering a portfolio that is the wider as possible approaching the corresponding whole market. From a technical point of view the equity beta of a company/asset is estimated through a regression analysis, i.e. by measuring the relationship between the returns of that company's shares and the returns of a market index, which is meant to approximate the whole economy.[69]

Given the above, the corresponding risk of an asset to the portfolio will depend also on the **financial leverage** or **'gearing'** of the firm.

As the Notice suggests, to estimate the equity beta in the CAPM model from a "peer group" of companies, it is relevant, in this case, to make reference, for fair comparison of the systematic risk, to an unlevered beta or asset beta from the observed equity beta of each peer. The use of asset beta will ensure that actual differences in underlying business risks (systematic risk) are compared between peers removing from the betas differences in financing decisions.

The main elements to estimate the equity beta are:

i) the methodology (Bottom-up/notional vs SMP operator);
ii) time horizon and sampling period for the estimation of the formula;
iii) market index;
iv) adjustment of the beta;

[68] Theoretical relation in case of "unbiased" estimation of the OLS linear regression line between market index return and stock return
[69] See Notice, para. 45.

v) the unlevering formula to get the asset beta.

For beta estimation the return of the security of each company should be calculated with a daily, weekly or monthly sampling period. A corresponding return of a market index in accordance with portfolio theory should be chosen. For the estimation of the asset beta of each peer an unlevering formula should be considered that need also the gearing estimation of each company. So, the gearing is faced in this section of the report due the fact that it is strictly related to the asset beta estimation.

The gearing (g) is a measure of a company's financial leverage. It compares the amount of debt financing to the amount of the value of the company. This parameter is relevant in the WACC formula as it provides the weight for the cost of debt and the complement (1-g) the weight for the cost of equity, but it is also strictly related to the estimation of the final equity beta as it is used in the formula for levering and re-levering the beta as already mentioned.

The "gearing" (g), in accordance with the Notice, is formally considered as the relative weight of debt on the overall firm value, in formula as:

$$g = \frac{D}{D + E}$$

This measures the company's **financial leverage** and shows to what extent its operations are funded by lenders as opposed to shareholders.

The main points for the gearing estimation are the following: i) kind of approach for the estimation of the debt and equity component (market vs book values); ii) kind of debt that can be considered in the debt component; iii) time windows and sampling period of the estimation as for the other main parameters (RFR, beta, cost of debt) of the WACC.

5.2. Methodology with reference to Notice

Following the Notice the approach to estimate the equity beta should be the following:

- Estimate the equity beta for each company in the group of EU companies, which form the peer group;
- Estimate the gearing level for each company in the peer group;
- Derive the asset betas from each company in the peer group, including the SMP operator (using the equity beta and gearing level for each company);
- Relever the asset beta to obtain the final equity beta.

BEREC will provide the data for asset beta and gearing for each company of the peer group, from which the corresponding ranges of values for each parameter can be used for estimating the final equity beta in the WACC formula by each NRA.[70]

[70] See SWD, page 86.

The Notice states that the equity beta calculation should use weekly data, a sampling period and a time window of five years, which is in line with the time window used for the calculation of the risk free rate (RFR).

Moreover, the Notice highlights that no adjustments to the equity beta calculation should be done with methods such as Blume[71], Dimson[72], Vasicek[73]. The Commission doubts that these adjustments would improve the efficiency of the beta estimator and are likely to make the regulator's approach more complex and less transparent.[74]

The Commission, in line with portfolio theory, suggests using a wide index[75] which in this case is an EU index rather than a domestic market index and favours the STOXX Europe TMI (Europe Total Market Index), also in line with the provision regarding the EU-wide Equity Risk Premium.

Moreover, for the estimation of the beta the levering and unlevering formula is crucial.

A company's financial structure, in fact, has an effect on its equity beta. In particular, financial leverage increases the risk of company's share. For this reason, and in order to be able to compare the systematic risk of a company, which is included in the equity beta, with the others, it is common to estimate an asset beta from the company's equity beta. When estimating the equity beta in the WACC formula from the peer group, one must first assess the effect of financial leverage on the observed equity betas (so-called 'levered betas') by calculating the unlevered (or asset) betas.

The Notice suggests using the formula known as "Miller Formula"[76]:

$$\beta_A = \beta_E \frac{E}{D+E} + \beta_D \frac{D}{D+E}$$

With reference to the beta debt the Notice considers that it entails significant difficulties to be estimated. The reason is the illiquidity of the biggest part of the traded bonds, which means that an estimation of debt betas as the ratio of the covariance between bond yields and market returns and the variance of the market return can give incorrect results. For this reason, the Commission suggests to lever and re-lever the beta including a beta debt of 0.1.[77]

With respect to the gearing the Notice provides the following: the Equity component should be measured considering the market value obtained as the product of the price of the share and

[71] The adjustment of the Blume formula relies on the idea that over the long term companies should tend towards a beta of 1 (e.g. firms that survive in the market tend to increase in size over time, become more diversified and have more assets in place, which should push betas towards 1) and adjusts the estimated company beta towards 1.
[72] Dimson corrects for distortions in the beta estimation when using daily returns due to the potential for mismatch between the changes in the market index and the reaction of the company's stock to these.
[73] The Vasicek formula is similar to the Blume adjustment, except that it does not assume a tendency of the beta to go to 1, but rather towards an industry average or some other prior expectation of beta, and the extent of the adjustment depends on the standard error of the observed beta.
[74] See SWD, page 80.
[75] In the CAPM framework the market portfolio includes all risky assets, in proportions defined by their relative market values.
[76] The formula proposed is the one used by most NRAs as reported related to beta in op. cit., page 28.
[77] See SWD, page 85.

the number of outstanding shares for each company. The motivation behind this is related to the fact that it is the market value of equity that measures the future earnings potential of firms and their ability to sustain debt.

As the level of liquidity of corporate bonds could be low, the book value of the debt is a good approximation of the market value of the debt. With respect to the kind of debt to be considered to be consistent with a market value estimation, the Notice suggests using only long term debt, as all the short term debt are generally netted off by the cash. As long-term debt the Commission considers it relevant to also include capital lease obligation.

5.3. Assumptions and choices made

BEREC estimates the asset beta and corresponding gearing of the 14 peer group companies that fulfill the Commission's selection criteria as reported in chapter 3 above. In this section the equity beta, gearing and asset beta are evaluated from raw data on equity prices of shares obtained on weekly basis of each peer and the corresponding price of the STOXX Europe TMI. The raw data have been obtained from Bloomberg.

The equity beta for each peer of the group is estimated regressing the variation of the shares price on a weekly basis with the corresponding variation of the price of the market index, the beta is obtained using OLS estimator (the analysis and the consistency of the estimation are reported in the Appendix).

The asset beta is derived applying the Miller formula including a beta debt of 0.1 as suggested by the Notice. The gearing is derived from the spot gearing evaluated on a weekly basis using a five years' time window. In the present report the relevant parameters estimated by BEREC for the purpose to fulfil the Notice mandate are gearing and the asset beta of each peer. The equity beta reported in the present paragraph is derived using the following formula rounding with two decimal points from the asset beta and gearing estimated for each peer considering of a beta debt equal to 0.1.[78]

$$\beta_E = (\beta_A - \beta_D * g) * \frac{1}{1-g}$$

A standard statistical test has been carried out and liquidity merit figures have been calculated to provide transparency on the data consistency for the equity beta estimation needed for the corresponding asset beta (see Annex 3). Testing for statistical criteria and liquidity in this context is relevant to check the efficient market assumption of CAPM, which is useful for the final quotation of the peer group and asset beta range estimated.

[78] This formula is the one reported at paragraph 50 of the WACC Notice where g=D/V and g/(1-g)= D/E.

5.4. Calculation steps – description of how the result is derived

For each comparable operator the information on gearing and asset beta has been derived, the equity beta is derived to fulfil the mandate of estimating the corresponding asset beta which is the only relevant figure that NRAs should consider.

The equity beta is calculated regressing the return of each company with the return of the STOXX Europe TMI, an analysis of the quality of the estimation of this parameter is reported in Annex 3.

The STOXX Europe TMI covers approximately 95 % of the free float of European market capitalization (generally more than 1800 peers from different economic sectors)[79] across 17 European countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

The calculation is derived on a weekly sampling period, in line with the Notice.

The weekly estimation for the equity beta and the Equity component of the gearing is derived from the daily data selecting the information of the last price of the security and the corresponding price of the market index of one trading day for each week that is included in the time window.[80] For a time window of five years 260 points are collected from 1st April 2019 to 1st April 2024.

The gearing has been evaluated from five year average of the spot gearing taken at weekly frequency. Gearing is evaluated using book value of the net debt, for five years annual data. The net debt is equal to the Short-term Debt plus Long-term Debt minus Cash and Cash Equivalent.[81] The Commission states that “short term loans and liabilities are likely to be offset by short-term assets such as cash and cash equivalents”[82] and that it would seem appropriate to estimate the gearing using the book value of the firm’s net debt, including the value of financial leases (capital lease). This is also the approach most frequently used by NRAs[83] also before the WACC Notice was widely adopted. According to this approach for the book value of the debt component only long term debt[84] and capital lease[85] will be included as proxy of the net debt definition.

Specifically, this assumption on the definition of the net debt is partially fulfilled: in fact, the ratio between “Cash” and “Cash Equivalent” with respect to the current liabilities “Notes Payable/Short Term Debt” and “Current Portion of Long Term Debt/Capital Leases” from the

[79] BKXP Stoxx Europe TMI, https://qontigo.com/index/bkxp/.
[80] The net return have been evaluated as r_t=P_t/P_(t-1)-1, with P_t the last price of the current trading day of one week and P_(t-1) the last price of the selected trading day of the week before for both the company and the market index (Friday and, when not available (i.e. market close), the previous trading day in the week has been considered).
[81] Net Debt = STD+LTD−CCE.
[82] SWD, page 87.
[83] See Regulatory Accounting Report 2021 (BoR (21) 161), WACC chapter.
[84] Not including pension liabilities.
[85] A capital lease is a contract entitling a lease holder to the temporary use of an asset, and such a lease has the economic characteristics of asset ownership for accounting purposes. In comparison operating leases are recorded only as operating expenses. The capital lease requires a lease holder to book assets and liabilities associated.

balance sheet of each peer is about 84% on average. At the same time, Bloomberg provides gearing data based on the book value of debt and the market value of equity. Debt also includes finance leases. Cash is not netted off.

With respect to Table 5 of the 2023 WACC parameters Report (BoR (23) 90), the ratio values of cash and equivalent with respect to current liability reached 86.31% from 86.47 % closer to 1 considering the thirteen companies (excluding Telenet and DIGI in both estimation from 2023 and 2024), and equal to 83.72 % including DIGI Communications from 82.84% of the past year in homogeneous terms. The evolution is mainly due to an increase of the "cash and cash equivalent" components in combination with a small increase of the short term debt component. This can be attributed also to a different allocation strategy of the companies' capital. The assumption that short term loans and liabilities are likely to be offset by short-term assets such as cash and cash equivalents holds also in comparison to past years when Telnet was included in the peer group.

Table 5 Ratio between Cash and Cash Equivalent in relation to current liabilities[86] 5. (a) and raw data from the balance sheets for the ratio calculation in 5. (b)[87]

5. (a)		Ratio between Cash and Cash Equivalent in relation to current liabilities					
No	**Company**	**2019**	**2020**	**2021**	**2022**	**2023**	**Average**
1	Deutsche Telekom AG	37.62%	73.21%	44.19%	29.72%	47.89%	46.53%
2	Elisa Oyj	34.41%	104.21%	96.45%	28.94%	20.92%	56.99%
3	Koninklijke KPN N.V.	70.79%	72.01%	97.42%	114.33%	92.26%	89.36%
4	NOS	14.50%	171.09%	12.51%	11.92%	11.23%	44.25%
5	Orange S.A.	124.83%	122.19%	179.98%	96.67%	81.18%	120.97%
6	Proximus S.A.	146.15%	134.20%	112.16%	162.84%	102.29%	131.53%
7	Telecom Austria AG	50.91%	23.35%	31.17%	15.27%	49.03%	33.95%
8	Tele2 AB	9.26%	20.59%	21.91%	28.70%	29.54%	22.00%
9	Telefónica S.A.	59.52%	64.54%	103.04%	127.19%	125.37%	95.93%
10	Telenor	57.64%	123.99%	93.66%	62.71%	123.36%	92.27%
11	Telia Company AB	47.22%	265.52%	387.95%	101.37%	85.41%	177.50%
12	Telecom Italia	83.48%	113.78%	106.25%	63.14%	44.86%	82.30%
13	Vodafone Group plc	319.37%	112.33%	68.58%	62.67%	79.51%	128.49%
14	DIGI	5.63%	7.02%	7.37%	150.10%	79.95%	50.02%
Average							83.72%

[86] "Notes Payable/Short Term Debt" and "Current Portion of Long Term Debt/Capital Leases". Source: Operator's balance sheets retrieved from Bloomberg. Red data is not included in the average calculation.

[87] The differences in the tables compared to the 2021 Report BoR (21) 86 are related to a restatement of the balance sheet for some operators: specifically, for Orange this is due to the application of IFRS 16 on lease term; For Vodafone the classification of the Balance Sheet is the one of the release (31/03) of each year. Differences due to restatements of the balance sheet for some operators may also occur compared to the 2022 and 2023 Report BoR (22) 70 and BoR (23) 90.

5. (b)		Cash and cash equivalent (Million of own currency)					Short Term Borrowings/Short Term Lease liabilities/Current Portion of Long Term Debt-Capital Leases (Million of own currency)				
No.	Company	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
1	Deutsche Telekom AG	5,393	12,939	7,617	5,767	7,274	14,334	17,675	17,236	19,407	15,188
2	DIGI	53	52	84	1,293	1,101	936	733	1,141	861	1377
3	Elisa Oyj	52	220	114	86	63	151	211	118	295	303
4	Koninklijke KPN N.V.	766	597	793	399	608	1,082	829	814	349	659
5	NOS	13	153	11	15	18	88	90	87	128	162
6	Orange S.A.	6,481	8,145	8,621	6,004	5,618	5,192	6,666	4,790	6,211	6,920
7	Proximus S.A.	323	310	249	298	715	221	231	222	183	699
8	Telecom Austria AG	140	211	534	150	169	276	903	1,714	981	344
9	Tele2 AB	448	970	880	1,116	1,634	4,836	4,712	4,016	3,889	5,531
10	Telefónica S.A.	6,042	5,604	8,580	7,245	7,151	10,152	8,683	8,327	5,696	5,704
11	Telenor	13,867	20,577	15,223	9,929	19,556	24,056	16,596	16,253	15,833	15,853
12	Telia Company AB	6,116	8,133	14,358	6,871	11,646	12,951	3,063	3,701	6,778	13,636
13	Telecom Italia	3,138	4,829	6,904	3,555	2,912	3,759	4,244	6,498	5,630	6,492
14	Vodafone Group plc	11,777	11,755	4,956	6,322	10,303	3,688	10,465	7,227	10,088	12,958

The equity component of the gearing is evaluated weekly from the number of outstanding shares[88] times the last price value of the share in the relevant trading day. The information is taken from Bloomberg.

5.5. Results

In the following the results for the **asset beta and gearing** for each of the peers is shown in Table 6 below. The asset beta is evaluated following the formula provided in the Notice:

$$\beta_A = (1-g)\left(\beta_E + \frac{D}{E}\beta_D\right)$$

The results are given with β_D (beta debt) equal to "0.1". The beta equity in the previous formula is the one estimated for each peer from the regression analysis previously illustrated where the results are also widely discussed in the Annex 3.

In line with the 2023 WACC parameters Report, the asset beta estimation is reported, considering also the "Pension liabilities"[89] for each operator in the debt component of the gearing, only for sensitivity purposes. In the literature, Pension Liabilities and Pension Assets should be treated in a way to include an adjustment to the asset beta provided in the Miller

[88] The numbers of outstanding shares are those available in the balance sheet for every year, as reported by Bloomberg in the Financial Analysis section of each operator (see Annex 3).
[89] Amount of pension obligations disclosed on companies' non-current liabilities section. The number may or may not net off with pension assets. It includes both pension and other post-retirement benefit obligations.

formula. A theoretical framework for taking into account pension assets and liabilities in the CAPM model has been developed by Jin, Merton and Bodie (JMB framework).[90] This framework sets out the need to estimate separate betas for pension asset (β_PA) and pension liabilities (β_PL) as well as the amount of pension asset (PA) and pension liability (PL), other than the equity beta (β_E), the beta debt (β_D), the Equity (E) and debt (D) components of a firm, as reported in the Miller formula, thus estimating the asset beta correctly.

In this framework the Miller formula for asset beta is only unbiased in case the pension liabilities and the pension assets offset each other and the β_PA and the β_PL are equal. The new asset beta can thus be rewritten in the following way:

$$\beta_A = \beta_E \frac{E}{D+E-S} + \beta_D \frac{D}{D+E-S} + \left(\beta_{PL} \frac{PL}{D+E-S} - \beta_{PA} \frac{PA}{D+E-S}\right)$$

This theoretical framework is hard to be applied in practice due to the fact that pension liabilities are not tradable as such. In general, an upward adjustment to the asset beta is needed in case there is a negative balance between pension liabilities and pension assets (S=PA-PL<0) within the hypothesis that the β_PA and beta β_PL are equal.

In any case the pension deficit reported in the balance sheet is generally understood by investors as a source of debt. Therefore, equity beta can be affected by a pension deficit as a leverage risk. At the same time the JMB framework states that the systematic "unlevered" risk increases in the presence of a pension deficit. Those two different views are sources of uncertainty about how to treat pension deficit: i) one view treated it to 100 % as a source of debt; ii) the other to 100 % as a source of systematic risk as in the JMB framework.[91]

Consequentially, the asset beta estimation has been carried out considering a case in which a pension deficit is treated as a full source of debt, in line with the "practitioners'" approach, with the outcome that the pension deficit, independent from the share of input to debt, does not have a material impact on the gearing calculation with an increase of the standard evaluation of about 1% and a decrease of the asset beta on average of about 0.01. The sensitivity analysis on impact of pension fund is reported in table A1 in Annex 3 for each peer.

In the following table the weighted averages based on market cap[92] as well as the arithmetic average are provided for the asset beta and gearing. The equity beta is also reported and derived from the asset beta and gearing with a beta debt equal to 0.1, rounding the estimation with two digits using the formula reported in paragraph 5.3.

[90] L. Jin, R. Merton Z. Bodie: Do a firm's equity returns reflect the risk of its pension plan?. Journal of Financial Economics 2006, Vol 81, Issue 1.
[91] https://www.ofcom.org.uk/__data/assets/pdf_file/0016/111535/Draft-statement-annex-30.pdf.
[92] The market cap has been calculated in Euro considering a five year average based on weekly prices of the shares (consistent with BEREC's approach to calculate five year averages). See Annex 3 for details.

Table 6 BEREC peer group 2024 – Equity beta, Gearing, Asset beta

No.	Company	Asset beta	Gearing	Equity beta	Market cap (Bilion Euro)
1	Deutsche Telekom AG	0.36	58.08%	0.72	84.81
2	DIGI Communications N.V.	0.21	72.83%	0.50	0.46
3	Elisa Oyj	0.43	12.57%	0.48	7.9
4	Koninklijke KPN N.V.	0.38	35.62%	0.53	11.62
5	NOS	0.41	41.31%	0.63	1.94
6	Orange S.A.	0.31	56.68%	0.58	29.15
7	Proximus S.A.	0.39	38.78%	0.57	5.21
8	Tele2 AB	0.42	25.41%	0.53	7.47
9	Telecom Italia	0.31	78.06%	1.06	7.55
10	Telefónica S.A.	0.41	62.75%	0.93	24.76
11	Telekom Austria AG	0.48	33.11%	0.67	4.46
12	Telenor	0.23	36.23%	0.30	18.64
13	Telia Company AB	0.36	40.70%	0.54	12.98
14	Vodafone Group plc	0.39	61.17%	0.85	36.24
	WA (information only)	0.36	52.56%		
	AM (information only)	0.36	46.66%		

Remarks on results

BEREC has performed in line with previous year Reports a cross-check of the results above with a rolling regression method to verify that the time evolution of betas that can be observed is correctly reflecting the trend. The estimation with the rolling regression method has

confirmed the slow decrease[93] of beta after the spike in the variation of the risk due to the pandemic situation in the first quarter of 2020 for most operators.[94] After this spike the risk conditions reverted again for most operators, and the main reduction trend has been generally accelerated over the years 2021 and 2022 without shock showing a reduction of the average perceived risk of telecom operators with respect to the market as a whole, i.e. the beta "normalizes" rapidly at a trend level comparable the one experienced before the shock for most operators. Thus, it can be concluded that the hypothesis of a small variation over time of the beta still holds.

In the following a specific comparison of the three parameters (equity beta, gearing and asset beta) estimated in the present section is reported in relation to the estimation done in past year reports since 2020.

From Table 6 (a) it can be observed that the risk perceived by the market for the selected peers is decreasing on average. The average equity beta has decreased by more than 0.10 points in three years for the majority of the peers.

Table 6 (a) Variation of Equity beta (2020-2024)

	Beta Equity					Beta equity variation				
	2020 BoR(20) 116	2021 BoR(21)86	2022 BoR(22)70	2023 BoR(23)90	2024 BoR(24)102	Delta 21-20	Delta 22-21	Delta 23-21	Total 23-20	Total
Deutsche Telekom AG	0.91	0.84	0.78	0.72	0.72	-0.07	-0.06	-0.06	0.00	-0.19
Elisa Oyj	0.59	0.46	0.43	0.42	0.48	-0.13	-0.03	-0.01	0.06	-0.11
Koninklijke KPN N.V.	0.72	0.75	0.65	0.57	0.53	0.03	-0.1	-0.08	-0.04	-0.19
NOS	0.77	0.78	0.7	0.67	0.63	0.01	-0.08	-0.03	-0.04	-0.14
Orange S.A.	0.85	0.79	0.7	0.62	0.58	-0.06	-0.09	-0.08	-0.04	-0.27
Proximus S.A.	0.74	0.62	0.53	0.55	0.57	-0.12	-0.09	0.02	0.02	-0.17
Tele2 AB	0.8	0.64	0.58	0.54	0.53	-0.16	-0.06	-0.04	-0.01	-0.27
Telecom Italia	1.12	1.08	1.02	1.07	1.06	-0.04	-0.06	0.05	-0.01	-0.06
Telefónica S.A.	1.07	1.12	1.01	0.95	0.93	0.05	-0.11	-0.06	-0.02	-0.14
Telecom Austria AG	0.69	0.69	0.68	0.65	0.67	0	-0.01	-0.03	0.02	-0.02
Telia Company AB	0.75	0.68	0.62	0.57	0.54	-0.07	-0.06	-0.05	-0.03	-0.21
Vodafone Group plc	0.8	0.9	0.9	0.85	0.85	0.1	0	-0.05	0.00	0.05
Telenor	-	0.42	0.33	0.31	0.30		-0.09	-0.02	-0.01	-0.12
Digi	-		0.46	0.50	0.50			0.04	0.00	0.04
WA		0.82	0.75	0.70	0.69		-0.07	-0.06	-0.01	-0.14
AM	0.79	0.75	0.67	0.64	0.64	-0.04	-0.08	-0.03	-0.01	-0.16

[93] Only in few cases a small increase happens since last year.

[94] If beta varies only slowly (relative to data sampling frequency) the forward looking beta may be well approximated by the current estimate on the most recent historical data,
cf. e.g. https://www.ofgem.gov.uk/sites/default/files/docs/2018/12/ofgem_dr_dec_2018.pdf.

As reported in the previous paragraphs the equity beta takes into account not only the systematic risk, but it is influenced *inter alia* by the level of financial leverage (gearing) of the company. In the following table the gearing estimations done in the previous reports in comparison with the one reported in the present report are shown. It is possible to observe that even if the equity beta is reducing, the corresponding gearing is increasing for almost all operators: generally, a higher gearing spurs a higher equity beta. The level of gearing is influenced by the level of debt (higher debt generally increases the level of gearing) as well as by the level of the equity (lower stock prices increase the market value of gearing). Looking at long term debt and capital lease relevant for the gearing calculation over the past five years, on average, the debts were increased by about +39.17 %, whereas only three operators of 14 have reduced their debts between 2018 and 2023. The specificity in every case is that no increase of equity beta can be observed due to this financial leverage effect, which means that a reduced perceived component of the systematic risk can be seen looking at the asset beta.

Table 6 (b) Variation of Gearing (2020-2024)

	Gearing					Gearing variation				
	2020 BoR(20)116	2021 BoR(21)86	2022 BoR(22)70	2023 BoR(23)90	2024 BoR(24)102	Delta 21-20	Delta 22-21	Delta 23-21	Total 23-20	Total 24-20[95]
Deutsche Telekom AG	42.57%	48.85%	52.69%	56.15%	58.08%	6.28%	3.84%	3.46%	1.93%	15.51%
Elisa Oyj	13.51%	13.61%	13.28%	13.04%	12.57%	0.10%	-0.33%	-0.24%	-0.47%	-0.94%
Koninklijke KPN N.V.	38.75%	39.12%	38.55%	38.18%	35.62%	0.37%	-0.57%	-0.37%	-2.56%	-3.13%
NOS	25.80%	31.90%	35.39%	38.02%	41.31%	6.10%	3.49%	2.63%	3.29%	15.51%
Orange S.A.	43.99%	50.19%	50.58%	54.09%	56.68%	6.20%	0.39%	3.51%	2.59%	12.69%
Proximus S.A.	19.48%	23.02%	26.66%	31.96%	38.78%	3.54%	3.64%	5.30%	6.82%	19.30%
Tele2 AB	16.64%	21.32%	22.41%	23.85%	25.41%	4.68%	1.09%	1.44%	1.56%	8.77%
Telecom Italia	63.80%	68.24%	70.52%	75.02%	78.06%	4.44%	2.28%	4.50%	3.04%	14.26%
Telefónica S.A.	50.39%	55.29%	58.01%	60.70%	62.75%	4.90%	2.72%	2.68%	2.05%	12.36%

[95] 21-24 for Telenor, 22-24 for DIGI

Telecom Austria AG	41.82%	37.66%	34.35%	33.27%	33.11%	-4.16%	-3.31%	-1.08%	-0.16%	-8.71%
Telia Company AB	34.10%	35.81%	36.27%	37.70%	40.70%	1.71%	0.46%	1.42%	3.00%	6.60%
Vodafone Group plc	45.77%	48.26%	50.06%	55.62%	61.17%	2.49%	1.80%	5.56%	5.55%	15.40%
Telenor		27.04%	29.71%	34.58%	36.23%		2.67%	4.87%	1.65%	9.19%
Digi			66.60%	70.90%	72.83%			4.30%	1.93%	6.23%
WA		45.32%	47.07%	50.26%	52.56%		1.75%	3.18%	2.30%	7.24%
AM	36.95%	39.22%	42.42%	45.36%	46.66%	2.27%	3.20%	2.95%	1.30%	9.71%

Looking at the asset beta a corresponding decrease can be seen due to a combination of a general decrease of the equity beta and an increase of the corresponding gearing. This means that a reduced systematic risk for the sector, on average, is still perceived. This situation might be seen in contrast to the usual perception that an increased level of investments (as the current ones in VHCN) comes with a higher systematic risk.[96] More specifically, the level of increased gearing due to the increase of debt is not offset by a more relevant increase of the corresponding equity beta that instead is still decreasing for the majority of operators. It should be said that the decrease measured is mainly attributable to the years 2020 and 2021 coinciding with the pandemic time frame, that intensified the reduced perceived systematic risk for the telecom sector compared to all other sectors of the economy. It remains to be seen whether this condition is still a long tail of a specific effect of the pandemic situation or if it indicates a new trend. This might signal that long term investors such as pension or infrastructure fund managers are looking for opportunities, which might facilitate funding of VHCN infrastructure investments as utilities (facilitating to reach connectivity targets in Europe).

Table 6 (c) Variation of Asset beta (2020-2024)

	Asset beta					Asset beta variation				
	2020 BoR(20) 116	2021 BoR(21) 86	2022 BoR(22) 70	2023 BoR (23)90	2023 BoR(24) 102	Delta 21-20	Delta 22-21	Delta 23-22	Total 24-23	Total 24-20[97]
Deutsche Telekom AG	0.57	0.48	0.43	0.38	0.36	-0.09	-0.05	-0.05	-0.02	-0.21
Elisa Oyj	0.52	0.41	0.38	0.38	0.43	-0.11	-0.03	-0.01	0.05	-0.09
Koninklijke KPN N.V.	0.48	0.49	0.44	0.39	0.38	0.01	-0.05	-0.04	-0.01	-0.10
NOS	0.6	0.57	0.49	0.45	0.41	-0.03	-0.08	-0.04	-0.04	-0.19
Orange S.A.	0.52	0.44	0.40	0.34	0.31	-0.08	-0.04	-0.06	-0.03	-0.21

[96] This is also confirmed looking more deeply on the balance sheets data as reported in the Annex 3.
[97] 21-24 for Telenor, 22-24 for DIGI

Proximus S.A.	0.62	0.5	0.41	0.41	0.39	-0.12	-0.09	0.00	-0.02	-0.23
Tele2 AB	0.69	0.52	0.47	0.43	0.42	-0.17	-0.05	-0.04	-0.01	-0.27
Telecom Italia	0.47	0.42	0.38	0.35	0.31	-0.05	-0.04	-0.03	-0.04	-0.16
Telefónica S.A.	0.58	0.56	0.49	0.44	0.41	-0.02	-0.07	-0.05	-0.03	-0.17
Telecom Austria AG	0.45	0.47	0.48	0.47	0.48	0.02	0.01	-0.01	0.01	0.03
Telia Company AB	0.53	0.48	0.43	0.39	0.36	-0.05	-0.05	-0.04	-0.03	-0.17
Vodafone Group plc	0.49	0.52	0.50	0.44	0.39	0.03	-0.02	-0.07	-0.05	-0.10
Telenor		0.33	0.26	0.24	0.23		-0.07	-0.03	-0.01	-0.10
Digi			0.22	0.22	0.21			-0.01	-0.01	-0.01
WA		0.48	0.43	0.38	0.36		-0.05	-0.05	-0.02	**-0.12**
AM	0.53	0.47	0.41	0.38	0.36	-0.06	-0.06	-0.03	-0.01	**-0.16**

6. ERP

6.1. Definition and data sources used

Like the RFR, the ERP is a parameter reflecting general macro-economic conditions. The ERP is the expected return on equities over and above the RFR, in other words, the expected additional reward (**premium**) for holding equities that entail a higher risk compared with the interest for holding risk-free assets. It compensates for the added risk of investing in equity rather than in a risk-free asset.[98]

The Commission follows a notional approach and considers it appropriate to calculate **a single EU-wide ERP using historical series** of market premiums in EU member states.[99] According to the Commission, estimating a single EU-wide ERP is consistent with empirical evidence suggesting that financial markets in the EU are increasingly integrated and therefore have convergent ERPs, which also is likely to ensure consistency with the CAPM assumption that investors hold an efficient portfolio and therefore should be rewarded only for non-diversifiable risks.[100]

Furthermore, as in 2021, 2022 and 2023 BEREC also estimated a separate EU/EEA ERP including data for Norway and Iceland (for exclusive use by Nkom and ECOI). In the 2023 report the DMS data for Switzerland are included in the country tables only for information for the national Office for Communication (AK) in Liechtenstein.[101] However, due to the missing

[98] Cf. Notice, para. 37, SWD, p. 46
[99] Cf. Notice, para. 38, SWD, p. 60 and section 5.2.3.2.
[100] Cf. Notice, para. 38, SWD, p. 60 and below 6.2.
[101] The DMS data for Switzerland can be used as a reference for Liechtenstein as Liechtenstein has a currency and a customs treaty with Switzerland, thus the Swiss Franc has been the currency of Liechtenstein since 1924 providing for a number of similarities with the Swiss economy. Hence, the DMS data for Switzerland can be

government bond market in Liechtenstein as well as the lack of an own country stock exchange this data is not used for the estimation of the notional EU-EEA ERP.

In the following part, the data used is described. Given that the calculation of the ERPs is based on the LBS data set, as updated for 2023[102], and the data derived from Bloomberg using the implied pricing method, the details of both the data used and the calculations based on it are described in this section (6.1). In section 6.3. the construction of the BEREC EU index with the BEREC weighting method based on the results of section 6.1. for each EU member state is explained. Finally, section 6.4 provides the detailed description of the "available years" weighting to "merge" data series of different lengths and its application. Section 6.5. displays and analyses the result.

For the calculation of a single EU-wide ERP and an EU/EEA ERP, BEREC retrieves data from the 2024 LBS data set, which contains the so-called DMS Global Returns Data (DMS in the following).[103] This dataset contains historical time series from 1900 – 2023 for the following 13 EU member states: Austria, Belgium, Denmark, Finland, France, Greece, Germany, Ireland, Italy, Netherlands, Portugal, Spain and Sweden and additionally for the EEA country Norway. For Iceland and other countries not included in the DMS data, the Implied Pricing Method has been applied with data retrieved from Bloomberg.

The DMS data consists of historical series of market premiums in the EU member states and Norway referred to above.[104] The DMS data is designed to measure the very long-run performance of equity (stocks) and bonds, and on this basis estimates the ERP an investor can expect to earn when investing in equity compared to holding risk-free assets. It is compiled by using best quality stock and bond indices and compiles long-run returns for each national market.[105]

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regarded as a proxy for the national Liechtenstein ERP value and is provided for information for the NRA of Liechtenstein, the national Office for Communication (AK).

[102] The database in use by BEREC is the latest available through DMS London Business School (LBS) – March 2024. This version of DMS data updates the previous version dated February 2023. The estimations available in the 2024 UBS Global Investment Returns Yearbook 2024 are based on this new version of the raw data time series, since DMS continually updates and improves the series, including revising historical data series. Since 2021 DMS data series have been updated to the current year. In 2020 the relevant Bond Total Return time series of the following countries have been adjusted: Belgium (since 1991), Denmark (since 1991), Finland (since 1996), France (since 1985), Germany (1995), Ireland (since 1999), Italy (since 1994), Netherlands (1985), Portugal (1999), Spain (1995) and Sweden (1991). The main change in the 2022 data series distributed by Morningstar was the inclusion of Greek data with the Bond Total Return index starting from 1992 and the Equity Total Return index from 1953). The new database of March 2024 updates the previous version used for the 2023 BEREC report, adjusting the Equity return time series of Finland from 1913 until 1981 in line with the new publication in 2024 from Vaihekoski.

[103] Dimson/Marsh/Staunton (DMS) data, as published in the *Global Investment Returns Yearbook 2024* UBS/London Business School; a *Summary Edition of the UBS Global Investment Returns Yearbook 2024* is available here: https://www.ubs.com/global/en/investment-bank/in-focus/2024/global-investment-returns-yearbook.html. The data source is Dimson/Marsh/Staunton, Global Investment Returns Database 2024.

[104] as well as data for other countries namely UK, USA, Argentina, Australia, Brazil, Canada, Chile, China, Hong Kong, India, Japan, Malesia, Mexico, New Zealand, Russia, Singapore, South Africa, South Korea, Taiwan, Thailand, and Switzerland. Together they represent 98 % of world equity market capitalization at the beginning of 1900. Together, these 35 countries cover 98 % of the investable universe at the beginning of 2024.

[105] For more details on the data sources used and methods applied to construct the historical global investment returns series see Dimson/Marsh/Staunton, Triumph of the Optimists: 101 Years of Global Investment Returns (2002), Dimson/Marsh/Staunton, Equity Premia Around the World, LBS 2011, available here:

The DMS database comprises annual returns for 35 countries in local currencies and the USD of the following main quantities: i) Nominal Equity Total Return; ii) Nominal Bond Total return; iii) Nominal Bill Total return; iv) Nominal Equity Premium Vs Bond; v) Nominal Equity Premium Vs Bill.[106]

For a better understanding of BEREC's calculation (see 6.3 and 6.4) based on the data series available it is relevant to explain three aspects of the DMS data:

i) General methodologies of the DMS data series;
ii) Equity Risk Premium evaluated for the "Europe Index" as provided in the Yearbook[107];
iii) Equity Risk Premium of the relevant 13 EU member states plus Norway where time series are available.

i) The General methodologies of the DMS data series[108]

The DMS database includes annual returns and is based on the best-quality capital appreciation and income series available for each country, drawing on previous studies and other sources. To span the entire period from 1900, DMS linked multiple index series. The best index is chosen for each period, switching, when feasible, to better alternatives, as they become available. Other conditions being equal, DMS has chosen equity indexes that provide the broadest possible coverage of market of each country. Virtually all DMS equity indexes are capitalization weighted and are calculated from year-end stock prices, but in the early years, for a few countries, DMS was forced to use equally weighted indexes or indexes based on average- or mid-December prices. All the security returns include reinvested gross (pre-tax) income as well as capital gain.

The guiding principle of the index selection was to avoid survivorship[109], success, look-ahead[110], or any other form of ex post selection bias. The criterion was that each index should follow an investment policy that was specifiable in advance, so that an investor could have replicated the performance of the index (before trading costs) using information that would

https://ssrn.com/abstract=1940165. The indices are described in Dimson/Marsh/Staunton, UBS Investments Returns Yearbook 2024 (available from London Business School (LBS)).

[106] The time series also list for each country the Maturity premium, Equity Capital Gain, Inflation, Exchange rates with USD and Real evaluation.

[107] The UBS Yearbook 2024 (which contains the DMS results in hard copy, the underlying DMS data is included in the LBS data set 2024 as a soft copy). The data source is Dimson/Marsh/Staunton, Global Investment Returns Database 2024 (distributed by LBS).

[108] The following explanations are mainly based on publicly available descriptions of the compilation of the DMS data, see Elroy Dimson, Paul Marsh, and Mike Staunton, "The Worldwide Equity Premium: A Smaller Puzzle"; Chapter 11 in "Handbook of the equity risk premium", editor Rajnish Mehra 2008, and Dimson/Marsh/Staunton Global Returns Data (DMS Global) Documentation; see also Dimson/Marsh/Staunton, Triumph of the Optimists: 101 Years of Global Investment Returns (2002), Dimson/Marsh/Staunton, Equity Premia Around the World, LBS 2011, available here: https://ssrn.com/abstract=1940165.

[109] Survivorship bias is the logical error of concentrating only on the capital that is related to the present, making it past, and using some selection process and overlooking the capital that didn't have effects on the present. This can lead to false conclusions in several different ways.

[110] Look-ahead bias occurs by using information or data in a study or simulation that would not have been known or available during the period being analysed.

have been available at the time.[111] The conventional view of the historical equity premium is that, at the start of each period, investors make an unbiased, albeit inaccurate, appraisal of the end-of-period value of the stock market. Consequently, the ex-post premium, averaged over a sufficiently long interval, is expected to be a relatively accurate estimate of investors' expectations. At the same time the historical premium may nevertheless be materially biased as a proxy for expectations because the past was in some sense unrepresentative.

The DMS bond indexes are based on government bonds that can be of different maturity, characteristic depending on the emitted product available along the time series for each country. They are usually equally weighted and chosen to fall within the desired maturity range. Generally long term bonds are targeted, but where these are not available, either perpetual (usually for earlier periods) or shorter maturity bonds are used.

The Equity Risk Premium provided in the year book is estimated from the arithmetic difference between the logarithmic return on equities and the logarithmic return on the riskless asset. Equivalently, DMS defines 1 + Equity Premium to be equal to 1 + Equity Return divided by 1 + Riskless Return. Defined in this way, the Equity Premium is a ratio and therefore has no units of measurement. It is identical if computed from nominal or real returns, or if computed from dollar or euro returns.[112]

Each index starts from 1899 with a base index 1 and comprises data from 1900 – 2023, i.e. 124 years.

ii) The Global indexes: "World Index" and "Europe Index" from DMS time series.

In the DMS data base four Global indexes are included: the "World Index",[113] the "Europe Index", the "Developed Market Index" and the "Emerging Markets Index".

The **"World Index"** comprises 23 countries (including Russia[114] and China) plus 9 countries that were added in the 2021 Yearbook and 3 new countries listed in the 2022 Yearbook[115]. It is evaluated in common currency (USD) for both equity and bond. This year, DMS assumes that at the beginning of each year the investor bought a portfolio of the 23+9+3+55[116] countries weighting each country by its size. The "World equity index" is obtained through a weight based on the market capitalization[117] of each of the 23+9+3+55 countries. The "World bond market index" is obtained through a weight based on country GDP of each of the 23+9+3[118] countries.

[111] Elroy Dimson, Paul Marsh, and Mike Staunton "The Worldwide Equity Premium: A Smaller Puzzle" Chapter 11 in "Handbook of the equity risk premium" editor Rajnish Mehra 2008.
[112] The time series are provided in local currency and in USD.
[113] There is also a derived composite index World excluding US.
[114] In 2022, sanctions and capital controls linked to the Russian invasion of Ukraine meant that most global investors could no longer access their holdings in Russian stocks and bonds, Therefore, following the major index companies (MSCI, S&P and FTSE Russell) in removing Russia, DMS also removed Russia from the composite equity and bond indices from 2022 onwards.
[115] **Greece**, Chile and Argentina have been included since the 2022 Yearbook.
[116] The equity index includes new countries when the data become available. The 2022 World Equity index includes 55 other countries where data is available.
[117] The market capitalization is included considering a free float adjustment from 2001.
[118] The bond index includes also 9+3 new countries of 2021 and 2022, but doesn't include the 55 other countries since in this case the data is not available.

The approach used in order to include a country is to avoid survivorship bias, in the sense that the index also includes this country when it registered a total loss (e.g. 1917 for Russia and 1949 for China), and re-enters the indexes when their market reopened in the early 1990ies.

For the **"Europe Index"** the approach is the same; it includes the 16 original countries, the equity index and the bond index are evaluated in a common currency (USD), so local currency returns are converted to US dollars. In each period it is assumed that the investor bought a 16 positions[119] portfolio composed of the following 16 countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, The Netherlands, Norway, Portugal, Russia, Spain, Sweden, Switzerland and the UK.[120]

The equity risk premium is always evaluated as the ratio of the equity return and bond return, considering a logarithmic difference. In this way the equity risk premium is independent with respect to an evaluation done in nominal or real terms as the adjustment due to inflation to estimate real evaluation of each component, Equity and Bond, is netted off. The equity risk premium is independent also with respect to the currency as, also in this case, the adjustment applied through exchange rates to convert the Equity and Bond index to the desired currency is netted off.

Switzerland, Russia and the UK, in the "Europe Index" are not relevant for BEREC's calculation of an EU-wide ERP; moreover, Norway is now included in the calculation of an EU/EEA-ERP for EEA notification purposes only. It has to be noted that the updated "Europe Index" is published in the UBS Investment Returns Yearbook 2024, but no longer appears in the free Summary edition.[121]

For the "Developed Market Index" and the "Emerging Market Index" DMS identify whether a market was developing or emerging at each year in the past based on GDP per capita. The "Developed Market Index" at the end of 2023 thus contains the following countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK, US, Hong Kong, Singapore, Luxemburg and Israel while the "Emerging Market Index" contains China, South Korea, Taiwan, India, Brazil, South Africa, Russia, Saudi Arabia, Thailand, Mexico, Malaysia, Indonesia as well as 14 smaller markets.

iii) The Equity Risk Premium of the relevant 13 EU member states + Norway from DMS time series.

The DMS UBS Global Investment Yearbook 2024 reports the following values in terms of arithmetic mean (AM) and geometric mean (GM): nominal annual Equity and Bond returns in local currency.[122]

[119] Greek data starts only in 1953.
[120] The European index starts from 1899 with 16 countries and increases to 35 countries over the years when data becomes available by 2022.
[121] See below for a comparison of the UBS "Europe Index" with the BEREC EU27-ERP.
[122] The data source of this table is Dimson/Marsh/Staunton, Global Investment Returns Database 2024 (distributed by LBS).

Table 7 Geometric Mean and Arithmetic Mean 1900-2023 Equity/Bond annual return in nominal terms and Geometric and Arithmetic Average of Equity vs Bond premium[123]

		Equities		Bonds		Equities vs Bonds	
		GM	AM	GM	AM	GM	AM
1	Austria	13.2%	27.8%	7.7%	17.6%	3.2%	21.1%
2	Belgium	7.8%	10.2%	5.1%	5.6%	2.5%	4.6%
3	Denmark	9.7%	11.6%	5.6%	6.2%	3.9%	5.6%
4	Finland	12.5%	16.1%	6.6%	6.8%	5.5%	9.1%
5	France	10.3%	12.8%	6.6%	7.1%	3.5%	5.7%
6	Germany	8.2%	13.0%	2.9%	5.0%	5.1%	8.3%
7	Greece	12.6%	21.6%	7.9%	11.3%	-5.3%	1.0%
8	Ireland	8.4%	10.8%	5.3%	6.1%	3.0%	4.9%
9	Italy	10.2%	14.1%	6.7%	7.3%	3.3%	6.6%
10	The Netherlands	8.1%	10.2%	4.3%	4.7%	3.6%	5.9%
11	Portugal	11.0%	15.9%	5.3%	6.4%	5.4%	9.4%
12	Spain	9.1%	11.2%	7.1%	7.7%	1.9%	3.8%
13	Sweden	9.5%	11.6%	5.8%	6.3%	3.5%	5.7%
14	Norway	8.2%	10.9%	5.2%	5.6%	2.9%	5.6%
15	Liechtenstein (Switzerland)	6.7%	8.3%	4.3%	4.5%	2.3%	3.8%

The values reported in the Yearbook refer to the time series from 1899 until 2023 for the index that is equal to 1 in 1899. The corresponding annual return for each year is evaluated from 1900 to 2023 as ((P_t/P_t-1)-1) with P_t the index value of the corresponding year "t" return.

The premium values Equity vs Bond are evaluated as averages (arithmetic/geometric) from the return evaluated as (1+Equity Annual return_t)/(1+Bond Return_t)-1.

The values reported in Table 7 are rounded from the first decimal place as in the Credit Suisse Yearbook and recalculated from the DMS data distributed by LBS. acquired by BEREC Office for BEREC. For the 12 EU member states + Norway the time series for Equity and Bond annual return are complete from 1900-2023, the only exceptions are Austria, Germany and Greece[124].

For Austria the Equity Risk Premium excludes the averages (AM and GM) for the hyperinflationary years 1921 and 1922, instead the values for the corresponding nominal Equity and Bond index are maintained.

[123] ERPs as notified by the NRAs may differ from the ones provided in the table.
[124] For Greece the index starts from 1954 for the Equities and from 1993 for Bonds and the corresponding Premium.

For Germany the nominal return and the corresponding Equity Risk Premium are evaluated excluding hyperinflation years 1922 and 1923.

iv) The Equity Risk Premium of the 14 EU member states plus Iceland not included in the DMS data calculated with the implied pricing method

For Iceland and the 14 EU member states that are not contained in the LBS data set, i.e. Bulgaria, Croatia, Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Luxembourg, Malta, Poland, Romania, Slovakia, and Slovenia relevant data was retrieved from Bloomberg and calculated according to a method applied by the CFA Institute (Charted Financial Analysts, which is an association of investment professional)[125]. The calculation, which could be referred to as an **Implied Pricing Method**, is based on the following three steps. First, the main equity index is identified for each market and with the annual P/E (ratio of the price of a stock and a company's earnings per share) for each index retrieved from Bloomberg it provides a valuation of each equity market.[126] Secondly, the inverse of the P/E ratio (1/(P/E)) is calculated, which is the earnings yield. It is the percentage of how much a company earn per share, which in this case is how much all stocks in the index earns. This reflects the return on investing in equity. The third step is to subtract a total bond return index from the earnings yield, which gives the equity risk premium on an annual basis.

The historical returns series thus assembled cover only a shorter period (see Table 9 below) due to missing long-term (liquid) financial markets because financial markets did not exist in most of the countries prior to joining the EU.[127] This lack of data is a consequence of the planned economy and can therefore not be remedied – where there is no market and consequently no data it cannot be "invented". BEREC therefore had to find a robust, transparent and not overly complicated way to "merge" historical data series with different lengths without however making a methodological mistake resulting in a systematic over- or underestimation of one or the other values, i.e. misrepresenting longer and shorter historic returns series. The solution (the so-called "available years"-weighting) is described in more detail in section 6.4.

In the following part the information about the other EU member states is given separately. In this case the source of data for Equity comes from the implied pricing method time series,

[125] Comparability and consistency with the Morningstar data has been assured (using the same definition to build the indices etc.). Source: Jason Voss, What the equity risk premium tells us today, Financial Times, FT, November 7, 2011.

[126] For the purpose of the Equity index the adjusted positive Price/Earnings ratio has been considered, calculated as the ratio of the last price divided by the positive Earnings per Share. The figure used is the ratio of an index's price (last price of the whole index of the country equity market) divided by Positive Earnings per share before extraordinary items. The Positive Earnings per share provides an index calculated as the sum of positive earnings before extraordinary items for member companies by the index divisor. Index member companies with negative earnings before extraordinary items are excluded from the calculation and the index divisor is adjusted to exclude those companies. For the Positive earnings per share the annual figure has been used and when missing the trailing 12M Earnings per Share value for each equity has been considered (i.e. 12M Earnings per Share is the sum of the most recent 12 months, four quarters, two semi-annuals information) as second best.

[127] This applies to Central and Eastern European countries. For the smallest EU member state, Malta, data is still not available for other reasons.

about the P/E ratio[128] evaluated in relation to Equity relevant market index of each country. For the bond component a specific index of government bond for each country has been considered as reported in Annex 4. These time series, on average, span 15 years. All data has been derived from Bloomberg. The result is shown in Table 8.[129]

Table 8 Geometric Mean and Arithmetic Mean 2001-2023 Equity/Bond annual return in nominal terms and Geometric and Arithmetic Average of Equity vs Bond premium.[130]

No.	Country	Mean returns % p.a.						Time series length
		Nominal				Premiums		
		Equities		Bonds		Equities vs Bonds		
		GM	AM	GM	AM	GM	AM	
1	Bulgaria	14.78%	14.91%	2.36%	2.70%	12.14%	12.69%	2006-2023
2	Croatia	7.58%	7.65%	2.48%	2.67%	4.97%	5.15%	2006-2023
3	Cyprus	16.32%	17.44%	-0.46%	-0.05%	16.86%	18.10%	2015-2023
4	Czechia.	8.64%	8.66%	2.95%	3.28%	5.53%	5.91%	2006-2023
5	Estonia	5.17%	5.18%	-5.17%	-4.60%	10.91%	11.63%	2021-2023
6	Hungary	8.87%	8.92%	3.95%	4.40%	4.74%	5.45%	2001-2023
7	Latvia	9.81%	9.88%	0.30%	0.72%	9.00%	10.41%	2005-2023
8	Lithuania	8.03%	8.06%	2.92%	3.34%	4.96%	5.57%	2005-2023

[128] The price-to-earnings ratio or P/E is one of the most widely-used stock analysis tools used by investors and analysts for determining stock valuation. In essence, the price-to-earnings ratio indicates the amount of dollar an investor can expect to invest in a company in order to receive one dollar of that company's earnings. This is why the P/E is sometimes referred to as the price multiple because it shows how much investors are willing to pay per dollar of earnings. However, Bloomberg is adjusting the data series over time (also retroactively) which may lead to variations not rooted in "observed" variations. As in the case of the DMS/LBS data, BEREC does not make adjustments to the Bloomberg data.

[129] ERPs as notified by the NRAs may differ from the ones provided in the table. Among other things this is due to the fact that BEREC's estimation is based on a bottom-up approach where the outcome is affected by the fact that only limited data is available, i.e. the time series are relatively short compared to the long time series with data for 123124 years for the 12 EU member states (121122 for Germany) originally included in the DMS data.

[130] Values last checked via Bloomberg in April 2024, the time series have been updated over time in line with the latest data available.

	Luxemburg [131]							No data available
	Malta							No data available
9	Poland	8.56%	8.59%	4.98%	5.44%	3.41%	4.07%	2001-2023
10	Romania	10.94%	10.98%	1.47%	1.93%	9.33%	10.02%	2006-2023
11	Slovakia	4.98%	5.01%	3.10%	3.45%	1.77%	2.11%	2005-2023
12	Slovenia	8.98%	9.03%	2.73%	3.05%	6.08%	6.64%	2005-2023
13	Iceland	6.36%	6.37%	-0.38%	0.61%	6.77%	8.12%	2009-2023

6.2. Methodology with reference to Notice

BEREC follows the methodology outlined in section 4.2 of the Notice and described in more detail in section 5.2.3.2 of the SWD[132], i.e. it uses historical returns series of DMS data for 13 EU member states (listed above, including Greece) + Norway and shorter historical returns series assembled by using the implied pricing method with data from Bloomberg for 13[133] EU member states + Iceland not included in the Morningstar data set (see above).

Therefore, BEREC cannot simply use an "off-the-shelf" European ERP as e.g. calculated by DMS, as the countries included in their (Old World) "Europe" Index[134] deviate from the EU member states that are relevant for BEREC's calculation of an EU-wide ERP. To our best knowledge, alternative off-the-shelf European ERP estimations are not available. Consequently, BEREC has estimated its own EU-wide ERP by applying a second weighting to reflect the limitation of data availability, which is different for the two groups of EU member states as outlined above. That also explains the difference to the "Europe" ERP shown in Table 21 of the SWD[135] and the result (an EU-wide ERP) estimated by BEREC exhibited in Table 11 in section 6.5.

[131] The information on earnings per share (ERP) is no longer supported on the Bloomberg platform for the Luxemburg equity index, so the implied pricing method cannot be applied with updated information. Due to the fact that the European ERP is not significantly affected whether Luxemburg data is included or excluded in the whole data set, the information has been removed from the aggregated index.

[132] SWD, pp. 65.

[133] Greece has been included in the DMS data set since 2021.

[134] Which comprises the following 16 countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal, Spain, Denmark, Sweden, Norway, Switzerland, UK and Russia. It is therefore not comparable with the EU-wide ERP calculated by BEREC.

[135] SWD, p. 66. Table 21 shows values for the period 1900 – 2010, i.e. is outdated. BEREC calculates the EU-wide ERP value using data until 2023.

The Notice provides guidance on how the ERP should be estimated. In line with general portfolio theory which makes the assumption that investors were perfectly diversified over the world, it would make sense to measure a "worldwide" ERP. The Commission's approach of a single EU-wide ERP is based on the idea of a single EU capital market and assumes an investor with an EU perspective holding an efficient portfolio of assets in EU member states. Therefore, the single EU-wide ERP is to be estimated based on appropriate data from all EU member states (and from EU/EEA countries for the separate EU/EEA-wide ERP).

6.3. Assumptions and choices made

In order to calculate a single EU-wide ERP a sound approach of using longer (for 13 EU member states, including Greece) + Norway and shorter (for 12 EU member states + Iceland) historical data series in one calculation without a systematic bias needed to be found. The solution is to apply a weighting reflecting the length of the available historical data series – the so-called **"available years"-weighting** as described below in section 6.4.

For 13 EU member states + Norway (listed above in Table 7) the estimation of the EU-wide ERP (and EU/EEA-ERP resp.) is based on the DMS historical returns series acquired by BEREC for 2023. These series do not cover the remaining 14 EU member states + Iceland (listed above in Table 8). For these member states the estimation has been carried out considering for the equity return time series provided by the implied pricing method using Bloomberg, for the bond market compound index based on long term government bond has been used. In the index selection, inflation index linked bond has been omitted when possible and using local currency indexes composed by long term bonds. The time series of these countries have been included in the estimation from 2001 at the earliest when available.[136] The relative weighting of these time series addresses a selection bias that may happen if countries with shorter data series are included.[137]

Following the Notice, BEREC provides an **EU-wide ERP** that is a weighted average of the ERP using DMS historical time series for 12 EU member states + Norway from 1900 and using DMS historical time series for Greece which time series of the Equity return start from 1954 and for the Bond return from 1993. In line with the approach used by DMS, all relevant countries are fully included in the composite indexes once data becomes available (Greece is included from 1954 with respect to Equity and from 1993 for the Bond) and for 12 EU member states + Iceland, where data is available, not included in the DMS time series available with the implied pricing method using Bloomberg starting from 2001 at the earliest and 2023 at the latest.[138] The **Equity component** of the new (BEREC) EU index will be derived considering **market capitalization** of each country (market size) in line with the global indexes constructed by DMS and **GDP** weight for the **bond component**.[139]

[136] For more details see section 6.1. above
[137] E. Dimson, P. March, M. Staunton "Survivorship Bias Is Negligible", paragraph 5.4 Chapter 11 Handbook of Equity Risk premium.
[138] For more details see above section 6.1.
[139] The use of Market cap and GDP for the "World Index" and the "Europe Index" have been considered since 2012 by DMS.

Using a weight for Equity that takes into account market capitalization is in line with the efficient market hypothesis[140] and with the general assumption that the weighted average market capitalization is the optimal method of asset allocation as it reflects the actual behaviour of markets. In this way, larger Equity markets tend to have a greater influence over the index, just as is the case of modern Index construction. This leads to a natural rebalancing mechanism where a growing Equity market is more influential in the index.

Market capitalization weighted indices reflect the available investment opportunity set in public equity markets. By design, they ignore any unlisted companies, whether privately held or state owned, since these are not accessible to the investing public.[141] However, all companies in a country contribute to the economy whether or not they are listed, available to local or foreign investors, private or public. Since the value of this larger universe of companies is not directly observable, the value of the economy as measured by the GDP is often used as a reference against which a country's current market capitalization is contrasted. This is more effective to catch asset allocation probability in the Bond market portfolio.

BEREC's approach of applying a **5-year averaging window (2019-2023)** when calculating the weights for equity (with market capitalisation) and bonds (with GDP) instead of a "year-by-year" weighting (as done by DMS), leads to "fixed weightings along the years" instead of the rebalancing used by DMS.[142] BEREC's method in this way appears to have an upward bias compared to the estimation followed by DMS for the calculation of a "Europe Index" calculated until 2023. However, the sensitivity analysis run by BEREC shows that the difference is not material.[143]

The annual market capitalisation data has been derived from Bloomberg using all outstanding shares that are only actively traded, the figure does not contain ETF (Exchange trade found) and ADR (America Deposit Receipt) as they do not represent companies directly. It includes only actively traded, primary securities on the countries' exchanges to avoid double counting. It is evaluated in Euro in line with the GDP weight used for the Bond index.[144] The same approach is applied in the DMS Yearbook where the World equity index is weighted using market capitalisation free float adjusted from 2001.

The GDP data has been derived from Eurostat in form of current prices in Euro[145].

Overall, these assumptions allow BEREC to calculate a single EU-wide ERP in a robust, transparent and comprehensible way taking into account the limitations as regards to data availability.

[140] The efficient-market hypothesis (EMH) is a hypothesis in financial economics that states that asset prices reflect all available information. A direct implication is that it is impossible to "beat the market" consistently on a risk-adjusted basis since market prices should only react to new information.
[141] GDP Weighting in Asset Allocation 2010 MSCI Research bulletin.
[142] i.e. BEREC uses the same weighting *factors* (market capitalisation, GDP), however a different weighting *method* (due to data constraints).
[143] See below section 6.5.
[144] Data is consistent with publicly available: https://data.worldbank.org/indicator/CM.MKT.LCAP.GD.ZS.
[145] https://ec.europa.eu/eurostat/databrowser/view/nama_10_gdp/default/table?lang=en

6.4. Calculation steps – description of how the result is derived

The first step of the analysis has been carried out considering the following.

As explained in section 6.3 above the weight for the market capitalisation and GDP has been considered as an average with five year time window (2019-2023), in line with the beta and RFR estimation. Using a five-year average window might slightly overestimate the result compared to using a year-by-year weighting which, for practical reasons (time and data constraints), was not possible.[146]

The evaluation of the ERP has been estimated using the following assumption:

For each year of the time series BEREC has obtained annual returns for Equity and Bonds in nominal terms:

Equity_EU_t = (Equity return_t_x* Market Capitalization_x+ Equity return_t_y* Market Capitalization_y+…)/(Sum of market capitalization_t) ;

Bond EU_t = (Average Bond_t_x*GDP_x+ AverageBond_y*GDP y_t+.)/(sum fo GDP_t).

Along the time line the sum of the denominator takes into account the number of countries that are included in recent years. This is affected via applying a second weighting to compensate for incomplete historic values. This is the **"available years"-weighting** according to the length of the time period of data availability. For the 12 EU member states + Norway listed in the DMS historical series this would be 124 years[147] divided by the maximum time period available (124), while for Greece the Equity time series started from 1954 with a maximum time period available of 70 years, and the Bond time series started from 1993 with a maximum time period of 31 years; for the remaining 12 EU member states + Iceland not included in the DMS data set the weight is the number of years for which data is available (2001 at the earliest – 2023) over the maximum time period available, i.e. 23/124). Thus, BEREC is able to incorporate data of different time lengths of all EU member states without over- or understating available data series with different lengths. The formula is shown hereafter:

Equity_EU = (Average Equity_x*Market Capitalization_x*(1)+Average Equity_y*Market Capitalization_y*(y/124)+...)/(market capitalization_x*1+ market capitalization_y*(y/124)+..);

Bond EU = (Average Bond_x*GDP_x*(1) + AverageBond_y*GDPy*(y/124)+...)/(sum for GDP_x*(1)+GDP_y*(y/124)+...).

After obtaining the values of Equity and bond returns in nominal terms BEREC has estimated the equity risk premium in coherence with the approach used in the Yearbook, as the difference of logarithm like (1+ Equity_EU)/(1+ Bond_EU)-1 for each point in time. After that BEREC computed the Arithmetic average and Geometric average of the new time series

[146] See below section 6.5.

[147] Or less, if individual years are taken out where the value is an outlier (this is the case for Germany for the two years 1922/1923 of hyperinflation, and the Austrian case for 1921/1922 is derived differently (see above). Apart from these two exceptions, BEREC did not make adjustments to the historic returns series of DMS/LBS.

established. The evaluated equity risk premium is independent from the nominal or real estimation as well as from the currency, due to the fact that BEREC used the ratio of the annual return instead of the difference of the annual return. In this way the adjustment due to nominal or real estimation as well as the currency are not relevant with respect to the final estimation.

Through this approach the time series of the 12 EU member states + Iceland (not contained in the LBS data set) are integrated in the final average only where data is available for both the Bond and Equity index.[148] The weights are adjusted year by year taking into account the relevant EU/EEA member states that are included. In the table below the year in which the time series are included is also given. The date of inclusion depends on the availability of both equity and bond data. Data is available for all countries (except Malta and Luxemburg), and thus all EU member states (except two) are included.

Table 9 Year and duration of the time series of the 12 EU member states + Iceland not included in the Morningstar data set

No.	Country	First year of the time series	Time Weight
1	Bulgaria	2006	18/124
2	Croatia	2006	18/124
3	Cyprus	2015	9/124
4	Czechia	2006	18/124
5	Estonia	2021	3/124
6	Hungary	2001	23/124
7	Latvia	2005	19/124
8	Lithuania	2005	19/124
	Luxemburg	No data available	
	Malta	No data available	
9	Poland	2001	23/124
10	Romania	2006	18/124
11	Slovakia	2005	19/124
12	Slovenia	2005	19/124
13	Iceland	2009	15/124

The limitation of the proposed approach is related to the fact that weights are dependent on when data is available for each country. This gives a sort of “look-ahead” bias as the probability of investing along the years, as market capitalization/GDP has changed along the 100 years,

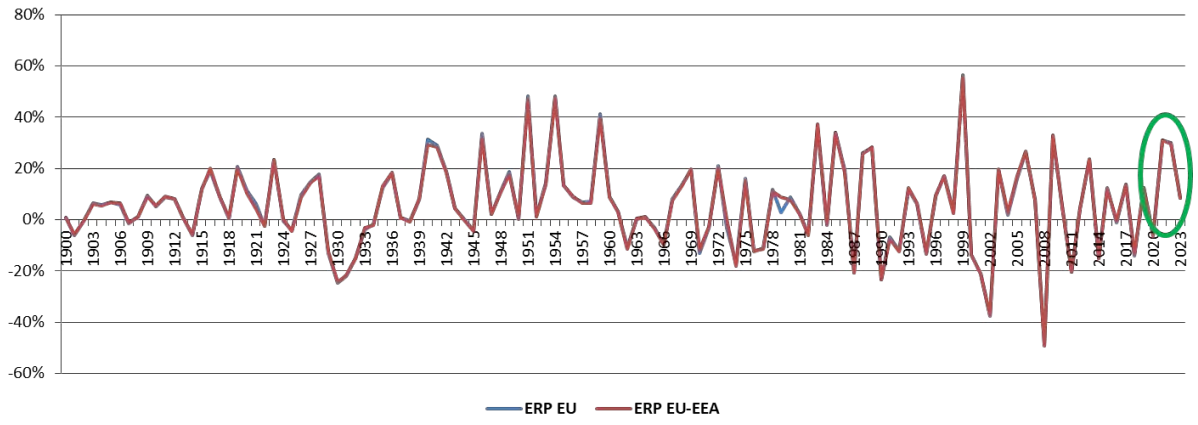
[148] The data availability is also a measure of liquidity of the market and so also an indicator of the relevance on representing a likely share in the portfolio.

but this is a trade-off with respect to the data availability, however, consistently in line with the general framework proposed by the Commission.

To estimate the single EU-wide ERP BEREC calculated the arithmetic mean (AM) and the geometric mean (GM). BEREC notes that the Notice and the SWD favour for transparency reasons the use of AM. With reference to the other regulatory objectives/principles the SWD is (at best) neutral and rightly points out – in line with financial theory – the drawbacks of an AM (upward bias), in particular with regard to predictability and efficiency.[149] To estimate the ERP on the basis of an arithmetic or geometric means has been subject to unresolved discussions in financial literature. Blume (1974) has shown that for estimating the end value of longer-term capital investments the arithmetic mean is generally an upward-biased estimator, whereas the geometric mean is a downward-biased estimator.[150] It follows that the AM usually provides the upper boundary of the value, whereas the GM is the lower boundary. For transparency reasons BEREC provides both the GM and the AM.

In the following Figure 3 the time evolution (1900-2023) of the proposed annual returns of the new EU Equity risk premium is shown, including 13 EU member states with long time series and 12 EU member states with shorter time series as described before. In the figure the evolution over time including Norway and Iceland (EEA) is also given. The increase of the average with respect to last year EU-ERP is mainly due to the persistent increase over the average of the premium experienced for most countries in 2021 and 2022. The data for 2023 show a reduction of the premium in the historical series, even if the value is higher than the average.

Figure 2 Equity Risk Premium 1900-2023 time series



The corresponding ERP averages are shown in Table 10.

[149] SWD, section 5.1.2, pp. 36-38.
[150] See also SWD, p. 37/38. For this reason the Credit Suisse Yearbook publishes both the AM and the GM.

Table 10 EU ERP (GM and AM) / EU/EEA-ERP (GM and AM)

	Geometric Mean (GM)	Arithmetic Mean (AM)
EU-ERP	**4.59 %**	**5.95 %**
EU/EEA-ERP	**4.59 %**	**5.92 %**

While the effect of the 12 EU member states + Iceland not included in the DMS time data set is still currently not substantial, the significance may increase in the future as markets become more mature.

6.5. Results EU-ERP and EU/EEA-ERP

The result of the calculation is shown in Table 1111. For each EU member state the GM and the AM is provided (unweighted).[151] The line below the last EU member state contains the lower boundary (GM) and the upper boundary (AM) of the single EU-wide ERP as estimated by BEREC with the method described above. BEREC considers that the result is robust based on the data available at this point in time. Only the EU-wide ERP with a value of **5.95 %** (AM) is relevant for NRAs' own estimations.

In addition, a separate EU/EEA-wide ERP average (GM and AM) is calculated. The EU/EEA-wide ERP with a value of **5.92 %** (AM) is a relevant reference only for the two EEA countries Norway and Iceland for EEA notification purposes.

Table 11 ERP

Country	Geometric Mean in %	Arithmetic Mean in %	Available years weight
Austria	**3.2%**	**21.1%**	**100% (124\124)**
Belgium	**2.5%**	**4.6%**	**100% (124\124)**
Bulgaria	**12.1%**	**12.7%**	**15% (18\124)**
Croatia	**5.0%**	**5.2%**	**15% (18\124)**

[151] Taken from Table 7 and Table 8, ERPs as notified by the NRAs may differ from the ones provided in the table. For the countries not included in the Morningstar data set, the available years-weighting is taken from Table 9, the EU-ERP from Table 10.

Cyprus	16.9%	18.1%	7% (9\124)
Czechia	5.5%	5.9%	15% (18\124)
Denmark	3.9%	5.6%	100% (124\124)
Estonia	10.9%	11.6%	2% (3\124)
Finland	5.5%	9.1%	100% (124\124)
France	3.5%	5.7%	100% (124\124)
Germany	5.1%	8.3%	100% (124\124)
Greece	-5.3%	1.0%	56% (70\124)
Hungary	4.7%	5.4%	19% (23\124)
Ireland	3.0%	4.9%	100% (124\124)
Italy	3.3%	6.6%	100% (124\124)
Latvia	9.0%	10.4%	15% (19\124)
Lithuania	5.0%	5.6%	15% (19\124)
Luxembourg	No data available		
Malta			
Netherlands	3.6%	5.9%	100% (124\124)
Poland	3.4%	4.1%	19% (23\124)
Portugal	5.4%	9.4%	100% (124\124)
Romania	9.3%	10.0%	15% (18\124)
Slovakia	1.8%	2.1%	15% (19\124)
Slovenia	6.1%	6.6%	15% (19\124)
Spain	1.9%	3.8%	100% (124\124)
Sweden	3.5%	5.7%	100% (124\124)
EU-ERP	4.59%	5.95%	
Norway	2.9%	5.6%	100% (124/124)

Iceland	**6.8%**	**8.1%**	**12% (15/124)**
EU/EEA-ERP	**4.59%**	**5.92%**	

Analysis of results

The result of BEREC's calculation presented in this chapter is broadly in line with likely expected findings.

Specifically, with respect to last year, the level of ERP is stable with a small increase by 0.03 points, in line with the "European ERP" evaluated by DMS with a difference of 0.01% from 4.52 % (AM, 2023 Yearbook) to 4.53 % (AM, 2024 Yearbook). Since most NRAs follow the method for estimating the ERP outlined in the Notice over the years, it is no longer relevant to compare the value estimated by NRAs with the single EU-one updated.

It should be noted that contrary to the development of the last two years, the difference between Equity and Bond performances has decreased. This is in line with a stabilization of economic conditions in comparison to previous years, where in 2021 and 2022 the ERP was the 10th and 11th highest values in the ERP historical series as evaluated by BEREC since 1900. This is reflected by the fact that the level of the ERP has decreased over the last two years compared to the peak in 2021, even if it is still higher than the average of the last 123 years.[152]

To better understand the dynamics of the Equity premium in the actual situation with an inflation rate that was very relevant in 2021 and 2022, we quote the empirical relation between the Real Bond and Real Equity returns versus the inflation rate that is included in the DMS Yearbook (Chapter 2), using the DMS database distribution available to BEREC. This analysis that is also reported in the Chapter 2 of the DMS Year Source Book[153] provides information on the correlation between the evolution of the inflation rate and the corresponding real return of equity and bonds. This empirical analysis specifically addressed by DMS in the Yearbook provides an insight on the question if Equity can be a hedge against the Inflation rate.[154] In the following we replicate the DMS analysis with respect to the 12 EU countries relevant for BEREC, where data have been available since 1900 (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, The Netherlands, Portugal, Spain, Sweden) and where DMS in the Yearbook include 21 world countries with a time series starting from 1900.

In the following figure the averages of Real Bond Return and Real Equity Return are calculated classifying the 1484 observations (124*12) excluding, as done by DMS, hyperinflation years for Austria (1921-1922) and Germany (1922-1923) in 8 baskets for inflation rate measured in

[152] As in previous years the impact of including data from Greece is not substantial (less than 0.01 point decrease). This is due to the fact that generally the Equity Risk Premium over Bonds for Greece was negative for most of the time series. It should be noted that for 2023 the DMS time series for Greece have been revised as reported in the previous paragraph, these modifications have been not material for the final result.
[153] Figure 16 Chapter 2 of Credit Swiss Global Investment Return Yearbook 2023.
[154] Tatom J. 2011, Inflation and Asset Prices, MPRA Paper 3460, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1957721

each country since the 1900 and available in the DMS database[155] (I<-3.5%;-3.5%<=I<-0.5%;-0.5%<=I<1.7%;1.7%<=I<2.7%;2.7%<=I<4.2%;4.2%<=I<7.5%;7.5%<=I<18%;I>18%).[156]

From this analysis it is clear that the level of correlation between the inflation rate and corresponding real return on equity and bonds are different depending on the period of inflation. In periods of a high inflation rate the level of the equity return is less affected with respect to the corresponding bond return. As highlighted by DMS the correlation coefficient between the inflation rate and equity return is still negative posing questions about the possibility to hedge inflation with equity investment.[157] At the same time the correlation coefficient between the inflation rate measured over the 1484 observations and the corresponding yearly real bond return is –0.42 in line with last year's report whereas the correlation coefficient between the inflation rate and the corresponding yearly equity return is -0.21. Those elements suggest that an equity premium over bonds may be higher in case of a higher inflation rate period on average.[158] During 2023 where the inflation rate has decreased about 1/3 in comparison to 2022, the corresponding premium has also decreased about 1/3. In figure 3 (b) a weighted average inflation rate (GDP weighted) of the 12 countries considered for this analysis is also reported showing that the level of inflation for 2023 decreased correspondingly.

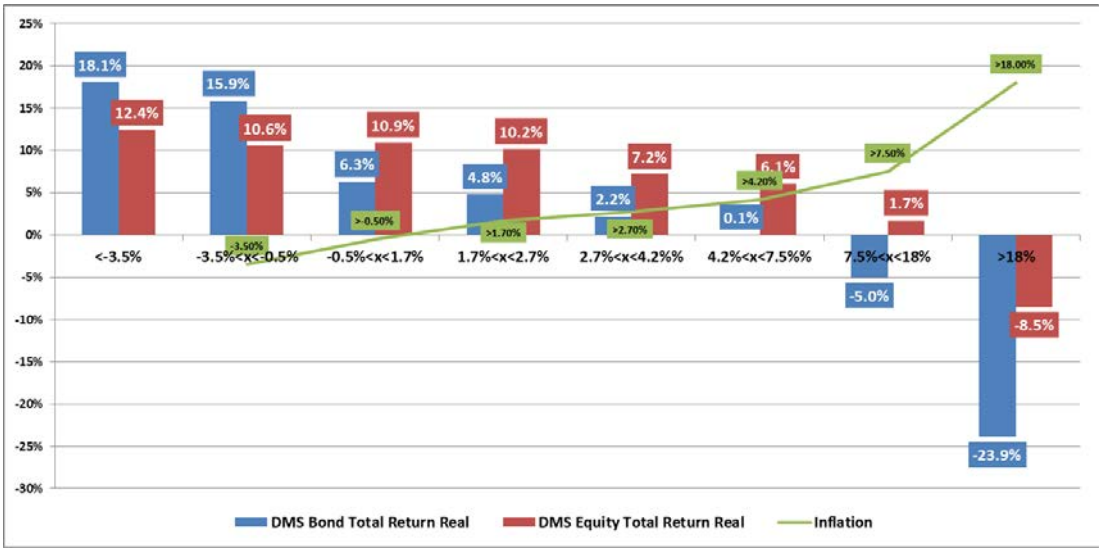
[155] The DMS Global Inflation rates are derived from the consumer price indices for each country, although for one or two early sub periods in a couple of countries, the wholesale price index is employed.

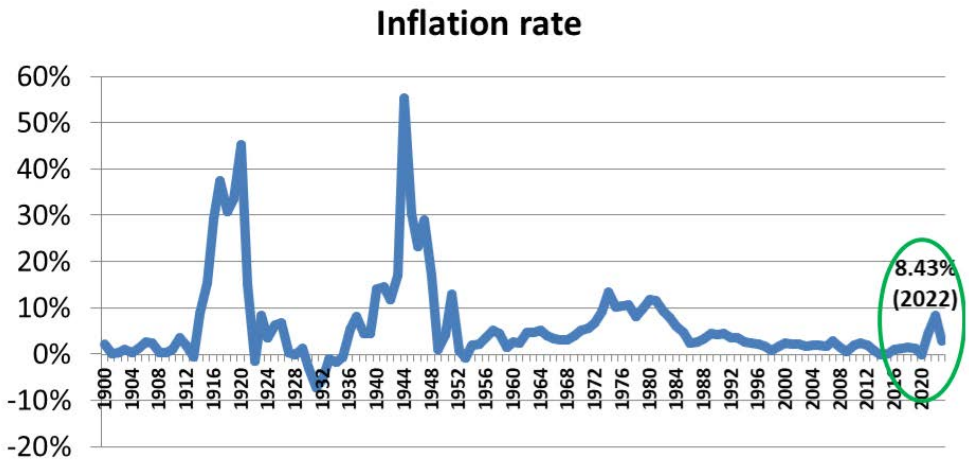
[156] The baskets are the same as reported in the 2024 Yearbook and are derived considering the first 5% low inflation rate observations and increasing by the next 15% for 6 baskets and including in the last basket the top 5% in term of inflation rate measured (15%*6+lower 5%+ higher 5%).

[157] Credit Suisse Global Investment returns Yearbook 2023, E, Dimson, P. Marsh M. Staunton (p. 32 Chapter 2)

[158] This argumentation provides support not to use the Total Market Return approach for ERP estimation in a long run investor perspective to overcome bias estimation.

Figure 3 Real bond and Equity returns versus inflation rates 1900-2023 (12 EU member states)





Bearing in mind that the (inherent) upward bias[159] in the AM might be further amplified by the BEREC weighting method[160], BEREC does not consider it justified to *solely* show the AM of

[159] See above section 6.3.

[160] In comparison to the estimation followed by DMS for the "Europe Index" BEREC's weighting method appears to have an upward bias caused by the use of a fixed five year averaging window (201-9-2023), which is due to lack of data. The UBS Yearbook 2024 provides an estimation still of 4.5 % (AM) for its "Europe Index", which however also includes Switzerland, Norway, Russia and the UK. In order to estimate the size of the upward bias BEREC conducted a sensitivity analysis also including Switzerland, Norway, Russia (for Russia 2022 and 2023 years data – in line with DMS - have been excluded in light of the Russian invasion of Ukraine in estimating the European index) and the UK in a calculation applying its weighting method to be able to compare the AM value published in the UBS Yearbook 2024 (4.5 % in line with the 4.5% value in 2022) to the EU-ERP AM value estimated by BEREC (5.94 %). The result of this estimation is 5.14 %, i.e. a difference of +0.64 % points compared to 4.5 %. So, taking the 4.5 % value as the "unbiased" value, the difference of 0.64 % points can be considered as an indication of the upward bias. Including this in BEREC's method would provide a hypothetical (unbiased) EU-wide ERP of 5.30 % (AM). This shows that albeit the bias exists, it is relatively small and in line with the upward bias estimated in the 2023 BEREC WACC parameters Report (0.60 % points).

the EU-wide ERP. Instead of making an arbitrary adjustment or using a combination of AM and GM, BEREC, provides both the AM (the upper boundary) of the EU-wide ERP which is displaying the result of the AM calculation transparently[161] and the GM (the lower boundary). Otherwise, the AM value would be challengeable on the allegation of the (concealed but certain) upward bias.

BEREC considers that the appropriate value of the **single EU-wide ERP** has a value of **5.95 %** which is the upper boundary of the margin given by the 4.59 % (GM as the lower boundary) and 5.95 % (AM). With this, BEREC unifies the calculation of the ERP in line with the Notice/SWD, thereby eliminating any methodological differences of NRAs' estimations while NRAs need to take into account the existing factual situation in their respective member states adequately in their decisions by setting the (other) parameters based on the BEREC parameter values. In a first step, this implies that national ERPs will converge more when NRAs start applying the EU-wide ERP compared to the current situation[162] with the standard deviation expected to go down considerably. In a second step, WACC values would also converge.

Overall, the WACC methodology as provided for in the Notice and used in the BEREC WACC parameters Report carefully balance consistency, transparency and continuity, i.e. aiming to reflect market realities of 27 EU Member States as well as the convergence towards an EU-wide capital market not yet fully completed. The application of the historical data series for both Bond and Equity index for the ERP estimation provides the best estimate in the long run perspective based on empirical evidence on the Equity premium over bond compared to other methodologies available.

NRAs not using the AM would need to provide an explanation justifying their result, although within the margin.

In the following paragraphs the evolution of the ERP estimated by BEREC is reported for the different yearly updates. We recall that the comparison between the WACC parameters Report 2020 (BoR (20) 116) and the next updated value is difficult to apply due to the fact that in the 2020 Report (BoR (20) 116) the ERP estimation included UK. Had the WACC parameters Report 2021 (BoR (21) 86) included the UK at that time it would have resulted in a reduction in comparison to the 2020 estimation. So, the increase from 5.31% to 5.50% was mainly due to the exclusion of the UK ("Brexit effect") that had a significant impact on the weighted average of the EU-ERP rather than an increase of the ERP for structural economic reasons.

For the comparison of the years between 21-22 and 22-23 the effects are mainly due to the empirical evidence on an increase of the ERP on a historical basis due to a mix of effects that has increased the volatility of the market. In March 2020 the Covid-19 effect increased the volatility even more than the levels seen during the Global Financial crisis of 2008. Even if the market volatility had returned to a more stable situation during 2021, the crisis in 2022 of the Russia-Ukraine war in combination with the fast increase of inflation since the end of 2021 and

[161] Without adjustments, in order to avoid unnecessary complexity.

[162] As shown in the RA Report 2023 (BoR (23) 196), WACC chapter. Since last year's WACC parameters Report most of the NRAs that calculate the WACC had fully applied the WACC Notice/BEREC's parameters values, with few exceptions related to the time of update.

the after-effects of the Covid-19 pandemic have produced new instability in the market.[163] Higher volatility can produce "unusual" returns that are actually seen in the corresponding risk premium that generally presents more stable results over longer time series. The increase of the ERP is mainly due to a strong underperformance of the Bond market that decreased in 2022 by around -30% with a corresponding reduction of the Equity market of approx. -9%. For 2023 the equity premium decreased by about 70% in comparison to the 2021 and 2022 values in homogenous terms, even if the value in absolute terms is still higher than the current the average of the time series. This may be explained, if confirmed by next year results, by the fact that economic conditions are returning to a "normal" situation with an equity market that is outperforming the corresponding bond market.

Table 11 (a) Evolution of the EU-ERP and EU/EEA-ERP from 2020 – 2024

	Average	BoR (20) 116	BoR (21) 86	BoR (22) 70	BoR (23) 90	BoR (24) 102	Δ 2021 ('20-'21)	Δ 2022 ('21-'22)	Δ 2023 ('22-'23)	Δ 2024 ('23-'24)
EU_ERP	AM	5.31	5.50	5.70	5.92	5.95	0.19	**0.2**	**0.22**	**0.03**
	GM	4.18	4.18	4.37	4.56	4.59	0	**0.19**	**0.19**	**0.03**
EU_EEA_ERP	AM	-	5.48	5.69	5.90	5.92		**0.21**	**0.21**	**0.02**
	GM	-	4.18	4.37	4.56	4.59		**0.19**	**0.19**	**0.03**

7. Summary of Results

7.1. Overview of Results

The following overview table (Table 12) summarises all results related to company specific parameters for the BEREC peer group. It has been compiled using the results of Ch. 2 to 6.

[163] Credit Suisse Global Investment returns Yearbook 2023, E, Dimson, P. Marsh M. Staunton (p. 20 Chapter 2)

Table 12 BEREC peer group 2024 – Overview of results for company specific parameters

Peer Group Company	SMP (legacy infrastruct.)	Company Credit Rating (S&P)	Country	Country Credit Rating (Moody's)	Debt Premium	RFR (domestic = national) of home country	Cost of Debt (=Debt Premium + RFR)	Equity beta	Gearing	Asset beta
Deutsche Telekom AG	Yes	BBB+	DE	AAA	132	0.6	192	0.72	58.08%	0.36
DIGI Communications N.V.	No	BB-	RO	BAA3	-	5.31	-	0.5	72.83%	0.21
Elisa Oyj	Yes	BBB+	FI	AA1	90	1.02	192	0.48	12.57%	0.43
Koninklijke KPN N.V.	No	BBB	NL	AAA	116	0.8	196	0.53	35.62%	0.38
NOS	No	BBB-	PT	A3	-	1.45	-	0.63	41.31%	0.41
Orange S.A.	Yes	BBB+	FR	AA2	83	1.05	188	0.58	56.68%	0.31
Proximus S.A.	Yes	BBB+	BE	AA3	90	1.08	198	0.57	38.78%	0.39
Tele 2 AB	No	BBB	SE	AAA	150	0.96	246	0.53	25.41%	0.42
Telecom Italia	Yes	B+	IT	BAA3	234	2.33	466	1.06	78.06%	0.31
Telefónica S.A.	Yes	BBB-	ES	BAA1	47	1.51	198	0.93	62.75%	0.41
Telekom Austria AG	No	A-	AT	AA1	-	1.03	-	0.67	33.11%	0.48
Telenor	Yes	A-	NO	AAA	119	2.11	331	0.3	36.23%	0.23
Telia Company AB	No	BBB+	SE	AAA	137	0.96	234	0.54	40.70%	0.36
Vodafone Group plc	No	BBB	UK	AA3	136	1.80	316	0.85	61.17%	0.39

KPN, Telekom Austria and Telia (until 21st April 2024) are no longer designated as SMP operators on legacy networks; however, they have either binding commitments or are in the transition period where they still have to provide access.

Table 13 Major EU/Peer Group Operators' Ownership[164]

Country	SMP/Other Operator	Included in Peer Group (directly or indirectly)	Publicly Traded (directly or indirectly)	Major owners
AT	Telekom Austria	Yes	Yes	America Movil 51%, Oesterreichische Beteiligungs AG 28.42%
BE	Proximus	Yes	Yes	Kingdom of Belgium 53.51%, Proximus SADP 4.61%, Vanguard Group Inc 1.57%
BG	Vivacom (previous Bulgarian Telecommunications Company (BTC) No longer SMP operator	No	No	United Group
HR	Hrvatski Telekom (T-HT)	Yes	Yes	Deutsche Telekom 53.55%, OTP Banka Dionicko Drustvo 11.79%, Raiffeisen OMF Kat B 11.31%
CY	CYTA	No	No	Semi-government organisation
CZ	CETIN	No	No	PPF Group
DK	TDC	No	No	Pension funds: ATP, PFA and PKA, infrastructure fund MIRA.
EE	Telia Eesti	Yes	Yes	Telia Company
FI	DNA Elisa	Yes	Yes	DNA is owned by Telenor. Elisa is owned by institutional owners, of which The Finnish state owns 10%, Black Rock 3.99%

[164] Source: Bloomberg and BEREC survey (referring to publicly listed companies).

	Telia Finland			Telia Finland is owned by Telia Company.
FR	Orange	Yes	Yes	French Republic 13.39%, Credit Agricole Group 11.33%, BPI France SA 9.56%
DE	Deutsche Telekom	Yes	Yes	Kreditanstalt fuer Wiederaufbau 16.60%, Federal Republic of Germany 13.80%, SoftBank Group Corp 4.50%
EL	Hellenic Telecommunications Organization (OTE)	Yes	Yes	Deutsche Telekom 50.86%, Massachusetts Financial Services Co 5.43%, Hellenic Republic 5.00%.
HU	Magyar Telekom	Yes	Yes	Deutsche Telekom 61.38%
IE	Eircom	No	No	Private consortium controlled by Iliad SA and NJJ Telecom Europe fund
IT	Telecom Italia	Yes	Yes	Vivendi 23.75%, Cassa Depositi e Prestiti SpA 9.81%.
LV	Tet (former Lattelecom)	Yes	Yes	Latvian Government 51% and Telia Company 49%
LT	Telia Lietuva AB	Yes	Yes	Telia Company 88.15%
LU	Entreprise des Postes et Télécommunications (Post Luxembourg)	No	No	Luxembourg state 100%
MT	Go	No	Yes	TT ML Limited 65.4% (owned by Telecom Tunisia), Institutional owners 34.6%
NL	Koninklijke KPN	Yes	Yes	Capital Group Cos 7.76%, BlackRock Inc 5.28, Vanguard Group Inc 3.35%%.
NO	Telenor	Yes	Yes	Norway Ministry of Trade Industry & Fisheries 53.97%,

				Folketrygdfondet 4.33%, BlackRock Inc 2.51%
PL	Orange Polska/Telekomunikacja Polska/Polish Telekom (TPSA)	Yes	Yes	Orange SA 50.67%, Nationale-Nederlanden OFE 5.49%, Allianz SA 7.96%, Powszechne Towarzystwo Emerytalne Allianz Polska SA. 7.70%
PT	MEO NOS	Yes	Yes	MEO is SMP operator. It is not listed owned by Altice which is privately owned. NOS is not a SMP operator, owned by Sonae SGPS SA 37.37%, Zopt SGPS SA 26.07%, Emirate of Abu Dhabi United Arab Emirates 5%
RO	Orange Romania Communications SA Digi Romania	Yes	Yes	Orange Romania 54%, Romanian State 46% Digi Communications N.V., and institutional owners
SK	Slovak Telekom	Yes	Yes	Deutsche Telekom 100%
SI	Telekom Slovenije	No	Yes	Republic of Slovenia 62.54%, Kapitalska Družba 5.59%, Slovenian Sovereign Holdning 4.25%
ES	Telefonica	Yes	Yes	Sociedad Estatal de Participacion Industriales 5.03%, Criteria Caiza SA 5.01%, Saudi Telecom Co 4.90%
SE	Telia	Yes	Yes	Kingdom of Sweden 41.08%, Telia Co AB 4.06%, Black Rock Inc 3.33%

The result for the ERP is as follows. Based on the calculations described in Chapter 6 (and shown in Table 10) above BEREC considers that the appropriate value of the single EU-wide

ERP is **5.95 %** (AM) and the single EU/EEA-wide ERP relevant only for the EEA countries Norway and Iceland is 5.92 % (AM).

7.2. Taxes and inflation

Section 6 of the Notice describes the taxes and inflation. Acc. to para. 60 it is appropriate to use the relevant domestic corporate tax rate.

Acc. to para 63 a Eurozone-wide inflation rate is appropriate for Eurozone Member States, for non-Eurozone Member States national inflation estimates may be justified. As a forecast the 5 year-ahead inflation forecast of the ECB is considered appropriate.

The latest available 5-year-ahead inflation forecast of the ECB is 2.0 % (as of Q2/2024).[165]

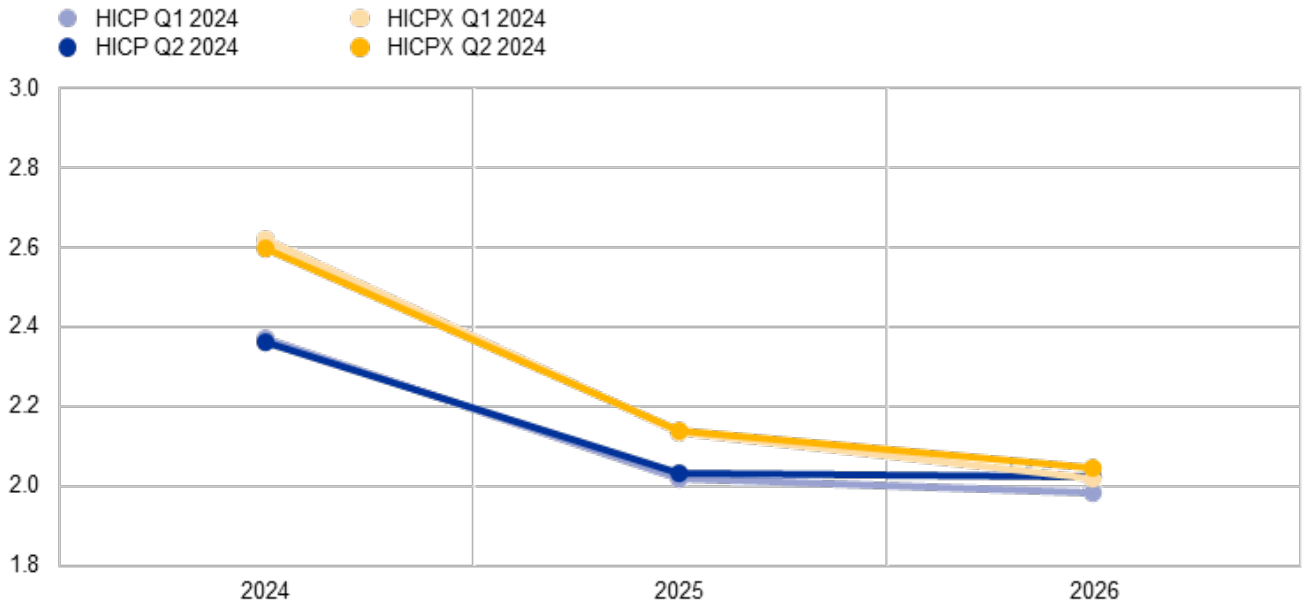
Market participants expect that inflation will be declining from 2.4% in 2024 to 2.0% in both 2025 and 2026. This is unchanged from the previous survey. For the longer term (for 2028) the inflation rate is expected to stand at 2.0% which corresponds to the target level of 2.0%.

> *"**SPF respondents' HICP inflation expectations for 2024 to 2026 were unchanged.** Headline inflation was expected to decline from 2.4% in 2024 to 2.0% in both 2025 and 2026 (see **Figure 4**). Respondents' qualitative explanations indicate that the main reasons behind the expected profile of inflation were similar to those given in the previous survey round. In particular, labour market tightness and wage growth were still viewed as high, but were also generally expected to moderate and thereby underpin the return of both headline inflation and HICP inflation excluding energy and food (HICPX) to 2.0%. Compared with the March 2024 ECB staff macroeconomic projections for the euro area, inflation expectations in this survey round were 0.1 percentage points higher for 2024 and 2026, but the same for 2025."*[166]

[165] The ECB inflation forecast is based on a survey of professional forecasters (SPF), which began in 1999, collects information on the expected rates of inflation, real GDP growth and unemployment in the euro area at several horizons, ranging from the current year to the longer term. Expectations are reported not only as point forecasts, but also as probability distributions, providing a quantitative assessment of risk and uncertainty. The aggregate results and microdata are published four times a year. The next update will be on 19th July 2024 (provisionally). For further information: https://www.ecb.europa.eu/stats/ecb_surveys/survey_of_professional_forecasters/html/index.en.html.

[166] https://www.ecb.europa.eu/stats/ecb_surveys/survey_of_professional_forecasters/html/index.en.html

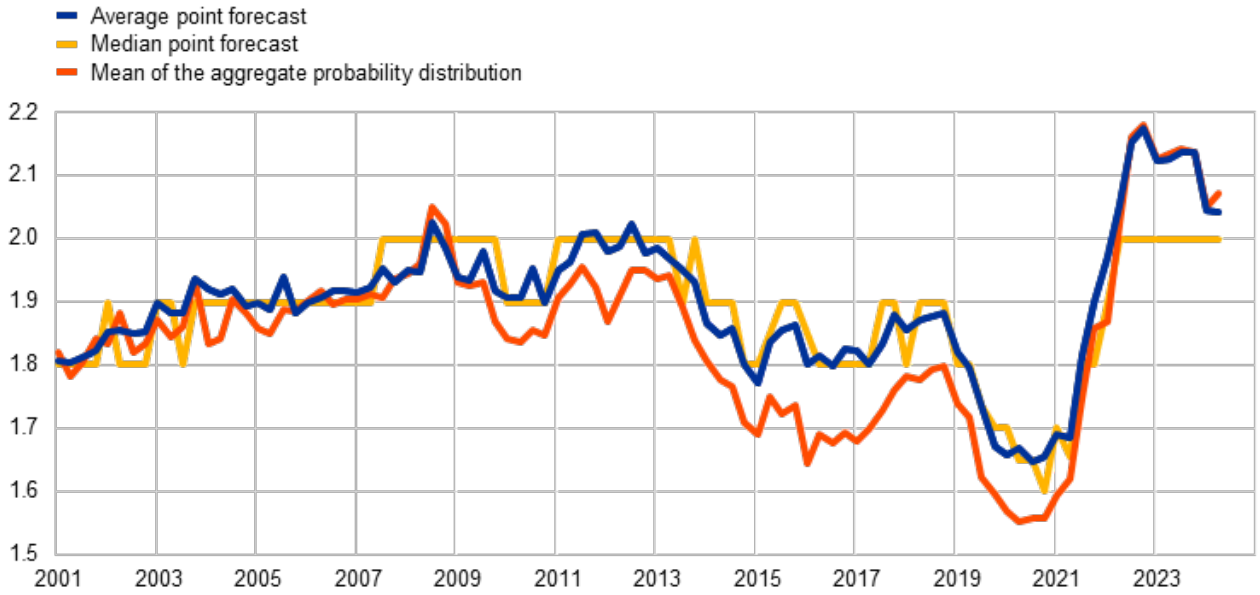
Figure 4 Inflation expectations: overall HICP inflation and HICP inflation excluding energy, food, alcohol and tobacco (annual percentage changes)



"Longer-term inflation expectations (which refer to 2028) were unchanged at 2.0%. *Thus, having stood at 2.1% since the second quarter of 2022 (after Russia's invasion of Ukraine), average longer-term inflation expectations in the SPF have been at the target level of 2.0% in the past two survey rounds. This evolution also holds when excluding the two highest and lowest responses or when considering a balanced panel of those who also replied in the first quarter of 2024 survey round.[3] The median and modal point expectations were also unchanged at 2.0% (see* ***Figure 5****)."*[167]

[167] https://www.ecb.europa.eu/stats/ecb_surveys/survey_of_professional_forecasters/html/index.en.html

Figure 5 Longer-term inflation expectations (annual percentage changes)



With regard to the issue of how to deal with a temporarily increased inflation rate BEREC points to the statements made in its recent Opinion on the Draft Gigabit Recommendation. BEREC states that the two issues of dealing with the temporary increased inflation and calculating a VHCN risk premium for new investment network projects should be clearly separated.[168] BEREC considers that the stability and predictability principle should be taken into account and in order to deal with the inflation rate issue appropriately in light of national circumstances, BEREC suggests that "The weighted average cost of capital (WACC) employed should allow an efficient rate of return on capital employed to reflect the current market situation (for instance a high inflation rate)".[169] As outlined above (section 1.2) the Gigabit Connectivity Recommendation (EU) 2024/539 took on board these suggestions.

Also, on the same issue, BEREC would like to point to the Commission's comments letter in the case of CNMC (ES/2022/2419) of 16 December 2022 and more recently in the case of AGCOM (IT/2023/2435) of 26 April 2023. Given that inflation rates are declining, and the effect of a temporarily increased inflation rate is reflected in the RFR trend (chapter 2), the provisions in the Gigabit Connectivity Recommendation referring to the WACC Notice allow NRAs to deal with macroeconomic developments efficiently and consistently.[170]

Furthermore, BEREC wants to highlight that the inflation is dealt with in a forward looking manner taking into account the ECB forecast for the future WACC in line with the Notice at the time of the regulatory decision. This cannot be adjusted retroactively.

[168] BEREC Opinion on the Draft Gigabit Recommendation (BoR (23) 83), p. 35-37, which is available here: https://www.berec.europa.eu/en/document-categories/berec/opinions/berec-opinion-on-the-draft-gigabit-recommendation.
[169] BEREC Opinion on the Draft Gigabit Recommendation (BoR (23) 83), p. 36.
[170] Cf. also Annex 6 – Overview of Commission comments on WACC notifications of NRAs.

7.3. Comparison to last year's Report

The 2024 WACC parameters Report is the fifth BEREC Report, therefore high level comparisons can be made between the 2024 and the 2023 Reports. The WACC methodology as provided for in the Notice and the BEREC WACC parameters Report carefully balance consistency, transparency and continuity, i.e. aiming to reflect market realities of 27 EU Member States as well as the convergence towards an EU-wide capital market. The latter is accounted for by estimating an **EU-ERP** using the CAPM. The CAPM assumes a rational investor acting in an efficient capital market which is the state of the art approach to estimate the cost of equity (as a fair reward for taking the risk to invest) and thus provides *objective* results of expected returns based on the comprehensive historic data series.

First, this year's Report uses the same methodology as last year's Report, so the difference in parameter values is attributable to factual developments. The results based on the application of the methodology of the WACC Notice reflect the fundamental factors driving the cost of capital. As shown above, the ERP is now estimated at 5.95% (AM) compared to 5.92 % (AM last year). This and the fact that the level of the ERP has decreased over the last two years compared to the peak in 2021, even if it is still higher than the average of the last 123 years is in line with the stabilization of the economic conditions.[171]

Second, as the BEREC peer group the EU/EEA area is considered as a whole, no distinction needed to be made when the eligibility criteria are fulfilled, thus Telenor was included in 2021. In 2022 DIGI Communications was added as it fulfills the eligibility criteria for the first time. In 2023 the peer group remained unchanged, i.e. the same 15 companies included in 2022 are the peers 2023. In 2024 Telenet was taken out as it was acquired by Global Liberty, thus the number of peers is now 14 (compared to 15 previously).

Another important point to highlight is the continued effort undertaken by BEREC to incorporate the longer time series available for non-DMS countries for the calculation of the EU-wide ERP and the fact that with Bloomberg a single data source could be used, which improves the robustness of the results. Generally, relying on long(er) time series of historical returns (such as the DMS data now including also Greek data) is evidence based and contributes to the reliability of the results as short term volatilities are reduced. The application of the historical data series for both Bond and Equity index for the ERP estimation provides the best estimate in the long run perspective based on empirical evidence on the Equity premium over bond compared to other methodologies available.

This approach is in line with the objectives of the WACC Commission Notice: i) to improve consistency in the methodology; ii) to enhance regulatory predictability by limiting unexpected variations in the methodology and the value over time; iii) to promote efficient investment and

[171] Cf. for a more detailed analysis Ch. 6.5 above and the UBS Global Investment Returns Yearbook 2024 Summary Edition, available here: Global Investment Returns Yearbook 2024 | UBS Global.

innovation by setting rates reflecting the appropriate level of risk; iv) to provide more transparency to all stakeholders on the way the calculations are done.

Comparison with values reported in previous BEREC WACC parameters Reports (2020 – BoR (20) 116, 2021 – BoR (21) 86, 2022 – BoR (22) 70, and 2023 – BoR (23) 90) are given. BEREC observes that over time most NRAs follow the Notice and use the BEREC parameter values in their national decisions, thus convergence can be seen.

Annex

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Abbreviations

A

AM	Arithmetic mean

B

BEREC	Body of European Regulators for Electronic Communications
Bloomberg	Bloomberg financial system

C

CAPM	Capital Asset Pricing Model
CFA	Charted Financial Analysts Institute
Credit Suisse Yearbook	Credit Suisse Global Investment Returns Yearbook 2022

D

DMS	Dimson/Marsh/Staunton dataset (distributed by Morningstar)

E

ECB	European Central Bank
ERP	Equity Risk Premium
EUR	Euro
Eurostat	European Statistical Office

G

GDP	Gross Domestic Product
GM	Geometric mean

H

HICP	Harmonised Index of Consumer Prices

M

M&A	Merger and Acquisitions

N

NGA	Next Generation Access network
NOK	Norwegian crowns
Notice	Commission Notice on the calculation of t. cost of capital of 6th Nov. 19
NRA	National Regulatory Authority

O

OAO	Other Authorised Operator
OLS	Ordinary least square

P

P/E ratio	Price-to-earnings ratio

R

RA Report	BEREC Regulatory Accounting in Practice Report
RFR	Risk-free rate
RON	Romanian lei

S

S&P	Standard & Poor's
SEK	Swedish crowns
SMP	Significant Market Power
STOXX Europe TMI	STOXX Europe Total Market Index
SWD	European Commission Staff Working Document

W

WACC	Weighted Average Cost of Capital

Annex 1: RFR

Long-term government bond yields - EMU convergence criterion series - monthly data[172]

	2019-04	2019-05	2019-06	2019-07	2019-08	2019-09	2019-10	2019-11	2019-12	2020-01	2020-02	2020-03	2020-04	2020-05	2020-06	2020-07	2020-08	2020-09	2020-10	2020-11	2020-12	2021-01	2021-02	2021-03	2021-04	2021-05	2021-06	2021-07	2021-08	2021-09	2021-10	2021-11	2021-12	2022-01	2022-02	2022-03	2022-04	2022-05	2022-06	2022-07	2022-08	2022-09	2022-10	2022-11	2022-12	2023-01	2023-02	2023-03	2023-04	2023-05	2023-06	2023-07	2023-08	2023-09	2023-10	2023-11	2023-12	2024-01	2024-02	2024-03	5 Y Avg.
Austria	0.31	0.24	0.03	-0.10	-0.37	-0.30	-0.20	-0.09	-0.04	-0.09	-0.26	-0.09	0.05	-0.10	-0.13	-0.25	-0.28	-0.32	-0.40	-0.41	-0.42	-0.49	-0.20	-0.09	-0.04	0.08	0.02	-0.13	-0.23	-0.08	0.08	-0.01	-0.05	0.18	0.54	0.72	1.29	1.54	2.07	1.70	1.68	2.46	2.92	2.70	2.74	2.81	3.04	3.06	3.03	3.03	3.05	3.12	3.18	3.29	3.49	3.21	2.68	2.76	2.89	2.85	1.03
Belgium	0.47	0.41	0.15	0.00	-0.28	-0.24	-0.16	-0.04	0.01	-0.03	-0.13	-0.02	0.14	0.04	-0.04	-0.17	-0.21	-0.25	-0.34	-0.38	-0.39	-0.36	-0.21	-0.04	0.04	0.18	0.12	-0.03	-0.14	0.01	0.16	0.07	0.03	0.26	0.59	0.79	1.30	1.58	2.13	1.80	1.71	2.45	2.84	2.65	2.70	2.79	2.96	3.04	3.06	3.04	3.05	3.14	3.22	3.32	3.52	3.23	2.70	2.81	2.95	2.91	1.08
Bulgaria	0.50	0.48	0.32	0.43	0.35	0.35	0.25	0.22	0.18	0.15	0.12	0.15	0.20	0.20	0.68	0.50	0.26	0.20	0.20	0.20	0.19	0.19	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.25	0.25	0.44	0.57	0.61	1.09	1.62	1.62	1.77	1.85	1.85	1.85	1.85	1.85	1.85	1.85	2.73	4.21	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.01	3.94	3.93	3.93	1.39
Croatia	1.82	1.69	1.36	1.06	0.83	0.49	0.47	0.53	0.59	0.61	0.57	0.96	1.24	0.91	0.96	0.97	0.85	0.79	0.78	0.73	0.63	0.59	0.52	0.51	0.50	0.50	0.49	0.45	0.43	0.37	0.32	0.32	0.38	0.70	1.23	2.08	2.44	2.96	3.02	3.31	2.48	3.18	4.02	3.57	3.36	3.65	3.76	3.86	3.72	3.71	3.73	3.74	3.93	3.95	4.18	3.93	3.39	3.29	3.30	3.29	1.87
Cyprus	1.49	1.34	0.82	0.66	0.44	0.48	0.51	0.58	0.57	0.61	0.56	1.26	1.87	1.69	1.05	0.95	0.89	0.72	0.44	0.29	0.19	0.21	0.30	0.39	0.41	0.54	0.36	0.25	0.15	0.23	0.39	0.55	0.64	0.86	1.59	1.92	2.26	2.69	3.42	3.41	3.07	3.70	4.20	4.19	4.20	4.19	4.12	4.28	4.01	3.97	3.79	3.74	3.84	3.99	4.13	3.79	3.23	3.27	3.32	3.21	1.90
Czechia	1.82	1.86	1.58	1.36	0.99	1.24	1.32	1.47	1.51	1.62	1.47	1.28	1.28	0.92	0.86	0.86	0.95	0.98	0.94	1.12	1.26	1.28	1.49	1.87	1.86	1.74	1.67	1.72	1.74	1.90	2.34	2.62	2.62	3.12	3.03	3.53	4.01	4.61	5.12	4.40	4.11	4.72	5.52	5.11	4.71	4.47	4.61	4.67	4.65	4.50	4.35	4.15	4.26	4.49	4.72	4.42	3.97	3.88	3.76	3.82	2.77
Denmark	0.08	0.04	-0.22	-0.31	-0.58	-0.59	-0.43	-0.31	-0.26	-0.26	-0.41	-0.41	-0.21	-0.29	-0.26	-0.34	-0.36	-0.39	-0.46	-0.46	-0.47	-0.44	-0.28	-0.03	0.00	0.11	0.11	-0.05	-0.16	-0.01	0.10	0.01	-0.08	0.11	0.46	0.57	1.04	1.30	1.84	1.59	1.38	2.20	2.60	2.38	2.29	2.43	2.55	2.55	2.60	2.54	2.57	2.70	2.77	2.83	3.05	2.79	2.28	2.31	2.37	2.32	0.81
Estonia	0.91	0.93	0.79	0.68	0.50	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.05	0.00	0.01	-0.08	-0.14	-0.18	-0.19	-0.11	0.05	0.09	0.16	0.13	0.09	0.02	0.03	0.18	0.20	0.11	0.31	0.79	1.20	1.49	1.91	2.48	2.66	2.38	2.93	4.07	3.75	3.46	3.79	3.83	3.96	3.89	3.94	3.94	4.09	4.15	4.25	4.09	3.67	3.21	3.31	3.49	3.49	1.49
Finland	0.34	0.25	0.05	-0.09	-0.35	-0.30	-0.21	-0.08	-0.04	-0.07	-0.25	-0.12	0.03	-0.12	-0.18	-0.21	-0.25	-0.30	-0.38	-0.40	-0.41	-0.38	-0.22	-0.13	-0.08	0.05	-0.02	-0.10	-0.21	-0.07	0.08	0.00	-0.06	0.18	0.51	0.72	1.18	1.43	2.06	1.72	1.63	2.53	2.90	2.69	2.71	2.77	2.94	2.98	2.96	2.98	3.00	3.07	3.15	3.25	3.47	3.20	2.68	2.80	2.88	2.85	1.02
France	0.37	0.30	0.08	-0.07	-0.34	-0.28	-0.16	-0.02	0.04	-0.01	-0.18	-0.06	0.06	-0.03	-0.04	-0.15	-0.17	-0.21	-0.30	-0.33	-0.34	-0.31	-0.15	-0.07	-0.01	0.21	0.15	-0.01	-0.11	0.04	0.20	0.09	0.05	0.31	0.68	0.78	1.28	1.52	2.06	1.71	1.69	2.41	2.77	2.58	2.62	2.69	2.87	2.92	2.90	2.94	2.93	3.04	3.11	3.24	3.45	3.19	2.65	2.74	2.85	2.82	1.05
Germany	-0.04	-0.13	-0.31	-0.39	-0.65	-0.59	-0.47	-0.35	-0.30	-0.31	-0.47	-0.54	-0.45	-0.52	-0.43	-0.52	-0.52	-0.52	-0.61	-0.61	-0.62	-0.58	-0.45	-0.36	-0.33	-0.22	-0.29	-0.45	-0.54	-0.36	-0.21	-0.31	-0.38	-0.12	0.15	0.28	0.75	0.95	1.45	1.08	1.03	1.80	2.19	2.07	2.09	2.19	2.37	2.38	2.36	2.34	2.38	2.46	2.55	2.66	2.82	2.60	2.10	2.18	2.33	2.35	0.60
Greece	3.42	3.37	2.67	2.16	1.98	1.50	1.34	1.36	1.42	1.34	1.07	1.97	2.05	1.93	1.32	1.14	1.08	1.08	0.90	0.75	0.63	0.65	0.81	0.91	0.88	0.99	0.81	0.70	0.59	0.80	0.96	1.22	1.29	1.62	2.46	2.61	2.89	3.54	3.93	3.38	3.46	4.44	4.87	4.42	4.22	4.29	4.26	4.29	4.22	3.98	3.71	3.85	3.88	4.08	4.30	3.88	3.28	3.29	3.45	3.37	2.42
Hungary	3.14	3.19	2.74	2.33	1.83	2.02	1.95	1.95	1.88	2.08	2.15	2.43	2.49	1.99	2.19	2.23	2.18	2.39	2.27	2.15	2.16	2.22	2.43	2.68	2.69	2.94	2.85	2.83	2.84	3.10	3.69	4.07	4.40	4.71	4.86	5.92	6.59	7.20	7.95	8.51	8.19	9.23	10.25	8.81	8.63	7.76	8.23	8.54	8.35	7.78	7.20	7.10	7.40	7.08	7.53	7.01	6.17	5.98	6.22	6.49	4.74
Ireland	0.56	0.50	0.27	0.13	-0.05	-0.01	0.02	0.07	0.04	0.00	-0.13	0.07	0.20	0.11	0.08	-0.05	-0.12	-0.13	-0.22	-0.25	-0.29	-0.24	-0.06	0.03	0.08	0.24	0.18	0.03	-0.08	0.07	0.22	0.19	0.10	0.38	0.78	0.93	1.40	1.63	2.13	1.74	1.71	2.42	2.71	2.53	2.59	2.65	2.86	2.86	2.77	2.79	2.78	2.90	2.96	3.09	3.27	3.01	2.46	2.60	2.78	2.75	1.08
Italy	2.62	2.64	2.28	1.65	1.40	0.90	1.00	1.27	1.37	1.28	0.96	1.55	1.80	1.76	1.46	1.20	1.03	0.98	0.77	0.66	0.58	0.62	0.59	0.70	0.80	0.98	0.88	0.75	0.63	0.78	0.96	1.01	1.05	1.35	1.79	1.85	2.44	2.99	3.64	3.36	3.30	4.14	4.53	4.24	4.26	4.24	4.27	4.24	4.23	4.31	4.07	4.16	4.22	4.51	4.89	4.43	3.82	3.81	3.87	3.70	2.33
Latvia	0.58	0.51	0.33	0.15	-0.07	-0.11	0.00	0.10	0.16	0.11	-0.04	-0.06	0.30	0.26	0.01	-0.17	-0.19	-0.20	-0.23	-0.25	-0.29	-0.29	-0.25	-0.20	-0.21	-0.06	0.14	0.09	0.00	0.02	0.17	0.26	0.30	0.38	0.79	1.20	1.59	1.99	2.55	2.47	2.29	2.96	3.81	3.74	3.50	3.70	3.68	3.91	3.88	3.83	3.79	3.81	3.85	3.88	4.14	3.98	3.49	3.38	3.41	3.40	1.40
Lithuania	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.97
Luxembourg	0.11	0.02	-0.16	-0.28	-0.54	-0.50	-0.40	-0.27	-0.23	-0.25	-0.43	-0.36	-0.25	-0.32	-0.34	-0.43	-0.45	-0.50	-0.54	-0.54	-0.55	-0.54	-0.45	-0.40	-0.38	-0.31	-0.33	-0.40	-0.47	-0.37	-0.20	-0.21	-0.22	-0.04	0.40	0.55	1.39	1.66	2.16	1.85	1.84	2.55	2.99	2.70	2.68	2.70	2.89	2.99	2.96	2.95	2.95	3.03	3.08	3.16	3.32	3.03	2.53	2.61	2.82	2.79	0.88
Malta	1.00	0.95	0.73	0.52	0.21	0.19	0.26	0.37	0.40	0.38	0.26	0.40	0.57	0.70	0.76	0.64	0.54	0.51	0.38	0.37	0.27	0.32	0.41	0.40	0.44	0.53	0.50	0.49	0.44	0.57	0.67	0.64	0.59	0.80	1.21	1.26	1.71	1.98	2.59	2.61	2.61	3.30	3.80	3.44	3.59	3.55	3.61	3.58	3.60	3.64	3.68	3.78	3.79	3.93	4.18	3.86	3.31	3.38	3.48	3.40	1.67
Netherlands	0.20	0.11	-0.09	-0.21	-0.50	-0.43	-0.31	-0.19	-0.14	-0.17	-0.34	-0.33	-0.22	-0.31	-0.29	-0.39	-0.41	-0.44	-0.53	-0.54	-0.55	-0.53	-0.39	-0.33	-0.30	-0.19	-0.24	-0.38	-0.48	-0.34	-0.18	-0.27	-0.32	-0.10	0.24	0.34	0.85	1.05	1.82	1.47	1.41	2.14	2.52	2.35	2.43	2.50	2.68	2.76	2.72	2.73	2.75	2.84	2.92	3.04	3.21	2.95	2.42	2.51	2.64	2.62	0.80
Poland	2.76	2.72	2.35	2.13	1.93	2.02	1.96	2.05	2.03	2.23	2.07	1.80	1.46	1.35	1.31	1.33	1.32	1.35	1.26	1.20	1.29	1.19	1.31	1.53	1.55	1.82	1.78	1.61	1.60	1.87	2.63	3.12	3.35	4.00	3.95	4.83	5.96	6.64	7.14	6.37	5.80	6.28	7.82	7.24	6.61	6.02	6.18	6.14	6.07	5.93	5.91	5.54	5.59	5.68	5.84	5.54	5.21	5.24	5.36	5.40	3.66
Portugal	1.18	1.02	0.59	0.44	0.17	0.20	0.19	0.35	0.41	0.37	0.25	0.71	0.97	0.81	0.53	0.40	0.36	0.32	0.18	0.07	0.03	0.03	0.16	0.23	0.35	0.53	0.43	0.27	0.14	0.26	0.39	0.39	0.36	0.58	1.06	1.16	1.76	2.14	2.65	2.26	2.16	2.89	3.26	3.02	3.10	3.13	3.27	3.27	3.20	3.16	3.09	3.23	3.31	3.45	3.59	3.30	2.86	2.97	3.06	3.02	1.45
Romania	4.91	4.93	4.59	4.51	4.12	4.12	4.12	4.29	4.57	4.28	4.04	4.56	4.83	4.54	3.89	3.94	3.88	3.49	3.29	3.04	2.94	2.72	2.65	2.96	2.84	3.03	3.11	3.24	3.72	4.00	4.75	5.11	5.37	5.37	5.60	6.20	6.61	7.84	8.74	9.26	8.14	8.07	9.13	7.65	7.17	6.80	7.46	7.10	7.00	6.30	6.11	6.20	6.34	7.48	6.81	6.75	6.19	6.14	6.06	5.96	5.31
Slovakia	0.57	0.45	0.25	0.02	-0.34	-0.34	-0.20	0.09	0.13	0.13	0.00	0.04	0.69	0.56	0.04	-0.16	-0.22	-0.27	-0.35	-0.39	-0.52	-0.43	-0.18	-0.05	-0.06	0.07	0.03	-0.14	-0.25	-0.08	0.13	0.02	-0.02	0.25	0.71	0.99	1.53	1.87	2.38	2.14	2.03	2.87	3.55	3.37	3.20	3.25	3.40	3.58	3.66	3.59	3.62	3.69	3.80	3.91	4.12	3.86	3.31	3.39	3.51	3.51	1.31
Slovenia	0.52	0.38	0.19	-0.01	-0.06	-0.16	-0.09	-0.01	0.02	0.09	0.04	0.02	0.27	0.74	0.42	0.09	-0.10	-0.08	-0.13	-0.18	-0.23	-0.17	0.02	0.03	0.02	0.21	0.15	0.14	-0.09	0.05	0.17	0.15	0.17	0.40	0.70	1.04	1.55	1.82	2.09	2.10	1.71	1.70	2.51	3.56	3.52	3.25	3.38	3.54	3.34	3.15	3.38	3.40	3.48	3.47	3.67	3.53	3.26	3.06	3.22	3.20	1.26
Spain	1.05	0.87	0.50	0.35	0.14	0.18	0.20	0.39	0.44	0.42	0.27	0.52	0.82	0.74	0.51	0.37	0.29	0.27	0.17	0.09	0.04	0.08	0.23	0.31	0.37	0.52	0.45	0.33	0.21	0.33	0.47	0.47	0.41	0.66	1.11	1.22	1.69	2.04	2.63	2.31	2.15	2.92	3.29	3.07	3.09	3.20	3.39	3.43	3.40	3.41	3.40	3.49	3.57	3.71	3.95	3.65	3.12	3.18	3.27	3.19	1.51
Sweden	0.23	0.07	-0.09	-0.12	-0.36	-0.23	-0.16	0.00	0.07	0.11	-0.05	-0.17	-0.07	-0.06	0.01	-0.07	-0.04	-0.08	-0.03	0.00	0.01	0.07	0.25	0.40	0.37	0.42	0.36	0.18	0.11	0.27	0.38	0.27	0.14	0.36	0.61	0.82	1.47	1.77	1.86	1.53	1.61	2.08	2.27	2.05	1.97	2.08	2.37	2.35	2.37	2.32	2.46	2.52	2.75	2.87	3.02	2.75	2.21	2.23	2.43	2.40	0.96
Iceland	4.14	4.21	3.90	3.82	3.61	3.51	3.37	3.69	3.44	3.18	2.88	2.60	2.35	2.25	2.53	2.53	2.61	2.69	3.01	3.12	3.18	3.40	3.61	3.49	3.76	3.74	3.51	3.45	3.58	3.90	4.03	3.95	4.07	4.47	4.54	5.13	5.15	5.25	5.67	5.56	5.69	5.94	6.17	6.27	6.29	6.46	7.32	6.51	6.51	6.53	6.51	6.65	6.89	7.51	7.57	7.28	6.93	6.81	6.48	6.86	4.67
Norway	1.74	1.56	1.46	1.36	1.13	1.23	1.36	1.38	1.55	1.31	1.12	0.87	0.62	0.58	0.61	0.55	0.79	0.61	0.68	0.83	0.94	1.03	1.44	1.52	1.49	1.52	1.36	1.18	1.27	1.58	1.68	1.48	1.70	1.96	2.04	2.54	2.76	2.72	3.01	2.78	3.35	3.30	3.50	3.13	3.19	2.93	3.51	3.02	3.14	3.31	3.63	3.82	3.76	3.94	4.06	3.57	3.26	3.52	3.80	3.54	2.11
UK	1.15	1.06	0.84	0.73	0.49	0.58	0.61	0.73	0.78	0.67	0.57	0.41	0.31	0.22	0.23	0.15	0.21	0.21	0.24	0.31	0.26	0.28	0.56	0.78	0.78	0.82	0.76	0.62	0.57	0.81	1.10	0.93	0.83	1.17	1.45	1.51	1.82	1.90	2.38	2.06	2.25	3.40	3.97	3.29	3.38	3.40	3.45	3.54	3.62	3.95	4.32	4.41	4.49	4.39	4.54	4.24	3.76	3.83	4.06	4.01	1.80

[172] Source: Eurostat IRT_LT_MCBY_M "Long-term government bond yields", monthly data. Online data code TEIMF050. Time series 2019M04 to 2024M03.
Estonia: 5 Year Average derived by BEREC since data for Estonia has only starting to become available in the Eurostat database from 06-2020. Prior data derived by BEREC from Bloomberg.
Iceland, Norway: Derived by BEREC from Bloomberg data. The bonds included have been provided by Bloomberg. Iceland data refer to the ticker "ICEGB 6,5 01/24/31; issued 01/18/2011; currency ISK" (the only government bond with a time to maturity close to 10 years). Norway data refer to the ticker "GTKNOK10YR" (generic 10 Year government bond curve). Over time Bloomberg modifies benchmark bonds to overcome the maturity drift over ten years, whenever better benchmarks become available.

Annex 2: Debt premium and cost of debt

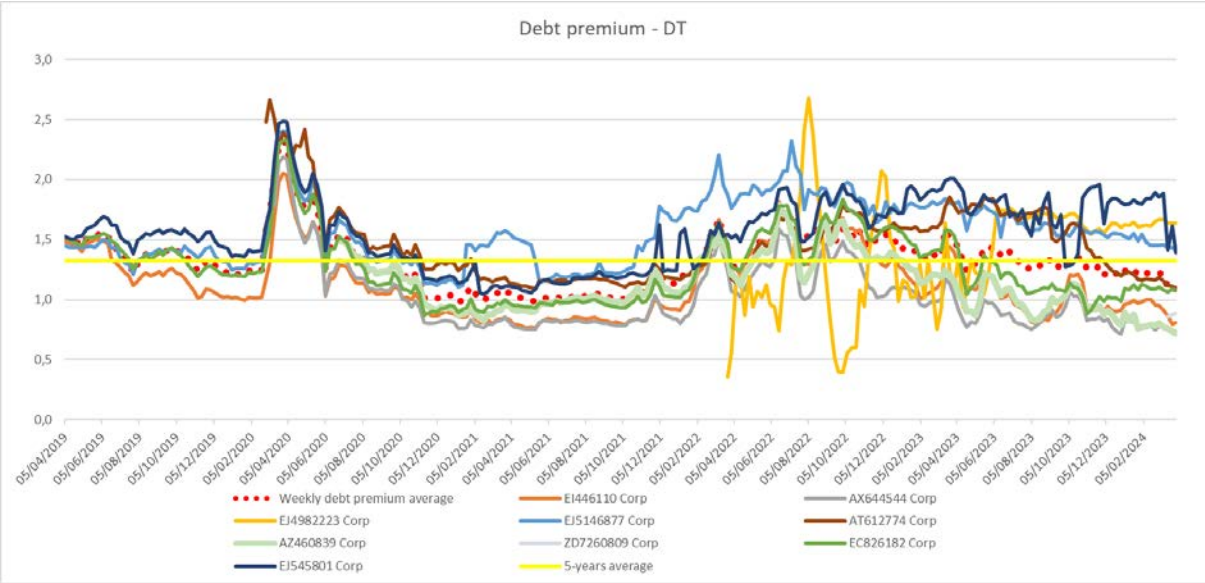
Deutsche Telekom	Issued	Currency	Government bond	Issued	Currency
DT 4 1/2 10/28/30 (EI446110 Corp)	28/10/2010	EUR	DBR 5 1/2 01/04/31 (EC3022802 Govt)	27/10/2000	EUR
DT 1 3/4 03/25/31 (AX644544 Corp)	25/03/2019	EUR	DBR 5 1/2 01/04/31 (EC3022802 Govt)	27/10/2000	EUR
DT 3 12/21/2032 (EJ4982223 Corp)	14/12/2012	EUR	DBR 4 3/4 07/04/34 (EC8300625 Govt)	31/01/2003	EUR
DT 3.55 01/17/33 (EJ5146877 Corp)	14/01/2013	EUR	DBR 4 3/4 07/04/34 (EC8300625 Govt)	31/01/2003	EUR
DT 7 1/2 01/24/33 (EC826182 Corp)	24/01/2003	EUR	DBR 4 3/4 07/04/34 (EC8300625 Govt)	31/01/2003	EUR
DT 3.55 02/11/33 (EJ545801 Corp)	05/02/2013	EUR	DBR 4 3/4 07/04/34 (EC8300625 Govt)	31/01/2003	EUR
DT 2.2 07/25/33 (AT612774 Corp)	16/07/2018	EUR	DBR 4 3/4 07/04/34 (EC8300625 Govt)	31/01/2003	EUR
DT 1 3/8 07/05/34 (AZ460839 Corp)	05/07/2019	EUR	DBR 4 3/4 07/04/34 (EC8300625 Govt)	31/01/2003	EUR
DT 3 ¼ 03/20/36 (ZD7260809 Corp)	13/03/2024	EUR	DBR 0 05/15/36 (BO2212567 Govt)	05/03/2021	EUR
Elisa	**Issued**	**Currency**	**Government bond**	**Issued**	**Currency**
ELIAV 4 01/27/29 (ZI9670665 Corp)	18/09/2023	EUR	RFGB 2 ⅞ 04/15/29 (ZI5153237 Govt)	23/08/2023	EUR
KPN	**Issued**	**Currency**	**Government bond**	**Issued**	**Currency**
KPN 3 ⅞ 07/03/31 (ZJ3117851 Corp)	27/06/2023	EUR	NETHER 0 07/15/31 (BN9427251 Govt)	11/02/2021	EUR
KPN 0 7/8 12/14/32 (ZO366662 Corp)	14/09/2020	EUR	NETHER 2 1/2 01/15/33 (EJ0510671 Govt)	09/03/2012	EUR
KPN 0 7/8 11/15/33 (BS3080196 Corp)	04/11/2021	EUR	NETHER 2 1/2 01/15/33 (EJ0510671 Govt)	09/03/2012	EUR
KPN 3 ⅞ 02/16/36 (ZF8930983 Corp)	07/02/2024	EUR	NETHER 4 01/15/37 (ED9083541 Govt)	25/04/2005	EUR
Orange	**Issued**	**Currency**	**Government bond**	**Issued**	**Currency**
ORAFP 1 7/8 09/12/30 (AU388690 Corp)	12/09/2018	EUR	FRTR 2 1/2 05/25/30 (EK2432749 Govt)	06/05/2014	EUR
ORAFP 2.6 09/17/30 (UV791099 Corp)	17/09/2015	EUR	FRTR 2 1/2 05/25/30 (EK2432749 Govt)	06/05/2014	EUR
ORAFP 1.342 05/29/31 (ZS753679 Corp)	29/05/2019	EUR	FRTR 1 1/2 05/25/31 (UV9949289 Govt)	05/10/2015	EUR
ORAFP 3.625 11/16/2031 (ZN246348 Corp)	16/11/2022	EUR	FRTR 0 11/25/2031 (BO939537 Govt)	12/04/2021	EUR
ORAFP 1 5/8 04/07/32	07/04/2020	EUR	FRTR 5 3/4 10/25/32	12/06/2001	EUR

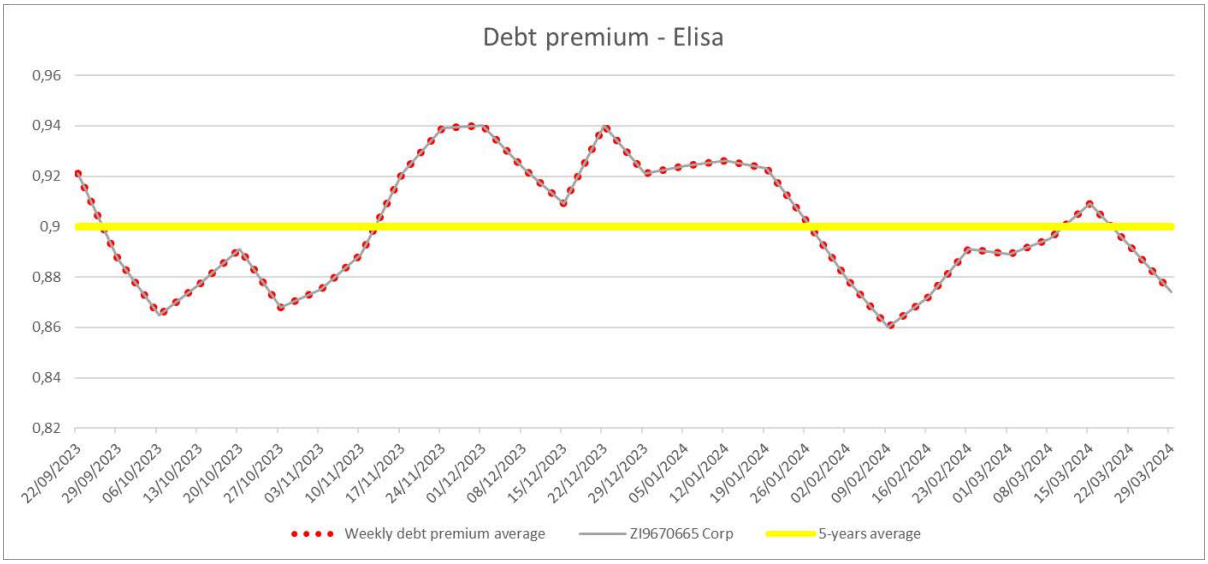
(BH472600 Corp)			(EC3954004 Govt)		
ORAFP 2.375 05/18/2032 (BW487187 Corp)	12/05/2022	EUR	FRTR 5 3/4 10/25/32 (EC3954004 Govt)	12/06/2001	EUR
ORAFP 0 1/2 09/04/32 (ZR363790 Corp)	04/09/2019	EUR	FRTR 5 3/4 10/25/32 (EC3954004 Govt)	12/06/2001	EUR
ORAFP 8 1/8 01/28/33 (EC822743 Corp)	28/01/2003	EUR	FRTR 5 3/4 10/25/32 (EC3954004 Govt)	12/06/2001	EUR
ORAFP 3 3/4 09/30/33 (EJ903924 Corp)	30/09/2013	EUR	FRTR 5 3/4 10/25/32 (EC3954004 Govt)	12/06/2001	EUR
ORAFP 0 5/8 12/16/33 (BS8953389 Corp)	07/12/2021	EUR	FRTR 1 1/4 05/25/34 (AQ9421480 Govt)	05/02/2018	EUR
ORAFP 0 3/4 06/29/34 (BQ2160068 Corp)	23/06/2021	EUR	FRTR 1 1/4 05/25/34 (AQ9421480 Govt)	05/02/2018	EUR
ORAFP 1.2 07/11/34 (AZ540895 Corp)	11/07/2019	EUR	FRTR 1 1/4 05/25/34 (AQ9421480 Govt)	05/02/2018	EUR
ORAFP 3 ⅞ 09/11/35 (ZI729185 Corp)	04/09/2023	EUR	FRTR 4 ¾ 04/25/35 (ED3871594 Govt)	25/04/2003	EUR
Proximus	**Issued**	**Currency**	**Government bond**	**Issued**	**Currency**
(ZL365320 Corp)	01/03/2023	EUR	BGB 0.1 06/22/30 (ZP5129355 Govt)	22/01/2020	EUR
PROXBB 1 3/4 09/08/31 (AX510759 Corp)	08/03/2019	EUR	BGB 1 06/22/31 (EK7448872 Govt)	17/02/2015	EUR
PROXBB 4 ⅛ 11/17/33 (ZG0308046 Corp)	08/11/2023	EUR	BGB 3 06/22/33 (ZM3269150 Govt)	17/01/2023	EUR
PROXBB 3 ¾ 03/27/34 (ZD8913653 Corp)	20/03/2024	EUR	BGB 3 06/22/34 (EK1192989 Govt)	18/03/2014	EUR
PROXBB 0 3/4 11/17/36 (BS3563688 Corp)	08/11/2021	EUR	BGB 1.45 06/22/37 (AN7110397 Govt)	23/05/2017	EUR
Tele2	**Issued**	**Currency**	**Government bond**	**Issued**	**Currency**
TELBSS 0 3/4 03/23/31 (BO6073452 Corp)	16/03/2021	EUR	DBR 0 02/15/31 (BN2612610 Govt)	06/01/2021	EUR
Telecom Italia	**Issued**	**Currency**	**Government bond**	**Issued**	**Currency**
TITIM 7 3/4 01/24/33 (EC817487 Corp)	24/01/2003	EUR	BTPS 5.34 02/01/33 (EC5346845 Govt)	03/07/2022	EUR
Telefonica	**Issued**	**Currency**	**Government bond**	**Issued**	**Currency**
TELEFO 2.592 05/25/2031 (BW667325 Corp)	25/05/2022	EUR	SPGB 0.1 04/30/2031 (BN5127343 Govt)	15/01/2021	EUR
TELEFO 1.93 10/17/31 (QZ843640 Corp)	17/10/2016	EUR	SPGB 5 3/4 07/30/32 (EC3301636 Govt)	23/01/2001	EUR

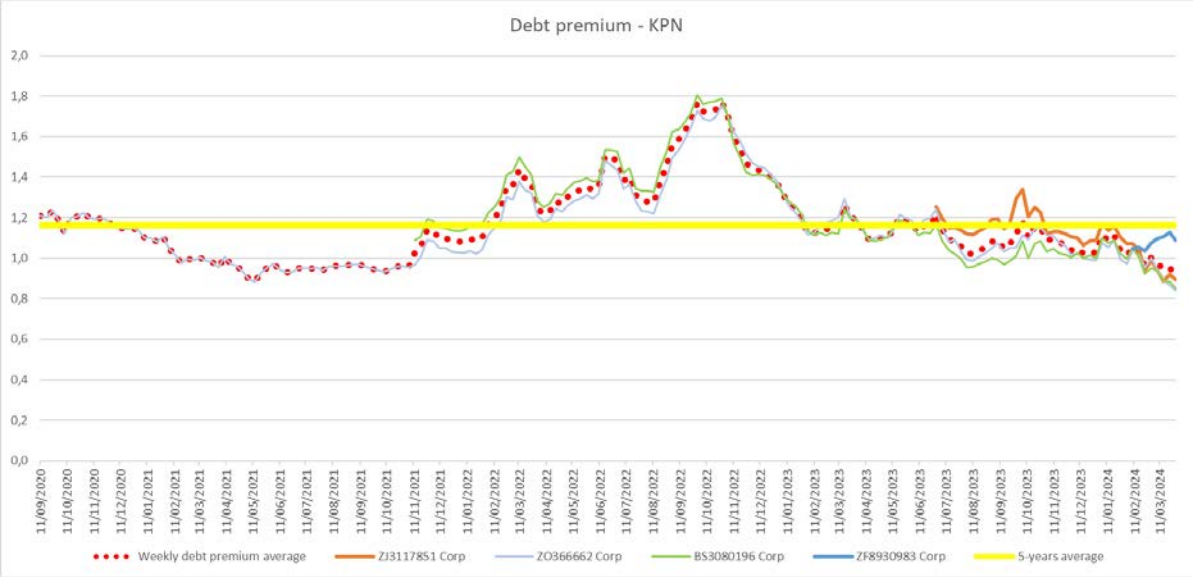
TELEFO 3.698 01/24/32 (ZF3953170 Corp)	17/01/2024	EUR	SPGB 0 ½ 10/31/31 (BQ1838797 Govt)	29/06/2021	EUR
TELEFO 1.807 05/21/32 (BJ468454 Corp)	21/05/2020	EUR	SPGB 5 3/4 07/30/32 (EC3301636 Govt)	23/01/2001	EUR
TELEFO 5 7/8 02/14/33 (EC851195 Corp)	14/02/2003	EUR	SPGB 5 3/4 07/30/32 (EC3301636 Govt)	23/01/2001	EUR
TELEFO 4.183 11/21/33 (ZG1357349 Corp)	14/11/2023	EUR	SPGB 3.55 10/31/33 (ZK9078195 Govt)	14/06/2023	EUR
TELEFO 4.055 01/24/36 (ZF3953154 Corp)	17/01/2024	EUR	SPGB 1.85 07/30/35 (AX4147556 Govt)	05/03/2019	EUR
Telenor	**Issued**	**Currency**	**Government bond**	**Issued**	**Currency**
TELNO 4 10/03/30 (ZH0982673 Corp)	25/09/2023	EUR	DBR 2.4 11/15/30 (ZJ8790413 Govt)	27/07/2023	EUR
TELNO 0 5/8 09/25/31 (ZR673369 Corp)	25/09/2019	EUR	DBR 5 1/2 01/04/31 (EC3022802 Govt)	27/10/2000	EUR
TELNO 1 3/4 05/31/34 (ZS824445 Corp)	31/05/2019	EUR	DBR 4 3/4 07/04/34 (EC8300625 Govt)	31/01/2003	EUR
TELNO 0 7/8 02/14/35 (ZP935488 Corp)	14/02/2020	EUR	DBR 0 05/15/35 (BJ3055610 Govt)	13/05/2020	EUR
TELNO 4 ¼ 10/03/35 (ZH0982681 Corp)	25/09/2023	EUR	DBR 0 05/15/35 (BJ3055610 Govt)	13/05/2020	EUR
Telia	**Issued**	**Currency**	**Government bond**	**Issued**	**Currency**
TELIAS 0 1/8 11/27/30 (BM682080 Corp)	27/11/2020	EUR	DBR 5 1/2 01/04/31 (EC3022802 Govt)	27/10/2000	EUR
TELIAS 5.135 04/01/31 (EI726094 Corp)	01/04/2011	EUR	DBR 5 1/2 01/04/31 (EC3022802 Govt)	27/10/2000	EUR
TELIAS 5.03 07/01/31 (EI726090 Corp)	01/07/2011	EUR	DBR 5 1/2 01/04/31 (EC3022802 Govt)	27/10/2000	EUR
TELIAS 3 ⅝ 02/22/32 (ZL1217450 Corp)	16/02/2023	EUR	DBR 0 02/15/32 (BT2450315 Govt)	07/01/2022	EUR
TELIAS 3 1/2 09/05/33 (EJ811675 Corp)	05/09/2013	EUR	DBR 4 3/4 07/04/34 (EC8300625 Govt)	31/01/2003	EUR
TELIAS 2 1/8 02/20/34 (AX185611 Corp)	20/02/2019	EUR	DBR 4 3/4 07/04/34 (EC8300625 Govt)	31/01/2003	EUR
TELIAS 1 5/8 02/23/35 (EK757380 Corp)	23/02/2015	EUR	DBR 4 3/4 07/04/34 (EC8300625 Govt)	31/01/2003	EUR
Vodafone	**Issued**	**Currency**	**Government bond**	**Issued**	**Currency**
VOD 5.9 11/26/32	26/11/2002	GBP	UKT 4 1/4 06/07/32	25/05/2000	GBP

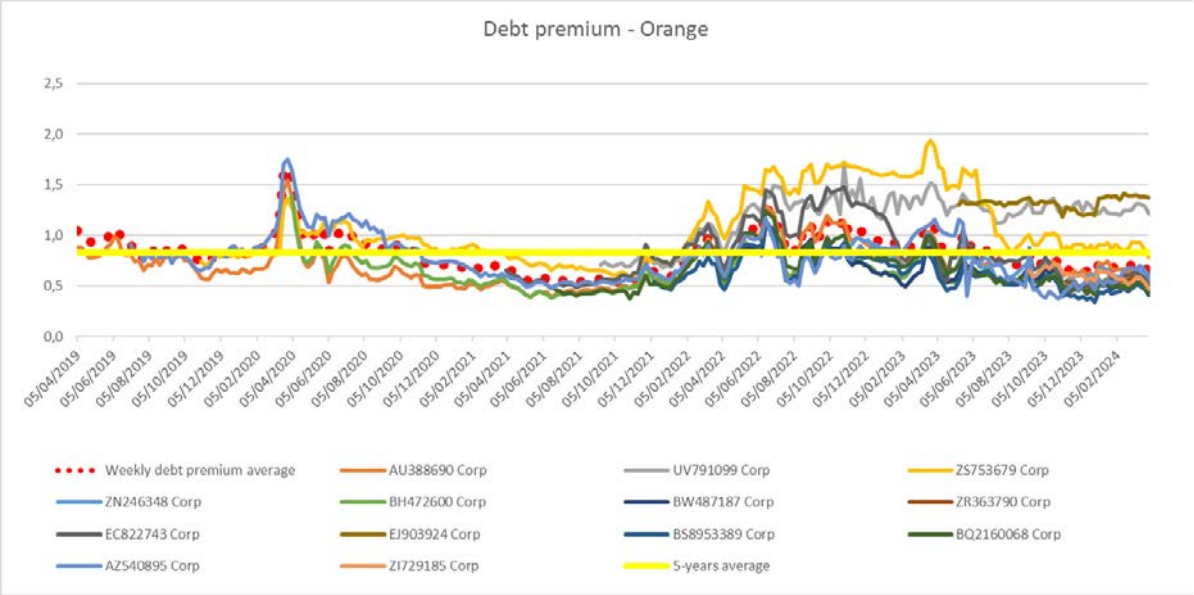
(EC766795 Corp)			(EC2565959 Govt)		

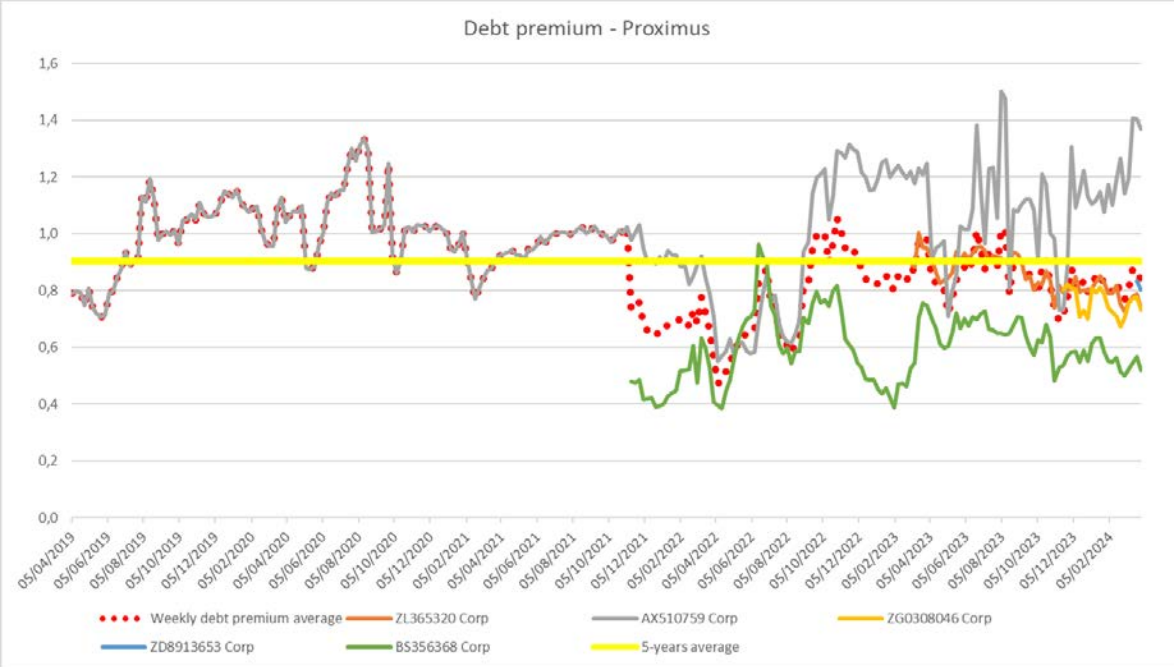
In addition, a graph for each company with the evolution during the 5-years averaging window of the debt premium of their different pairs of bonds are attached:

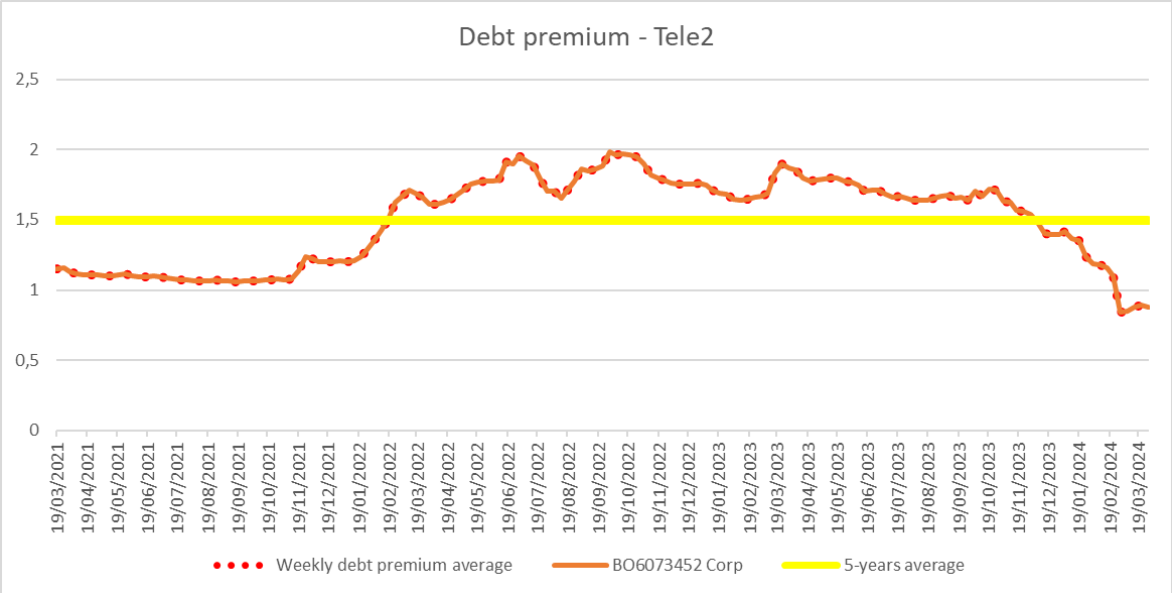


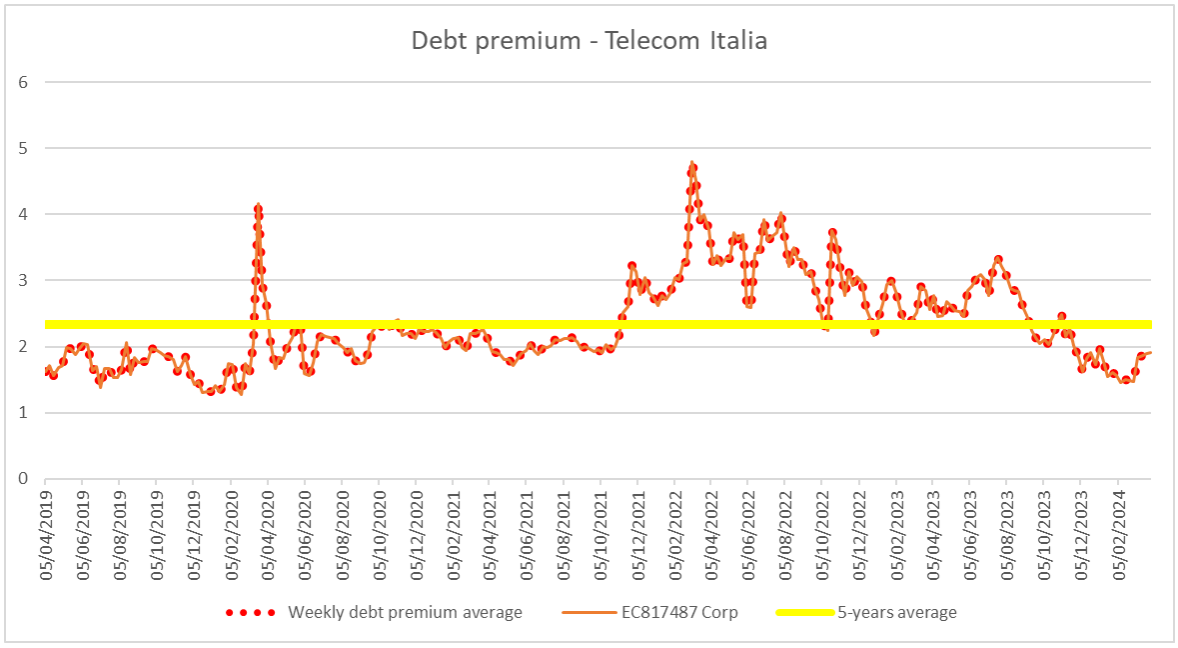


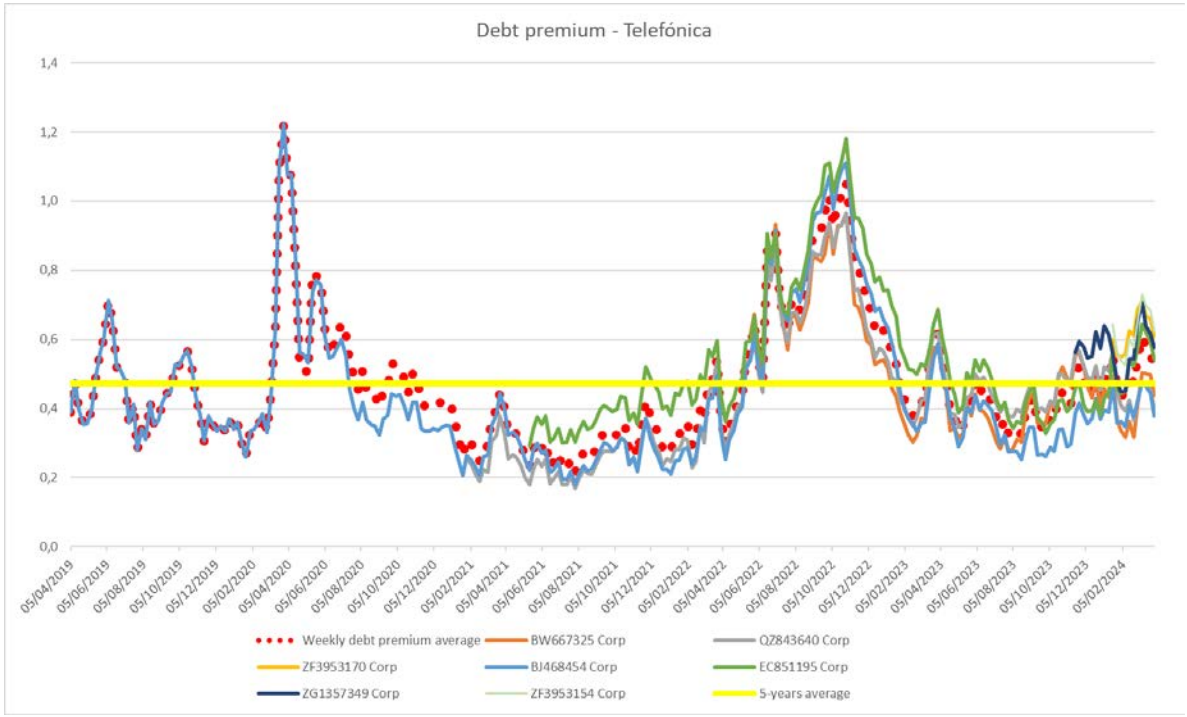

Debt premium - KPN
2,0
1,8
1,6
1,4
1,2
1,0
0,8
0,6
0,4
0,2
0,0
11/09/2020
11/10/2020
11/11/2020
11/12/2020
11/01/2021
11/02/2021
11/03/2021
11/04/2021
11/05/2021
11/06/2021
11/07/2021
11/08/2021
11/09/2021
11/10/2021
11/11/2021
11/12/2021
11/01/2022
11/02/2022
11/03/2022
11/04/2022
11/05/2022
11/06/2022
11/07/2022
11/08/2022
11/09/2022
11/10/2022
11/11/2022
11/12/2022
11/01/2023
11/02/2023
11/03/2023
11/04/2023
11/05/2023
11/06/2023
11/07/2023
11/08/2023
11/09/2023
11/10/2023
11/11/2023
11/12/2023
11/01/2024
11/02/2024
11/03/2024
Weekly debt premium average
ZJ3117851 Corp
ZO366662 Corp
BS3080196 Corp
ZF8930983 Corp
5-years average

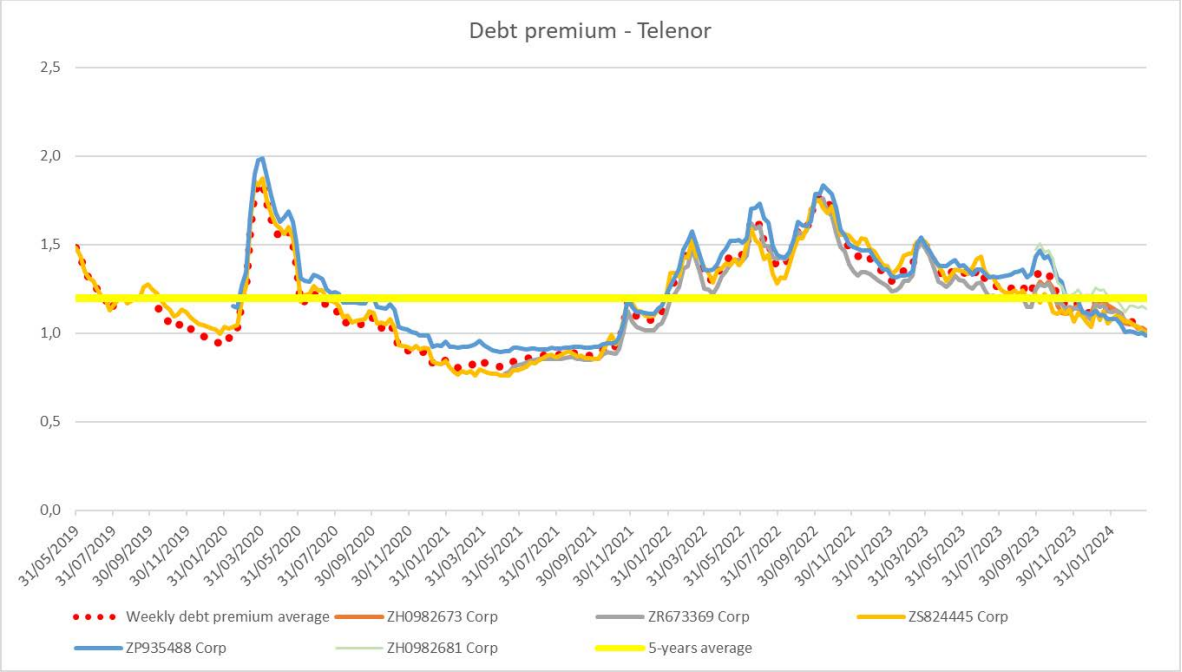

Debt premium - Orange
2,5
2,0
1,5
1,0
0,5
0,0
05/04/2019
05/06/2019
05/08/2019
05/10/2019
05/12/2019
05/02/2020
05/04/2020
05/06/2020
05/08/2020
05/10/2020
05/12/2020
05/02/2021
05/04/2021
05/06/2021
05/08/2021
05/10/2021
05/12/2021
05/02/2022
05/04/2022
05/06/2022
05/08/2022
05/10/2022
05/12/2022
05/02/2023
05/04/2023
05/06/2023
05/08/2023
05/10/2023
05/12/2023
05/02/2024
Weekly debt premium average
AU388690 Corp
UV791099 Corp
ZS753679 Corp
ZN246348 Corp
BH472600 Corp
BW487187 Corp
ZR363790 Corp
EC822743 Corp
EJ903924 Corp
BS8953389 Corp
BQ2160068 Corp
AZ540895 Corp
ZI729185 Corp
5-years average

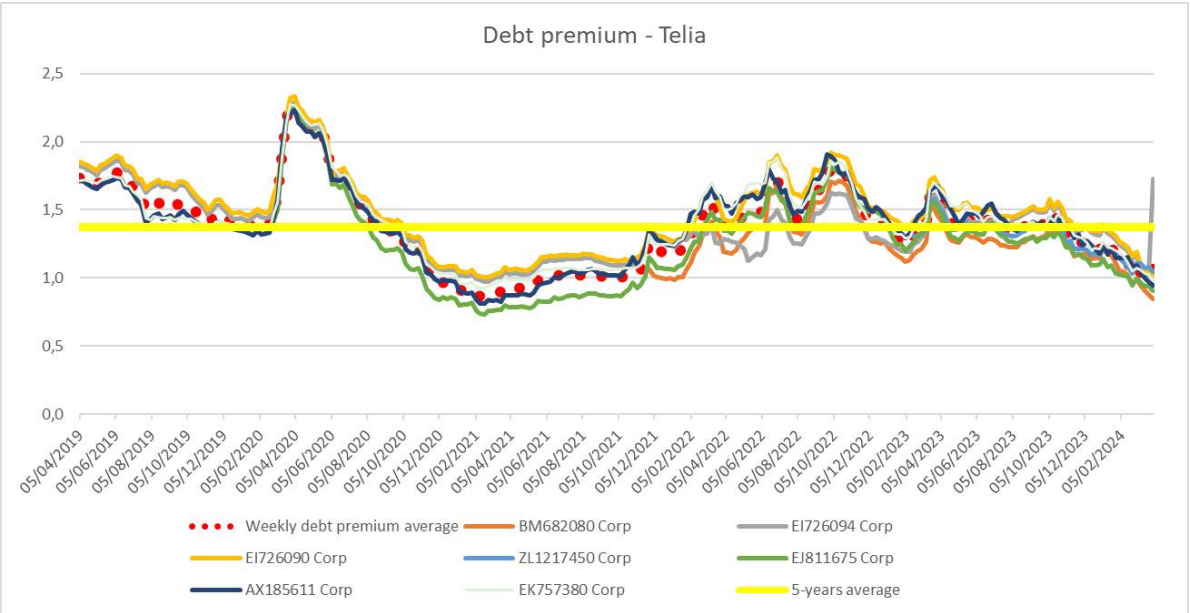

Debt premium - Proximus
1,6
1,4
1,2
1,0
0,8
0,6
0,4
0,2
0,0
05/04/2019
05/06/2019
05/08/2019
05/10/2019
05/12/2019
05/02/2020
05/04/2020
05/06/2020
05/08/2020
05/10/2020
05/12/2020
05/02/2021
05/04/2021
05/06/2021
05/08/2021
05/10/2021
05/12/2021
05/02/2022
05/04/2022
05/06/2022
05/08/2022
05/10/2022
05/12/2022
05/02/2023
05/04/2023
05/06/2023
05/08/2023
05/10/2023
05/12/2023
05/02/2024
Weekly debt premium average
ZL365320 Corp
AX510759 Corp
ZG0308046 Corp
ZD8913653 Corp
BS356368 Corp
5-years average

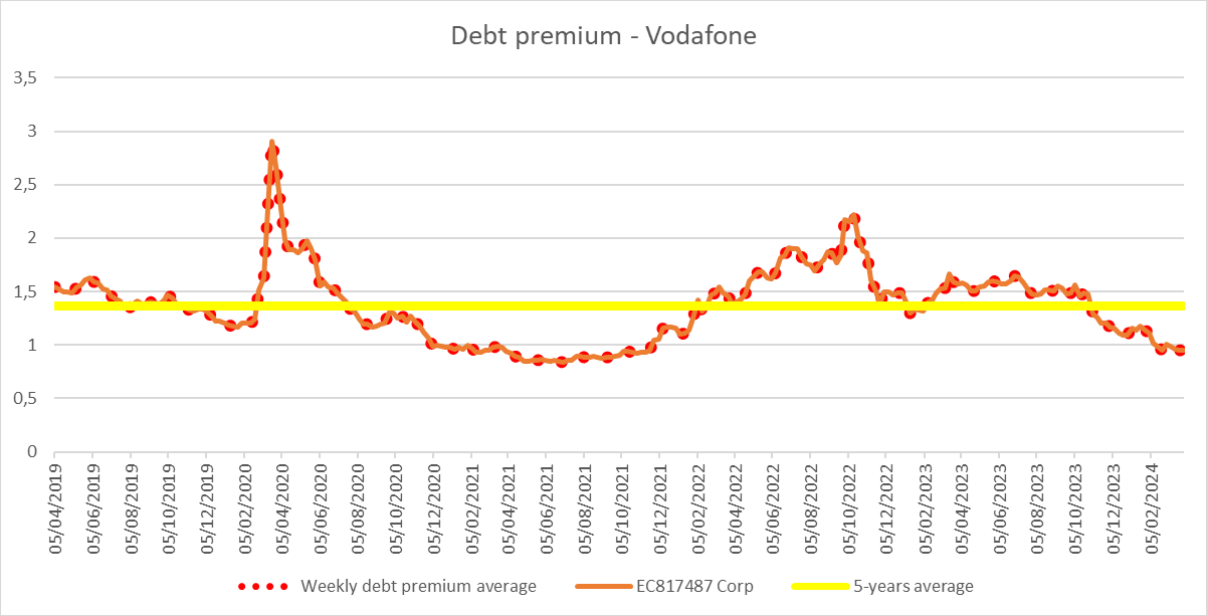

Debt premium - Tele2
2,5
2
1,5
1
0,5
0
19/03/2021
19/04/2021
19/05/2021
19/06/2021
19/07/2021
19/08/2021
19/09/2021
19/10/2021
19/11/2021
19/12/2021
19/01/2022
19/02/2022
19/03/2022
19/04/2022
19/05/2022
19/06/2022
19/07/2022
19/08/2022
19/09/2022
19/10/2022
19/11/2022
19/12/2022
19/01/2023
19/02/2023
19/03/2023
19/04/2023
19/05/2023
19/06/2023
19/07/2023
19/08/2023
19/09/2023
19/10/2023
19/11/2023
19/12/2023
19/01/2024
19/02/2024
19/03/2024
Weekly debt premium average
BO6073452 Corp
5-years average


Debt premium - Telecom Italia
6
5
4
3
2
1
0
05/04/2019
05/06/2019
05/08/2019
05/10/2019
05/12/2019
05/02/2020
05/04/2020
05/06/2020
05/08/2020
05/10/2020
05/12/2020
05/02/2021
05/04/2021
05/06/2021
05/08/2021
05/10/2021
05/12/2021
05/02/2022
05/04/2022
05/06/2022
05/08/2022
05/10/2022
05/12/2022
05/02/2023
05/04/2023
05/06/2023
05/08/2023
05/10/2023
05/12/2023
05/02/2024
Weekly debt premium average
EC817487 Corp
5-years average


Debt premium - Telefónica
1,4
1,2
1,0
0,8
0,6
0,4
0,2
0,0
05/04/2019
05/06/2019
05/08/2019
05/10/2019
05/12/2019
05/02/2020
05/04/2020
05/06/2020
05/08/2020
05/10/2020
05/12/2020
05/02/2021
05/04/2021
05/06/2021
05/08/2021
05/10/2021
05/12/2021
05/02/2022
05/04/2022
05/06/2022
05/08/2022
05/10/2022
05/12/2022
05/02/2023
05/04/2023
05/06/2023
05/08/2023
05/10/2023
05/12/2023
05/02/2024
Weekly debt premium average
BW667325 Corp
QZ843640 Corp
ZF3953170 Corp
BJ468454 Corp
EC851195 Corp
ZG1357349 Corp
ZF3953154 Corp
5-years average


Debt premium - Telenor
2,5
2,0
1,5
1,0
0,5
0,0
31/05/2019
31/07/2019
30/09/2019
30/11/2019
31/01/2020
31/03/2020
31/05/2020
31/07/2020
30/09/2020
30/11/2020
31/01/2021
31/03/2021
31/05/2021
31/07/2021
30/09/2021
30/11/2021
31/01/2022
31/03/2022
31/05/2022
31/07/2022
30/09/2022
30/11/2022
31/01/2023
31/03/2023
31/05/2023
31/07/2023
30/09/2023
30/11/2023
31/01/2024
Weekly debt premium average
ZH0982673 Corp
ZR673369 Corp
ZS824445 Corp
ZP935488 Corp
ZH0982681 Corp
5-years average


Debt premium - Telia
2,5
2,0
1,5
1,0
0,5
0,0
05/04/2019
05/06/2019
05/08/2019
05/10/2019
05/12/2019
05/02/2020
05/04/2020
05/06/2020
05/08/2020
05/10/2020
05/12/2020
05/02/2021
05/04/2021
05/06/2021
05/08/2021
05/10/2021
05/12/2021
05/02/2022
05/04/2022
05/06/2022
05/08/2022
05/10/2022
05/12/2022
05/02/2023
05/04/2023
05/06/2023
05/08/2023
05/10/2023
05/12/2023
05/02/2024
Weekly debt premium average
BM682080 Corp
EI726094 Corp
EI726090 Corp
ZL1217450 Corp
EJ811675 Corp
AX185611 Corp
EK757380 Corp
5-years average



Annex 3: Beta and Gearing

In this annex the process and the results of the estimation for the 15 peers analyzed will be reported.

The information for each peer about the estimation of the equity beta, the spot gearing and its components (Equity and Debt) are provided. For each comparable a statistic analysis is also reported to get information on the consistency, in term of bias and efficiency of the estimation.

In the table below we report some information about the 15 peer-operators. Specifically, information about where i) the shares have been traded; ii) the revenues have been achieved since last financial, reports public available, in the EU countries; iii) the free float percentage of the traded share (spot value);[173] iv) the sensitivity analysis as reported in chapter 5 considering an estimation of the gearing including pension liabilities in the debt component and the corresponding asset beta evaluated with this new gearing.

[173] May 2023

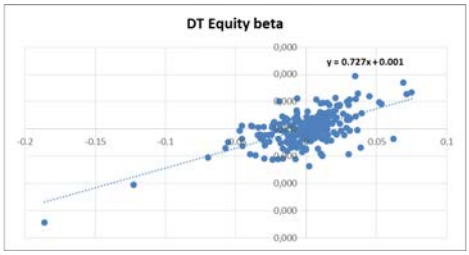
Table A1 Peer group companies

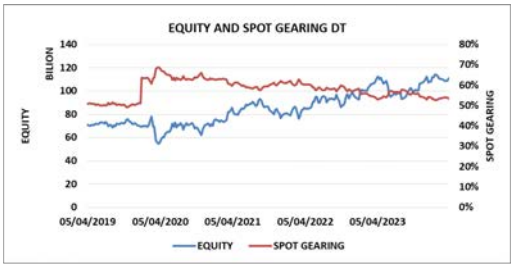
	Peer Group operator	country	Fitch	Moody's	S&P	Free Float	Market Cap (5Years time window weekly sampling period in EURO)	Weight (market cap)	Equity beta	Gearing	Gearing including pension fund	Asset beta	Asset beta with gearing including pension fund	Debt premium
1	Deutsche Telekom AG	Germany	BBB+	Baa1	BBB+	65.10%	84.81	33.50%	0.72	58.08%	59.22%	0.36	0.36	132
2	Elisa Oyj	Finland		Baa2	BBB+	88.02%	7.9	3.12%	0.48	12.57%	12.69%	0.43	0.43	90
3	Koninklijke KPN N.V.	Netherlands	BBB	Baa3	BBB	95.11%	11.62	4.59%	0.53	35.62%	35.96%	0.38	0.38	116
4	NOS	Portugal	BBB		BBB-	36.12%	1.94	0.77%	0.63	41.31%	41.31%	0.41	0.41	-
5	Orange S.A.	France	BBB+	Baa1	BBB+	76.95%	29.15	11.51%	0.58	56.68%	58.25%	0.31	0.30	83
6	Proximus S.A.	Belgium		A2	BBB+	41.89%	5.21	2.06%	0.57	38.78%	42.00%	0.39	0.37	90
7	Tele2 AB	Sweden			BBB	87.16%	7.47	2.95%	0.53	25.41%	25.41%	0.42	0.42	150
8	Telecom Italia	Italy	BB-	B1	B+	75.59%	7.55	2.98%	1.06	78.06%	78.52%	0.31	0.31	234
9	Telefónica S.A.	Spain	BBB	Baa3	BBB-	82.00%	24.76	9.78%	0.93	62.75%	65.38%	0.41	0.39	47
10	Telecom Austria AG	Austria	A-	A3	A-	13.10%	4.46	1.76%	0.67	33.11%	35.11%	0.48	0.47	-
11	Telenor	Norway	NR	Baa1	A-	40.67%	18.64	7.36%	0.3	36.23%	36.72%	0.23	0.23	119
12	Telia Company AB	Sweden	WD	Baa1	BBB+	48.27%	12.98	5.13%	0.54	40.70%	41.48%	0.36	0.36	137
13	Vodafone Group plc	UK	BBB	Baa2	BBB	95.19%	36.24	14.31%	0.85	61.17%	61.33%	0.39	0.39	136
14	DIGI	Romania			BB-	55.24%	0.46	0.18%	0.5	72.83%	72.83%	0.21	0.21	-

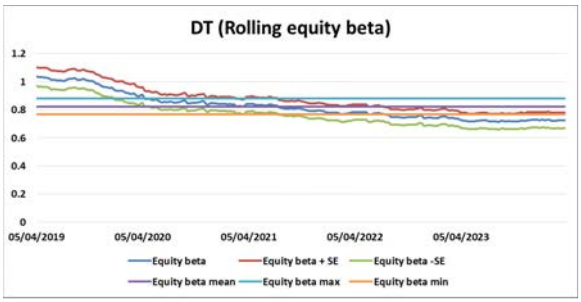
More detailed information for the selected parameters for each company are reported in the following. Specifically, the balance sheet data which are needed for the debt component of the gearing are reported including ten year data (2014-2023) due to the fact that a rolling beta estimation over a time windows of five years is reported for information only to show a clearly the trend present along the years. The values that are reported in the pictures on the rolling Equity beta refer: i) to the equity beta estimated through the standard OLS estimator along the time windows (5 years) and on a weekly basis; ii) the equity beta +/- one Standard error[174] (population corrected and homoscedasticity assumption of the error); iii) the simple average of the three values on a five year time windows and using a weekly sampling period. The corresponding rolling asset beta is provided as well based on the corresponding equity beta which is reported and gearing used for estimating the corresponding asset beta in the same graph.

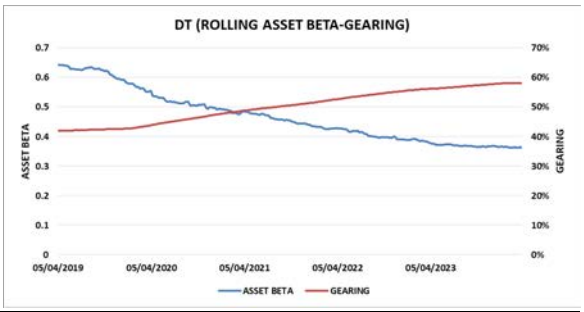
Deutsche Telekom Group

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	43,388	45,575	47,810	46,436	49,485	57,327	93,678	98,566	95,861	92,419
Capital leases	1,281	1,616	1,962	1,884	1,622	15,848	27,607	28,094	33,666	35,144
Cash and Cash Equivalent	7,523	6,897	7,747	3,312	3,679	5,393	12,939	7,617	5,767	7,274
Pension liability	8,465	8,028	9,734	9,211	6,307	5,831	7,684	6,135	4,150	4,060
Short debt/Current portion of long term debt-capital lease	10,152	14,255	13,144	8,623	10,093	14,334	17,675	17,236	19,407	15,188
Out standing shares (milion)	4,516	4,607	4,657	4,743	4,743	4,743	4,743	4,972	4,973	4,979





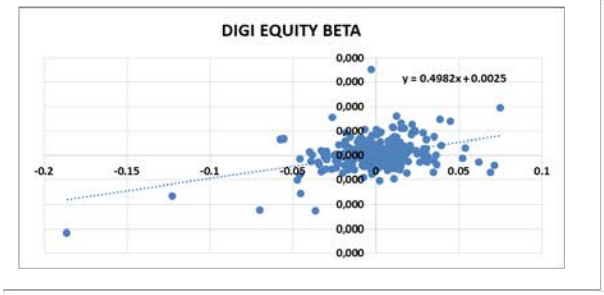


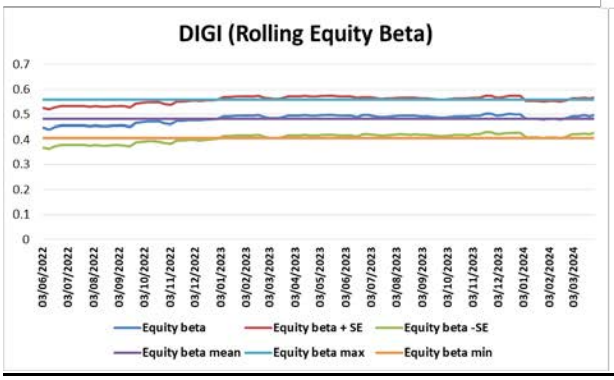


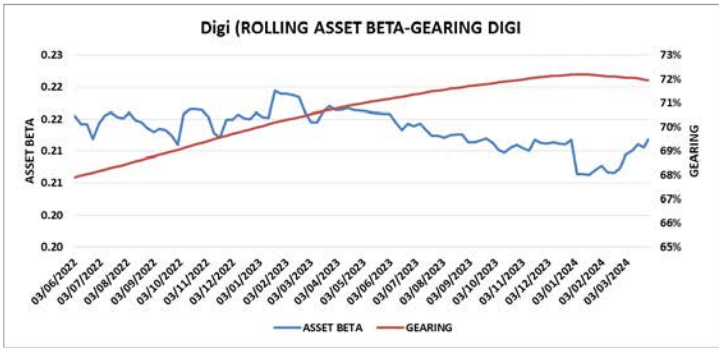
[174] The standard error of the estimate represents the average distance that the observed values fall from the regression line.

DIGI Communications

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	0	0	3,006	3,014	3,317	3,885	4,583	5,580	5,084	5,084
Capital leases	0	0	18	11	17	639	795	619	1,070	1,070
Cash and Cash Equivalent	0	0	66	75	64	53	52	84	1,293	1,293
Pension liability	0	0	0	0	0	0	0	0	0	0
Short debt/Current portion of long term debt-capital lease	0	0	200	383	785	936	733	1,141	861	861
	0	0	0	0	0	0	0	0	0	0
Out standing shares (milion)	0	0	0	64	64	64	64	64	64	64

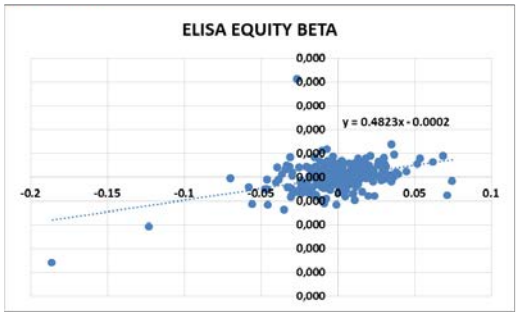


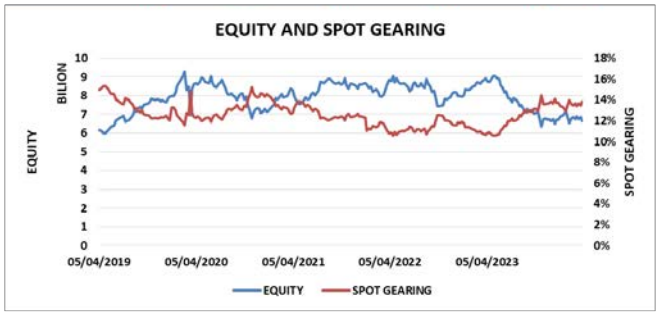


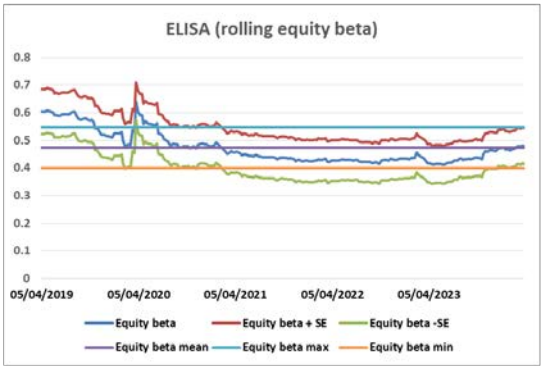


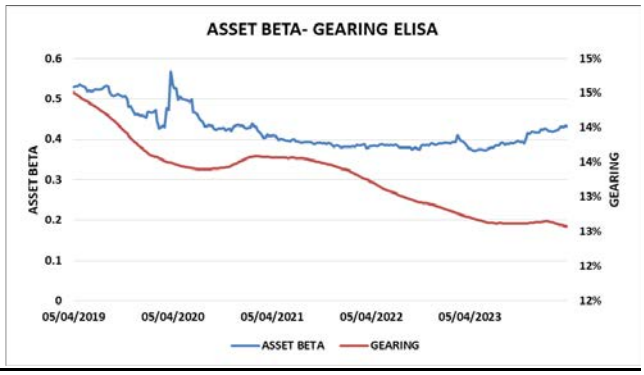
Elisa

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	791	662	805	917	840	1,008	1,137	1,141	995	997
Capital leases	27	24	23	22	22	78	79	73	71	68
Cash and Cash Equivalent	41	29	45	44	81	52	220	114	86	63
Pension liability	18	16	17	16	15	17	11	14	13	9
Short debt/Current portion of long term debt-capital lease	225	305	341	178	287	151	211	118	295	303
Outstanding shares (milion)	159	160	160	167	160	160	160	160	160	160



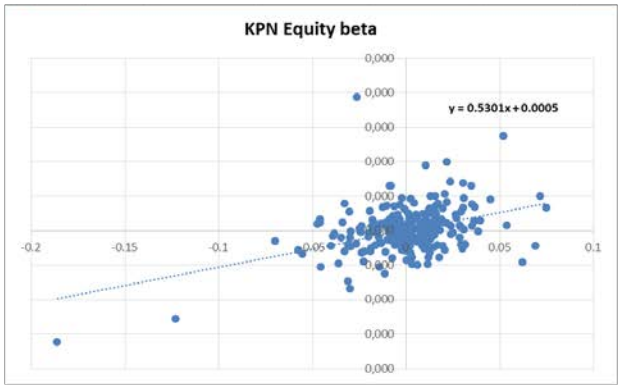


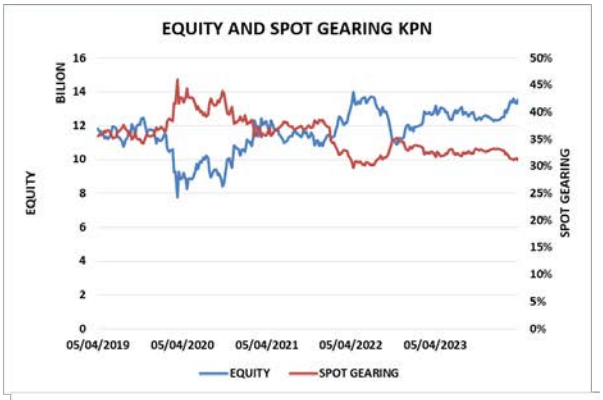


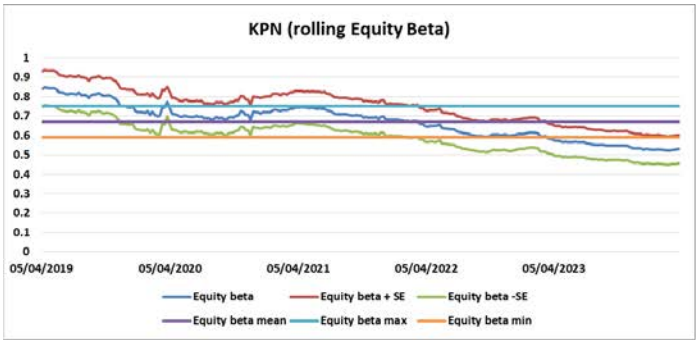


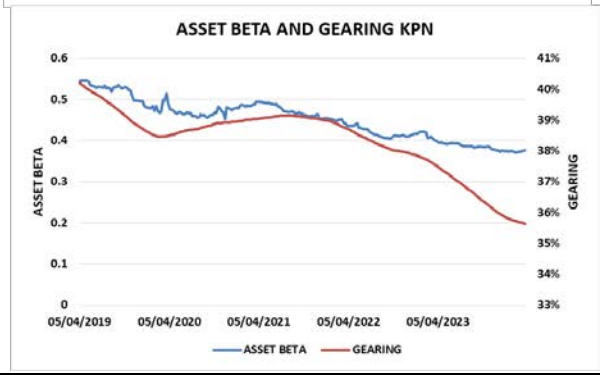
KPN

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	9,397	8,853	7,897	7,579	6,939	5,722	5,821	6,067	5,171	5,397
Capital leases	0	0	0	0	827	785	787	736	770	733
Cash and Cash Equivalent	1,976	1,446	1,179	856	594	766	597	793	399	608
Pension liability	316	259	262	218	206	188	152	92	49	35
Short debt/Current portion of long term debt-capital lease	1,044	847	735	18	589	1,082	829	814	349	659
Outstanding shares (milion)	4,270	4,270	4,270	4,270	4,203	4,203	4,203	4,203	4,037	3,947



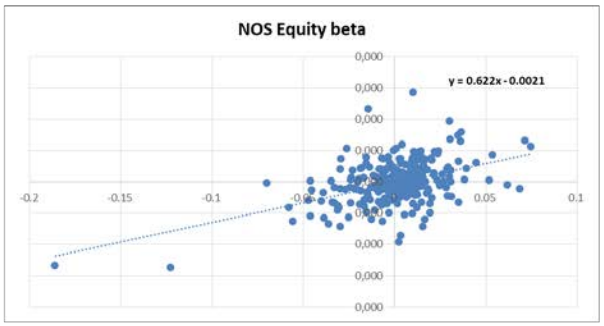


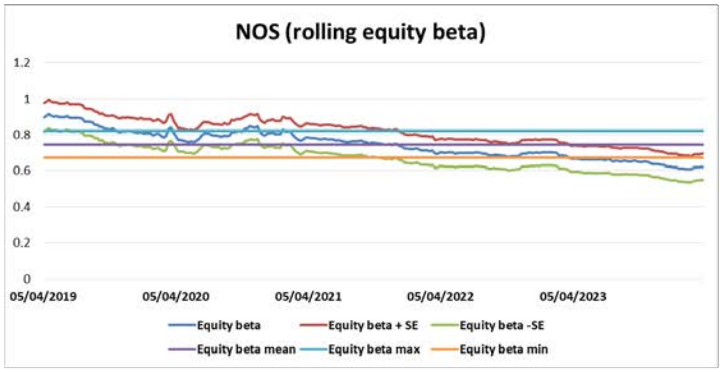


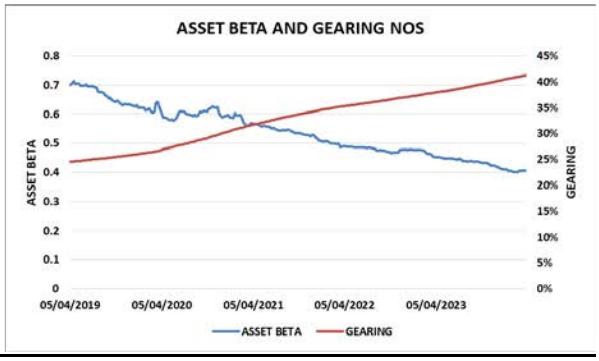


NOS

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	485	863	872	870	825	1,022	855	807	655	949
Capital leases	122	117	100	84	189	195	575	469	556	547
Cash and Cash Equivalent	21	10	2	3	2	13	153	11	15	18
Pension liability	0	0	0	0	0	0	0	0	0	0
Short debt/Current portion of long term debt-capital lease	504	178	225	210	215	88	90	87	128	162
Outstanding shares (milion)	513	514	512	513	513	513	512	512	511	511

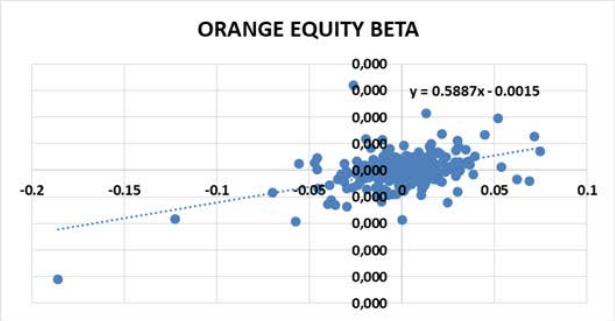


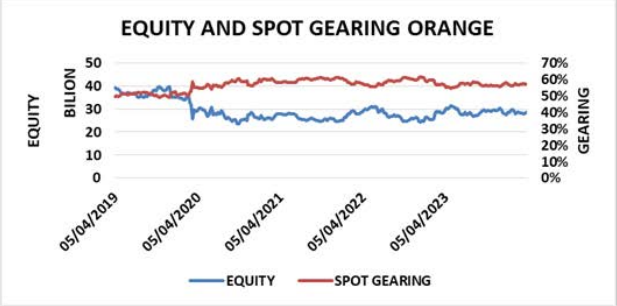


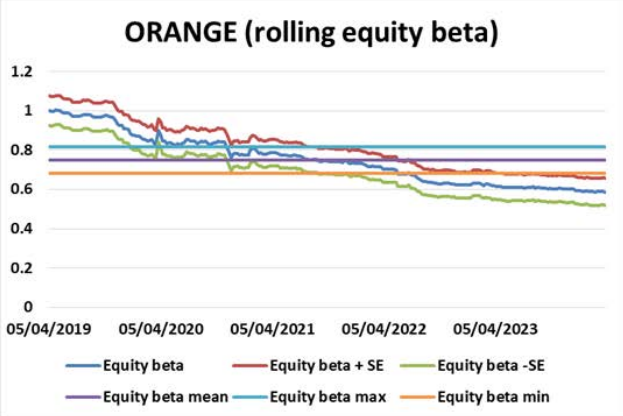


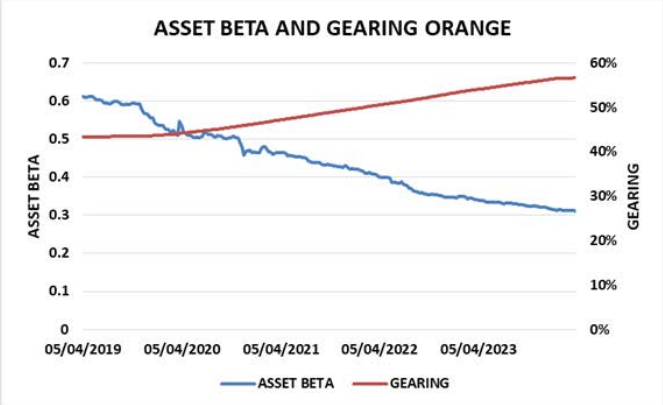
Orange

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	29,482	29,528	28,404	25,839	26,323	33,148	30,089	31,922	31,930	30,535
Capital leases	0	0	505	454	426	5,225	5,875	6,696	6,901	7,099
Cash and Cash Equivalent	6,758	4,469	6,355	5,810	5,634	6,481	8,145	8,621	6,004	5,618
Pension liability	3,239	3,142	3,029	2,674	2,823	2,554	2,202	2,798	2,567	2,551
Short debt/Current portion of long term debt-capital lease	4,891	4,536	4,759	6,311	7,270	5,192	6,666	4,790	6,211	6,920
Outstanding shares (milion)	2,649	2,649	2,660	2,660	2,653	2,650	2,659	2,658	2,658	2,658



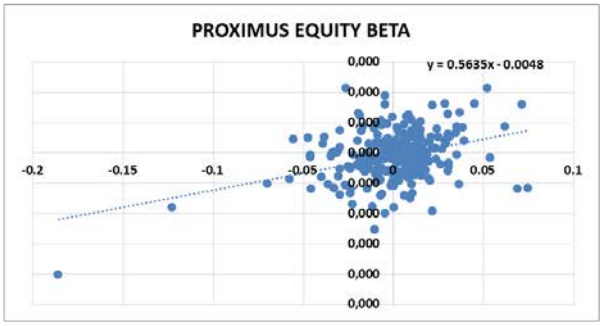


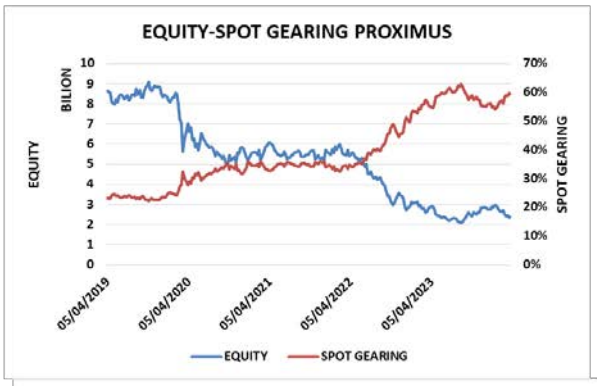


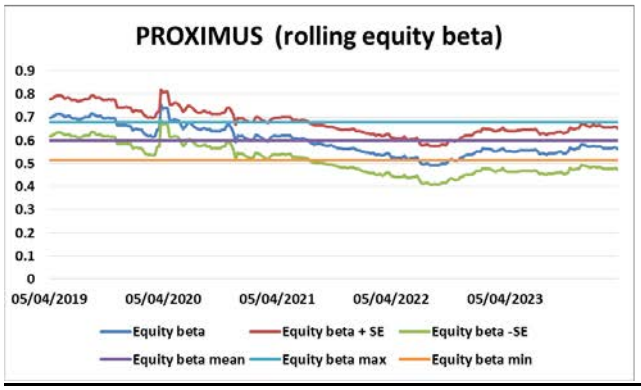


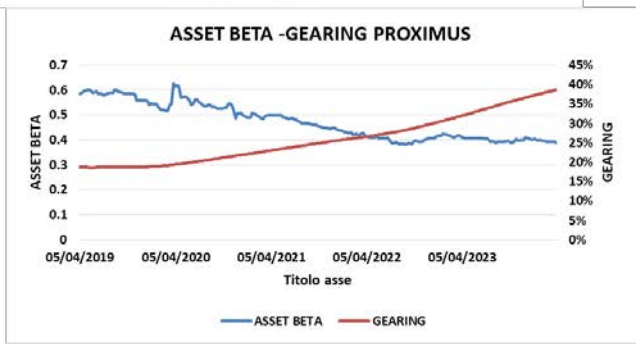
Proximus

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	2,363	1,753	1,755	1,850	2,255	2,355	2,506	2,738	2,676	3,305
Capital leases	3	3	2	6	4	243	216	205	199	209
Cash and Cash Equivalent	702	502	297	333	340	323	310	249	298	715
Pension liability	504	464	544	515	553	639	559	447	361	337
Short debt/Current portion of long term debt-capital lease	153	673	407	570	234	221	231	222	183	699
Outstanding shares (milion)	321	322	323	323	323	323	323	323	322	323



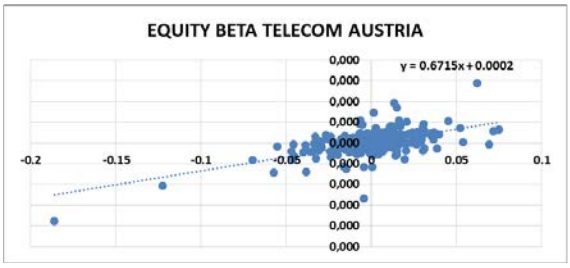


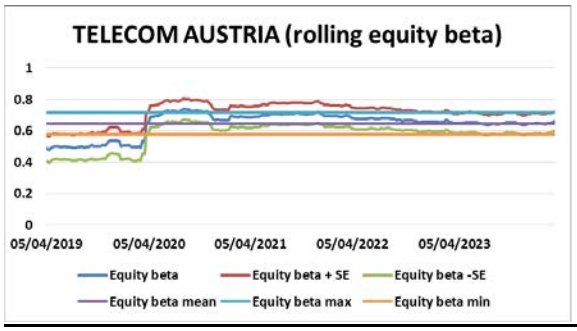


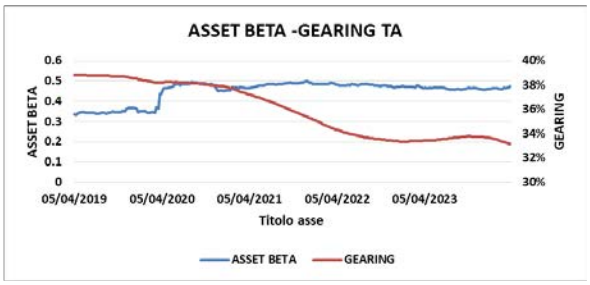


Telekom Austria

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	3,385	2,584	2,303	2,533	2,536	2,540	1,794	1,046	1,047	748
Capital leases	0	0	0	0	0	788	701	606	522	1,672
Cash and Cash Equivalent	1,018	909	458	202	64	140	211	534	150	169
Pension liability	201	197	206	197	204	220	232	222	172	187
Short debt/Current portion of long term debt-capital lease	341	904	500	1	245	276	903	1,714	981	344
Outstanding shares (milion)	664	664	664	664	664	664	664	664	664	664

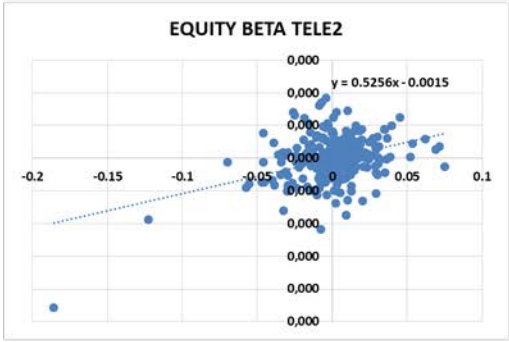


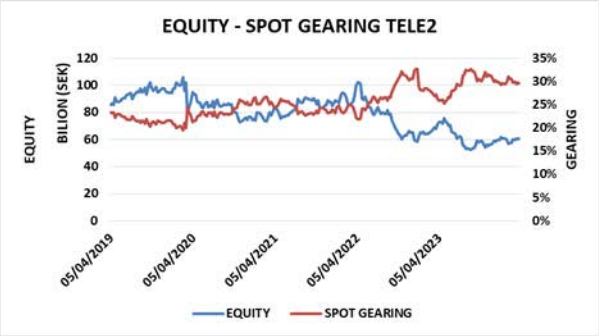


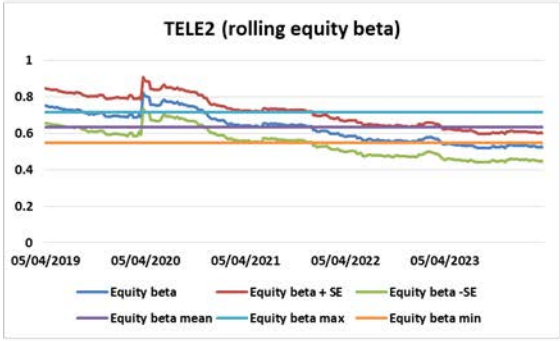


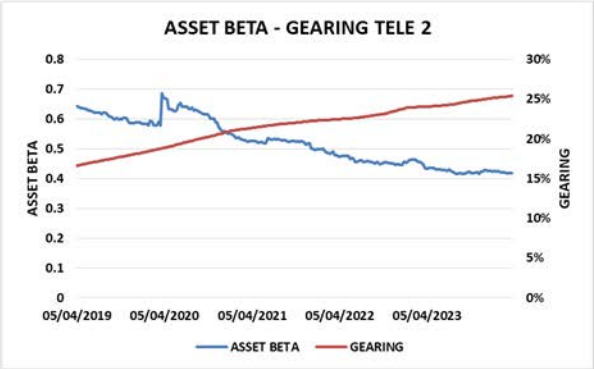
Tele 2

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	4,555	4,284	7,746	10,567	21,753	21,572	21,406	22,512	24,273	22,333
Capital leases	38	45	32	15	14	4,501	4,209	4,289	4,289	3,111
Cash and Cash Equivalent	151	107	257	802	404	448	970	880	1,116	1,634
Pension liability	0	0	0	0	0	0	0	0	0	0
Short debt/Current portion of long term debt-capital lease	2,609	4,964	3,037	567	6,426	4,836	4,712	4,016	3,889	5,531
Outstanding shares (milion)	463	463	502	503	687	690	689	690	691	692



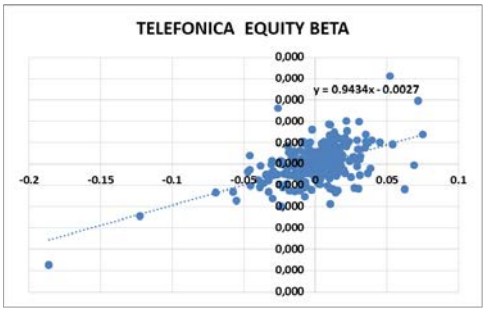


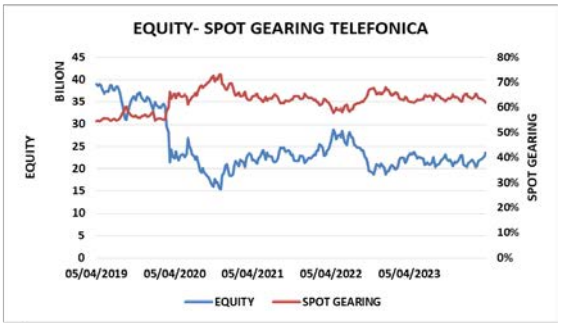


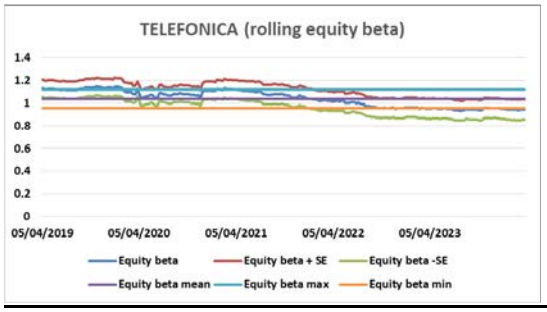


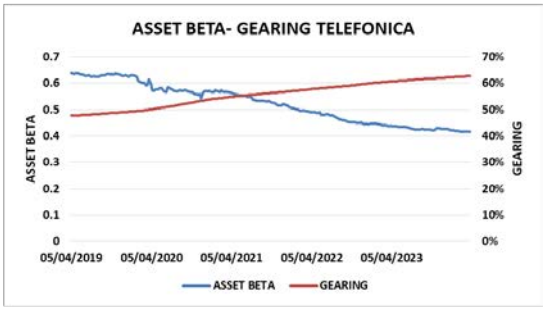
Telefonica

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	47,457	44,110	43,562	44,120	43,805	40,930	38,129	33,453	33,035	31,703
Capital leases	0	0	0	0	0	5,626	4,039	6,391	6,657	6,708
Cash and Cash Equivalent	6,529	2,599	3,736	5,192	5,692	6,042	5,604	8,580	7,245	7,151
Pension liability	3,426	5,366	6,147	5,666	4,499	5,789	4,960	5,395	4,093	4,949
Short debt/Current portion of long term debt-capital lease	8,693	12,625	13,977	9,134	9,138	10,152	8,683	8,327	5,696	5,704
Outstanding shares (milion)	4,711	4,975	5,038	5,192	5,192	5,192	5,526	5,779	5,775	5,750



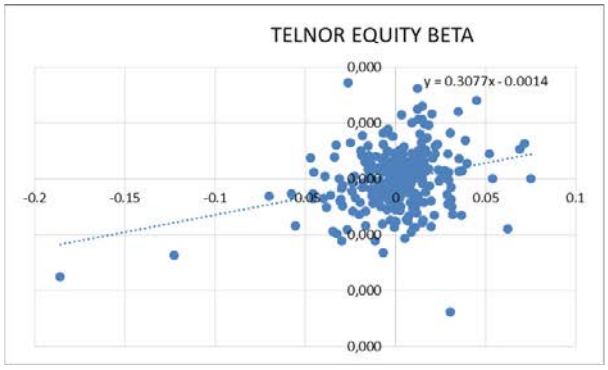


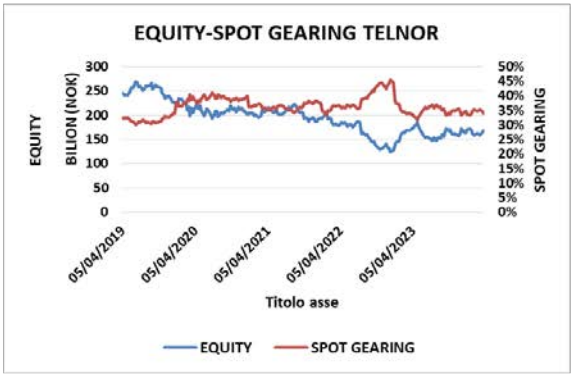


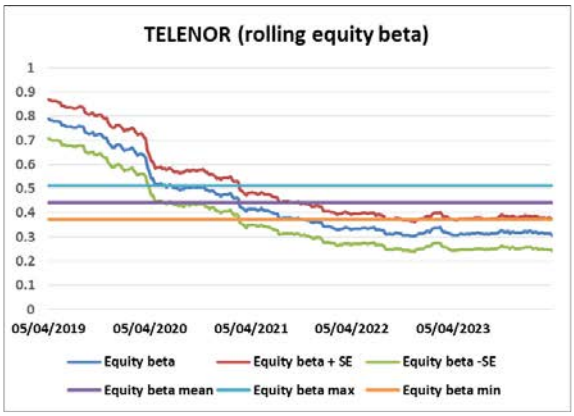


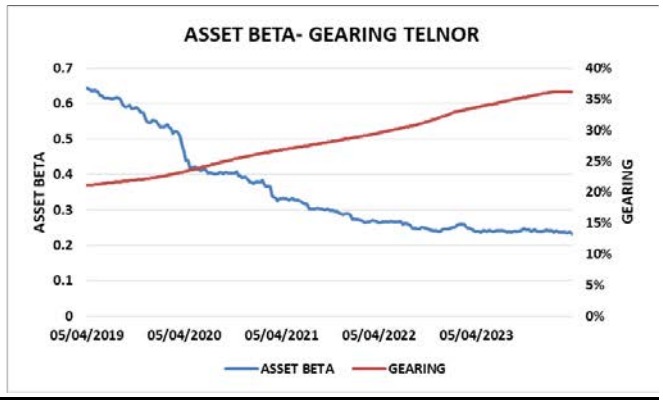
Telenor

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	59,982	62,784	59,467	50,745	55,120	83,987	98,627	87,810	79,072	73,238
Capital leases	832	1,018	924	842	805	32,002	35,584	28,101	24,417	13,201
Cash and Cash Equivalent	13,956	13,956	23,085	22,546	18,492	13,867	20,577	15,223	9,929	19,556
Pension liability	3,568	2,424	2,585	2,565	3,036	2,605	2,991	2,624	1,919	1,821
Short debt/Current portion of long term debt-capital lease	7,388	12,626	25,968	22,710	15,740	24,056	16,596	16,253	15,833	15,853
Outstanding shares (milion)	1,502	1,502	1,502	1,493	1,458	1,423	1,400	1,400	1,400	1,400



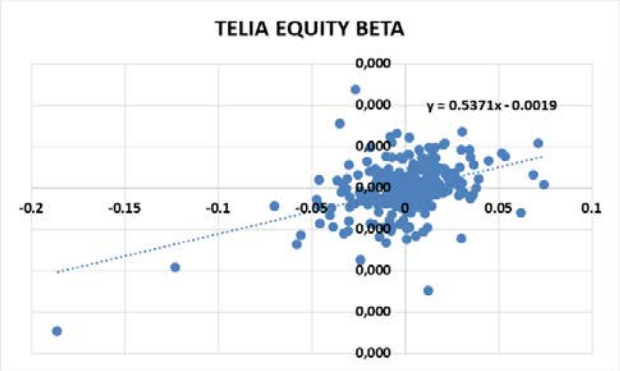


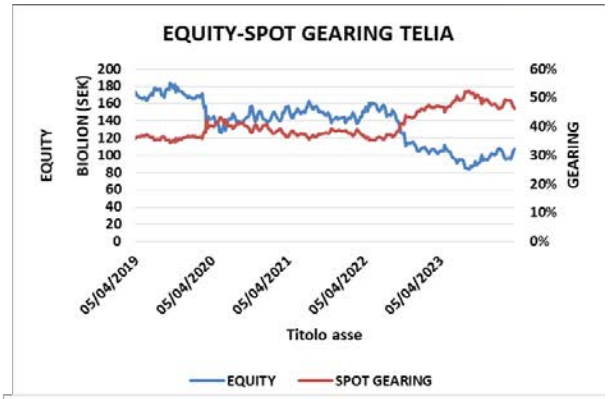


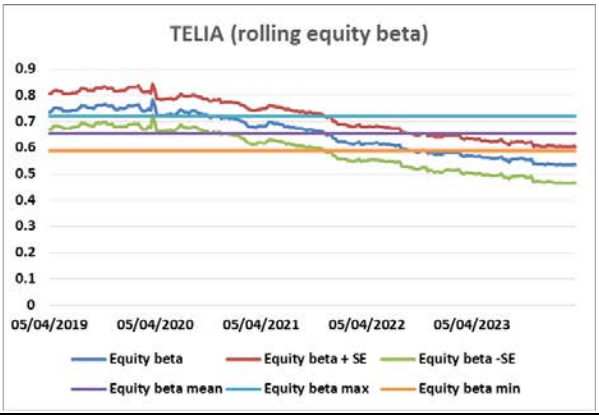


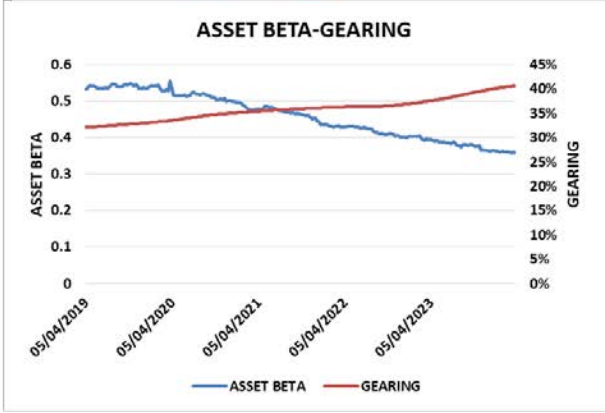
Telia Company

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	88,247	89,279	80,256	85,375	83,673	84,929	84,014	77,206	73,336	78,233
Capital leases	62	46	221	171	1,363	12,046	12,183	12,859	13,971	14,511
Cash and Cash Equivalent	28,735	14,647	14,510	15,617	18,764	6,116	8,133	14,358	6,871	11,646
Pension liability	3,505	1,824	2,109	2,377	2,519	3,334	7,428	2,682	1,279	1,364
Short debt/Current portion of long term debt-capital lease	10,991	9,266	11,113	3,471	9,213	12,951	3,063	3,701	6,778	13,636
Outstanding shares (million)	4,330	4,330	4,330	4,330	4,330	4,113	4,090	4,090	3,932	3,932



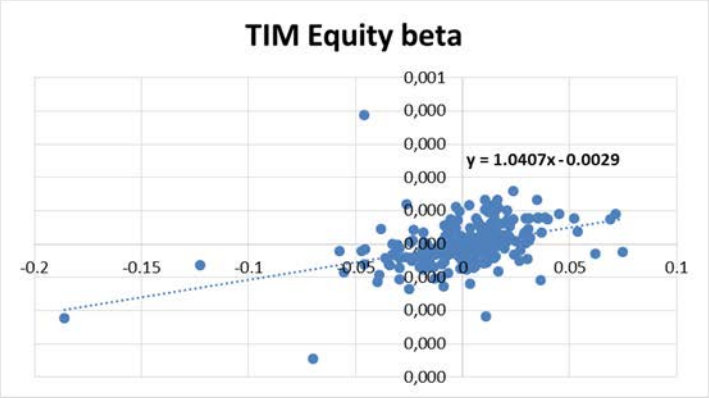


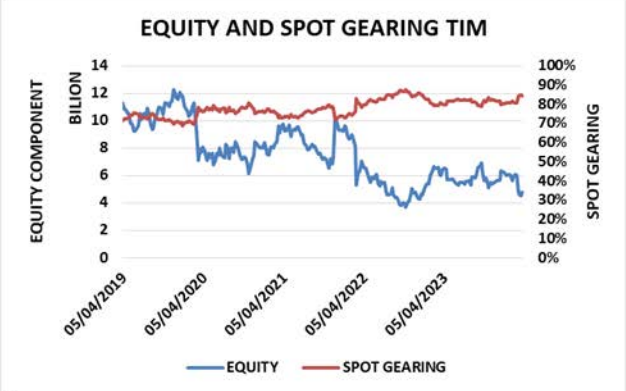


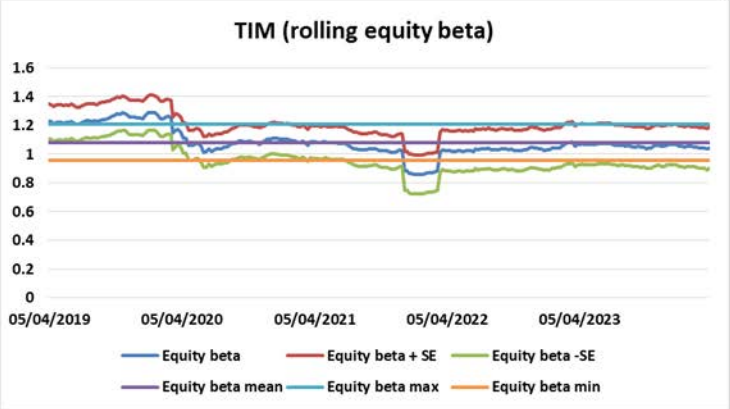


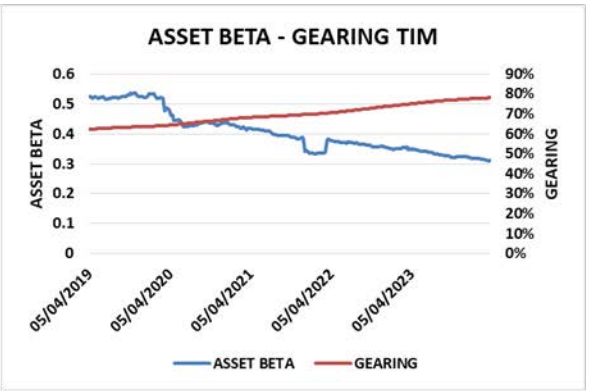
Telecom Italia

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	29,172	26,652	26,136	23,940	21,894	23,945	21,813	22,083	21,462	20,872
Capital leases	984	2,271	2,444	2,249	1,740	4,576	4,199	4,064	4,597	4,743
Cash and Cash Equivalent	4,812	3,559	4,064	3,675	1,917	3,138	4,829	6,904	3,555	2,912
Pension liability	1,056	1,420	1,355	1,736	1,567	1,182	724	699	684	511
Short debt/Current portion of long term debt-capital lease	4,441	5,549	3,976	4,681	5,575	3,759	4,244	6,498	5,630	6,492
Outstanding shares (milion)	19,335	19,363	19,363	21,067	21,067	21,067	21,196	21,241	21,241	21,252



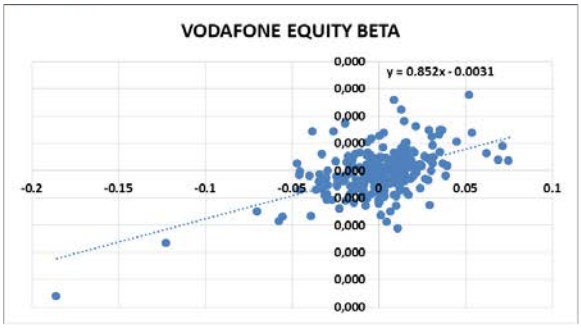


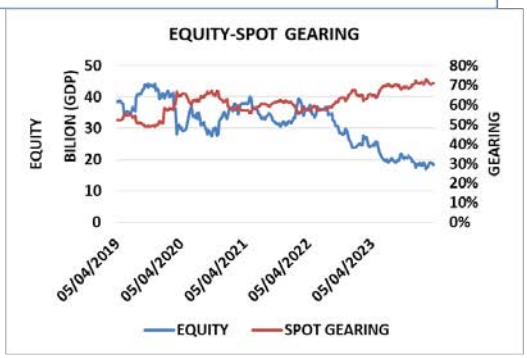


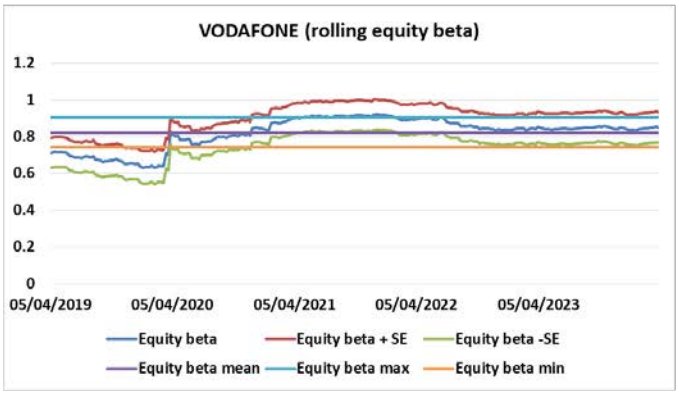


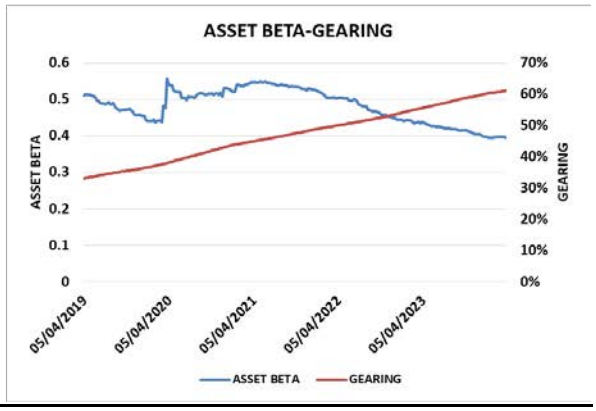
Vodafone

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Long term debt	21,351	22,310	29,168	28,981	28,672	41,824	52,424	42,030	40,756	36,398
Capital leases	103	125	159	203	234	221	3,229	8,437	8,274	9,082
Cash and Cash Equivalent	10,134	6,882	10,218	7,535	4,105	11,777	11,755	4,956	6,322	10,303
Pension liability	584	567	447	555	457	476	388	437	237	227
Short debt/Current portion of long term debt-capital lease	7,747	12,623	16,020	6,328	6,454	3,688	10,465	7,227	10,088	12,958
Outstanding shares (milion)	26,440	26,512	26,559	26,622	26,676	27,230	26,772	28,224	28,370	26,993









Statistical Analysis

The estimation of the asset betas is subject to the consistency of the OLS (Ordinary Least Square) in term of bias[175] (that affects the beta estimation) and efficiency[176] that affects the significance level of the estimation.

More specifically, the following elements should be taken into account to address the consistency of the OLS estimation:

- The Error terms of the regression are normally distributed around a zero mean;
- The Error terms are homoscedastic that means that the error terms have constant variance across the sample.
- The Error terms are not autocorrelated, i.e. there is no systematic dependence across the error terms.

Specifically, the failure of normality can put a question on the validity on the single factor CAPM method. The presence of heteroscedasticity in the meaning of failing the general hypothesis of constant variance, generally does not bias the beta estimate, but it affects the confidence interval and therefore statistical inferences around those estimates.[177] When error terms are "autocorrelated", this means that the validity of a time independent model can be questionable.[178]

In the following we present visual inspections and statistical tests -where relevant- of the residual component of the regression model presented in the previous section, for each comparable, to test the three main issues (normality, heteroscedasticity, autocorrelation) previously addressed. The subsequent analysis focalizes on last five year time series spot beta as 1 of April 2024 and, when relevant, all the rolling beta data estimations are also taken into account for the analysis.[179]

[175] In statistics, an unbiased estimate refers to the property that the sample statistic converges to its true "population" value in repeated samples.

[176] In statistics, an efficient estimate is an estimate/sample statistic that has the minimum variance, i.e. lowest uncertainty surrounding that estimate/sample statistic.

[177] Armitage, S & Brzeszczynski 2011 "Heteroscedasticity and interval effects in estimating beta: UK evidence" Applied Financial Economics, Vol. 21, no. 20, pp. 1525-1538.

[178] The presence of autocorrelation in the residual for the beta estimation is generally attributable to significantly variation of the beta in the time windows considered due to the fact that the beta evolution is not a stationary process. The presence of autocorrelation can be more evident when daily observation are used on longer time windows. In this case the beta estimation using the OLS can be biased. When this happens dynamic models for beta estimation, generally, can be taken into account, such as ARCH model (AutoRegressive Conditional Heteroskedasticity) or GARCH (Generalized Autoregressive Conditional Heteroskedasticity). https://www.ofgem.gov.uk/ofgem-publications/145143

[179] In case of DIGI the rolling estimation has taken into account data from May 2017, as before the operator had not traded shares, so the rolling estimation for DIGI refers to values between May 2022 and April 2024. For the other comparable the time series has started since March 2014 with a rolling estimation from April 2019 until April 2024..

Normality

To test the normality only a visual approach[180] through the Box-plot, density plot, and Q-Q plot[181] have been used.

In the following picture, the Box-plot of the residual distribution is provided. The box-plot shows the median as a horizontal line inside the box and the interquartile range (range between the 25th to 75th percentiles) as the length of the box. The whiskers (line extending from the top and bottom of the box) represent the minimum and maximum values when they are within 1.5 times the interquartile range from either end of the box. Scores greater than 1.5 times the interquartile range are out of the boxplot and are considered as outliers, and those greater than 3 times the interquartile range are extreme outliers. A boxplot that is symmetric with the median line at approximately the center of the box and with symmetric whiskers that are slightly longer than the subsections of the center box suggests that the data may have come from a normal distribution.

The Kernel plot of the distribution of the residual is also included in comparison with the corresponding theoretical normal distribution with same mean and standard deviation is provided.

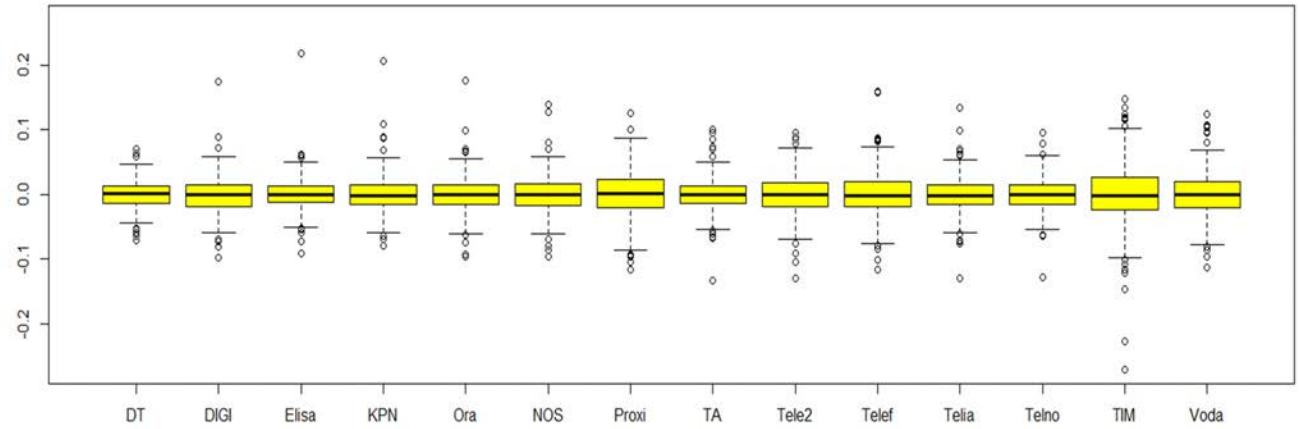


Figure A1 Box plot of residual distribution of the beta equity estimation

A more accurate picture of the distribution of the residual with respect to the theoretical normal distribution is provided in the Q-Q plot below. A Q-Q plot represents the quantiles (values that

[180] Parametric test for larger samples (i.e. more than one hundred), as in the cases under consideration, are not suitable as the assumption of normality might be rejected too easily due to high sensitivity to outlier. So, for large samples Q-Q plot, histogram is the best solution. https://www.sheffield.ac.uk/polopoly_fs/1.579191!/file/stcp-karadimitriou-normalR.pdf. Non parametric test are generally less powerful to test normality of the sample https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3693611/.

[181] In statistics, a Q–Q (quantile-quantile) plot is a probability plot, which is a graphical method for comparing two probability distribution by plotting their quantiles against each other. First, the set of intervals for the quantiles is chosen. A point (x, y) on the plot corresponds to one of the quantiles of the second distribution (y-coordinate) plotted against the same quantile of the first distribution (x-coordinate). Thus, the line is a parametric curve with the parameters which is the number of the interval for the quantile.

split a data set into equal portions) of the data on the y-axis with respect to the quantile of the theoretical normal distribution reported on the x-axis; the red line provides the theoretical line if the residual data comes from a normal distribution with same average and standard deviation of the residual data under inspection.

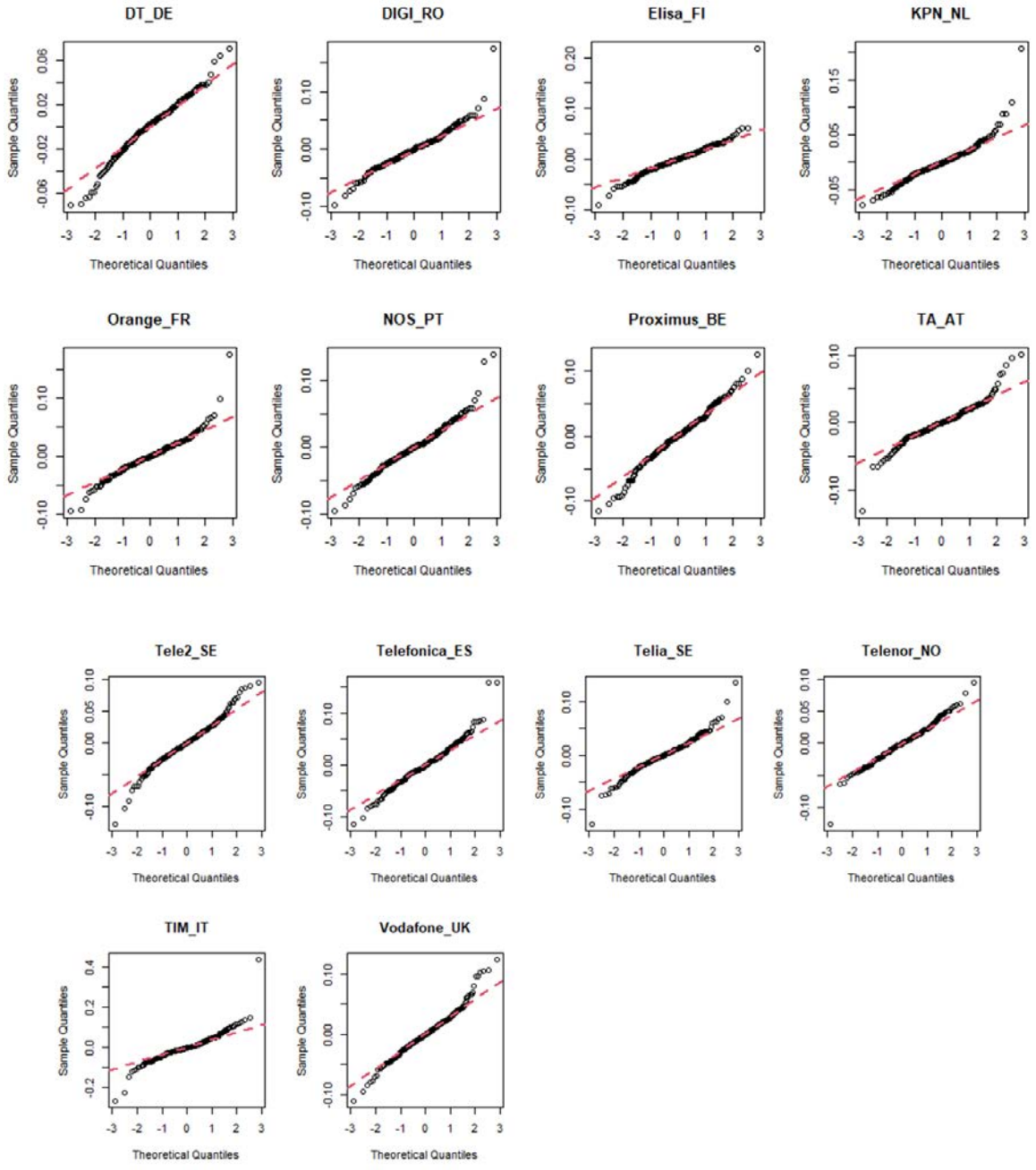


Figure A2 Q-Q plot of residual distribution of the beta equity estimation

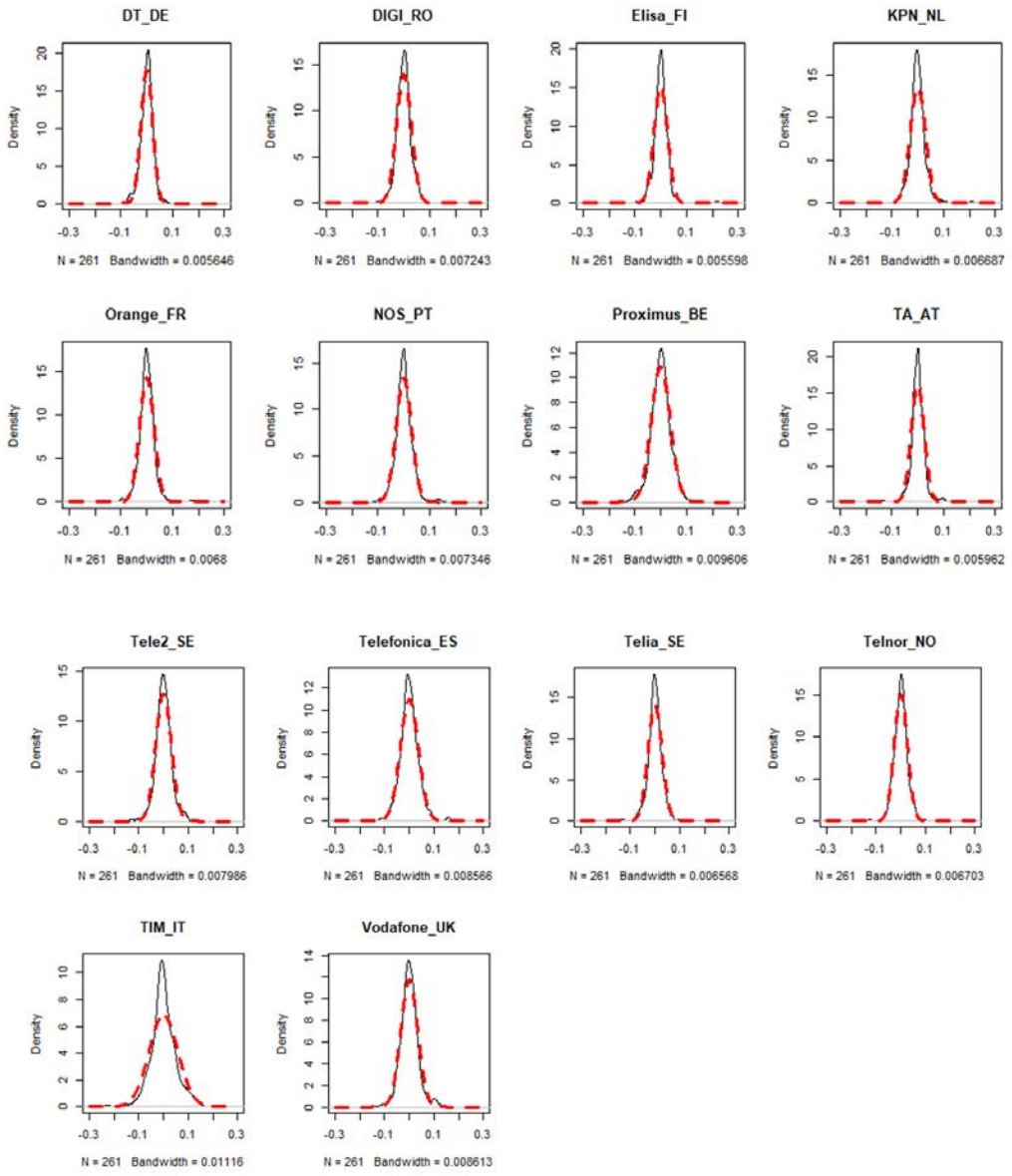


Figure A3 – Density plot of the residual of the distribution

From the graphical analysis of the box plot, density plot and Q-Q plot it can be observed that the normal distribution assumption is generally violated only due to the presence of outliers' values in the residual. In that sense, a general approximation of normal distribution can be accepted.

Table A2 focuses on each comparable and on: i) the beta spot at 1 of April 2024, ii) the rolling beta estimated over a five year time window. It provides the number of relevant outliers[182] as well as the p-values of the Shapiro Wilk normality test[183]. For the rolling beta the averages on the number of outliers as well as the p-values for each comparable over a five year time window and a weekly sampling period are reported. In figure A4 and A5 the corresponding values of the number of outliers, and the p-values of the Statistical tests are shown for visual inspection and transparency reasons over the five year time window from which the corresponding averages for the rolling beta have been derived (blue lines of figures A4 and A5)

This analysis shows that the normality assumption can be generally accepted, and the failure of the normality test is not due to systematic failure of the model assumption, but due the presence of some outliers that are between 3 to 6 % of the whole number of observations.

	Spot beta		Rolling beta (average values)	
	Number of outliers	P-value shapiro test	Number of outliers	P-value shapiro test
DT	13	0.001926477	14	0.03716251
Digi	16	5.620097e-08	16	4.91187e-08
Elisa	11	5.424025e-14	13	0.0005845769
KPN	12	7.705508e-12	13	5.169719e-05
NOS	16	1.119591e-05	17	0.09899708
Orange	17	2.163197e-09	14	0.003213786
Prox	13	0.04464391	14	0.08105703
Tele2	16	0.0003253876	14	3.298809e-05
TIM	11	7.548511e-14	14	0.1101218
Telef	13	3.741312e-05	14	0.002892806
TA	13	1.737686e-09	16	0.003124406

[182] The number of outliers has been evaluated considering influential observations in the residual that have a combination of high leverage and large error. The leverage coefficient is a measure of the effect of a particular observation on the regression predictions due to the position of that observation in the space of the inputs. A common measure of influence is Cook's distance. The Cook's distance of each observation has been considered high if it is larger than 4/n with n the number of observations.

[183] The Shapiro-Wilk test is one of the most used normality test generally used for small sample (<50), as all the parametric normality tests. In this case the objective is to find a measure between comparable to detect outliers of the level of "non-normality". Only two operators pass the normality test highlighted in blue. For the others where the alpha level is 0.05 and the p-value is less than 0.05, the null hypothesis that the data are normally distributed is rejected.

Telenor	13	0.0009169075	16	0.00435177
Telia	11	1.289834e-06	12	4.671235e-07
Vodafone	15	0.0002579298	15	6.120659e-05

Table A2 –Relevant outlier and normality test of spot beta and rolling beta for each peer

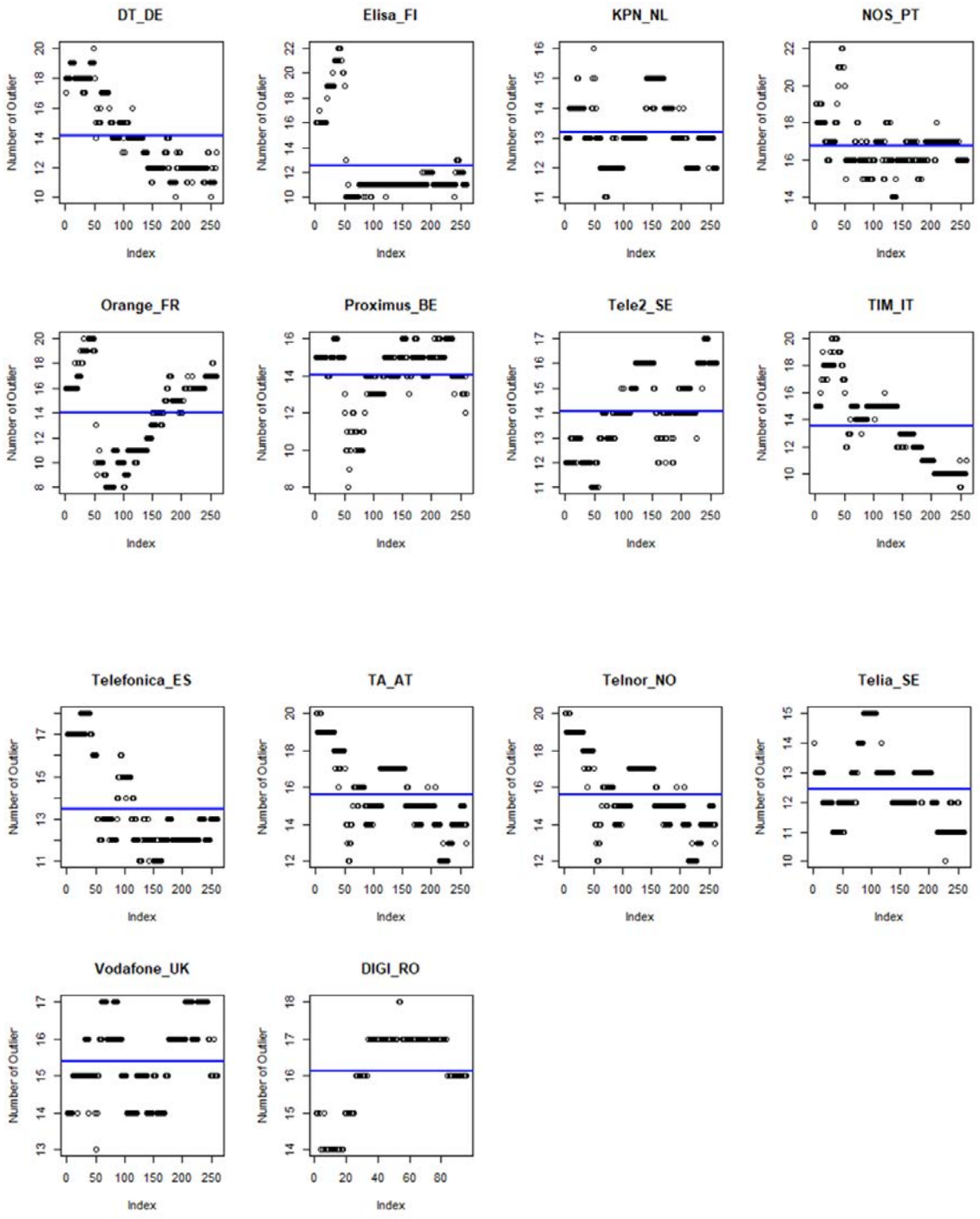


Figure A4 –Number of outlier along the rolling beta time window (the blue line is the average value reported in table A2)

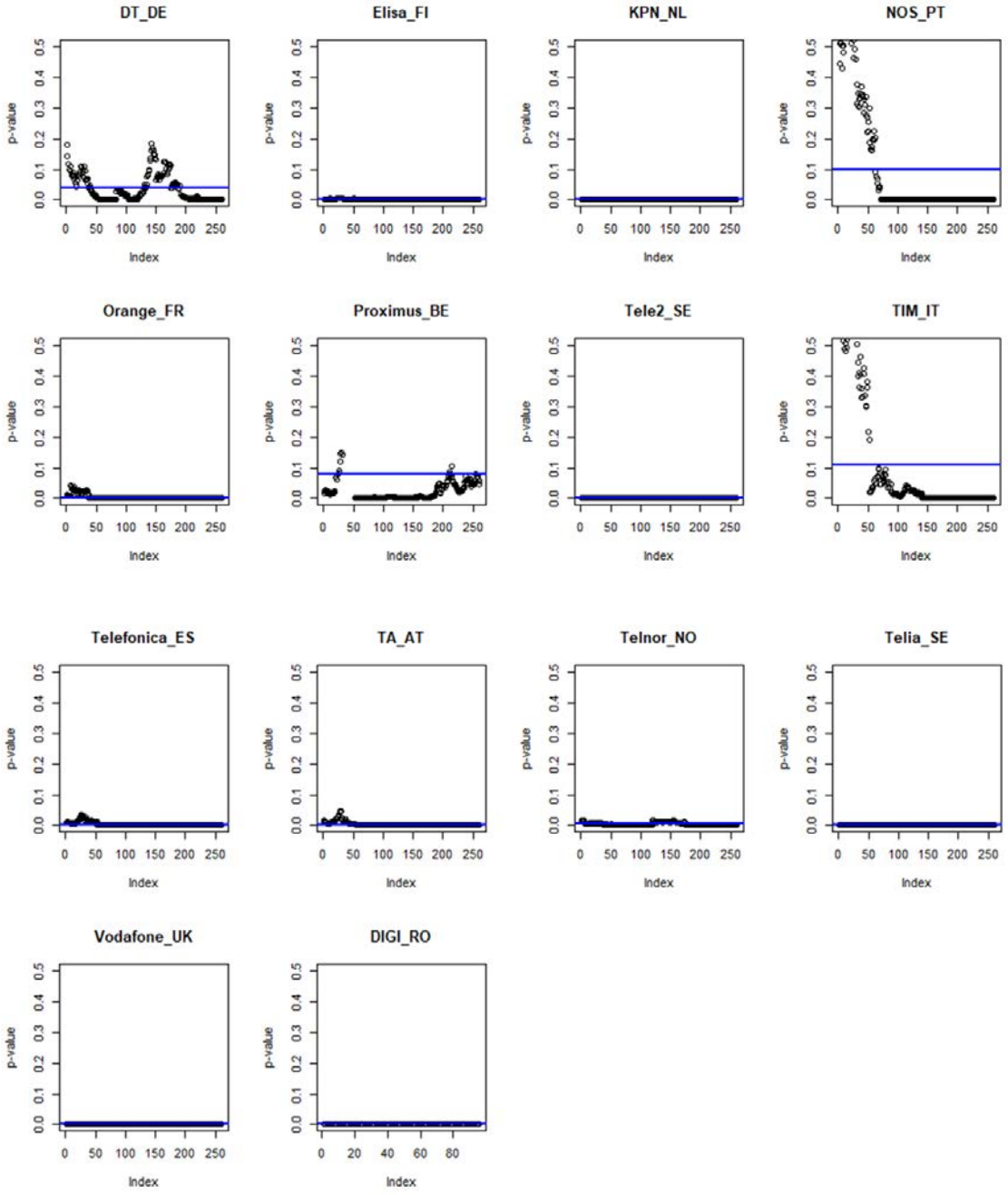


Figure A5 –P-value of Shapiro-Will Normality test along the rolling beta time window (the blue line is the average value reported in table A2)

Homoscedasticity

In relation with the homoscedastic behavior (constant variance of the residual), a graphical analysis of the distribution of the residual with respect to the corresponding fitted value of the model is provided. If the residuals are distributed around the zero line, and no pattern is observable, then the residuals are homoscedastic at least with respect to the constant

variance attribute across the sample. In figure A6 the corresponding situation of the residual estimation is given for the spot beta at 1 of April 2024.

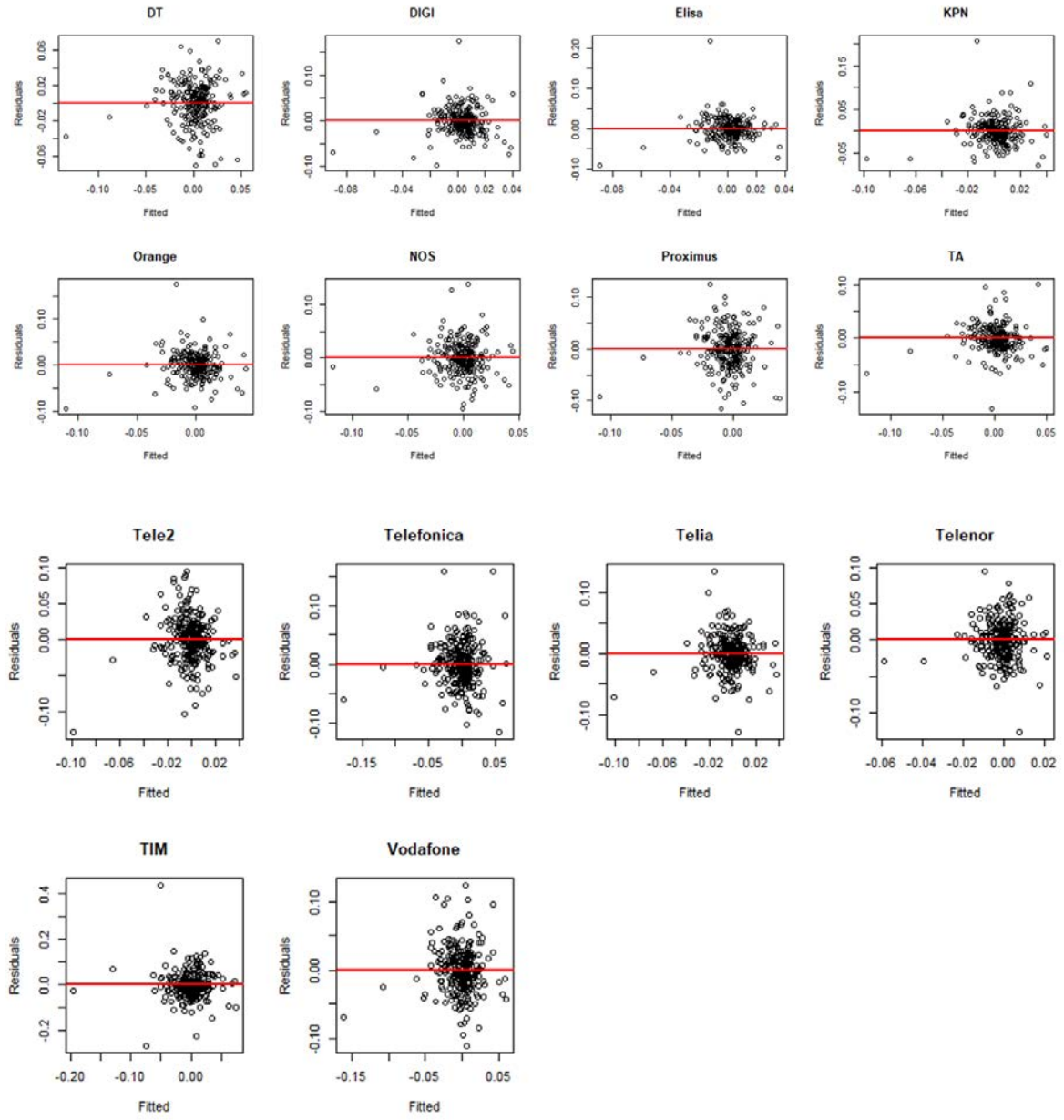


Figure A6 - Residual versus Fitted Values (spot beta at 1 of April 2024)

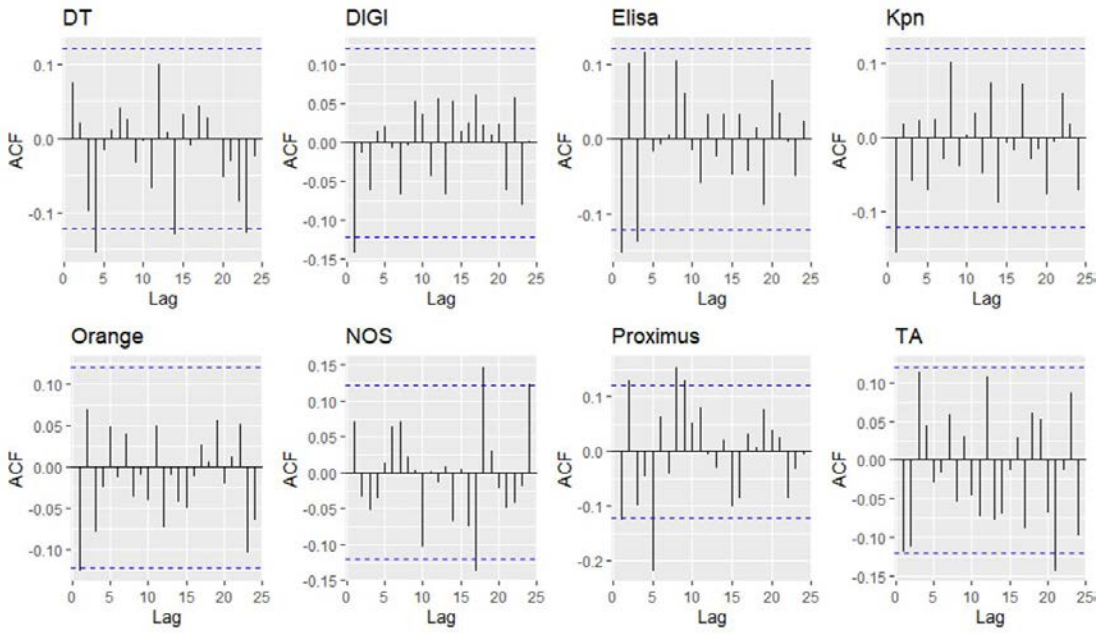
The general picture of the residuals shows a distribution in line with a homoscedastic property of the residuals. Deviation from a “random noise” of the residual around a zero line is only due to some outliers, and thus not based on a systematic pattern of the residual.

Autocorrelation of the residuals

The graphical analysis reported in the previous section indicates that the presence of strong autocorrelation in the residuals is statistically unlikely. At the same time in this section a deepening on this issue will be given.

In the following the autocorrelation (ACF) of the residual from each comparable is reported for the residual of the spot beta at 1 of April 2023.[184]

In the same graph the “test bound” (dashed lines) is also shown. These bounds are used to test the null hypothesis that an autocorrelation coefficient is 0. The null hypothesis is rejected if the sample autocorrelation is outside the bounds. The picture below (Correlogram)[185] shows that the level of autocorrelation of the residual is low or absent for all the comparables considered until the 24 lags of the ACF are taken into account.



[184] The Autocorrelation function is used to assess to what extent a time series is dependent on its past.
[185] The plot of the Autocorrelation sample for different lags is known as an Autocorrelation plot.

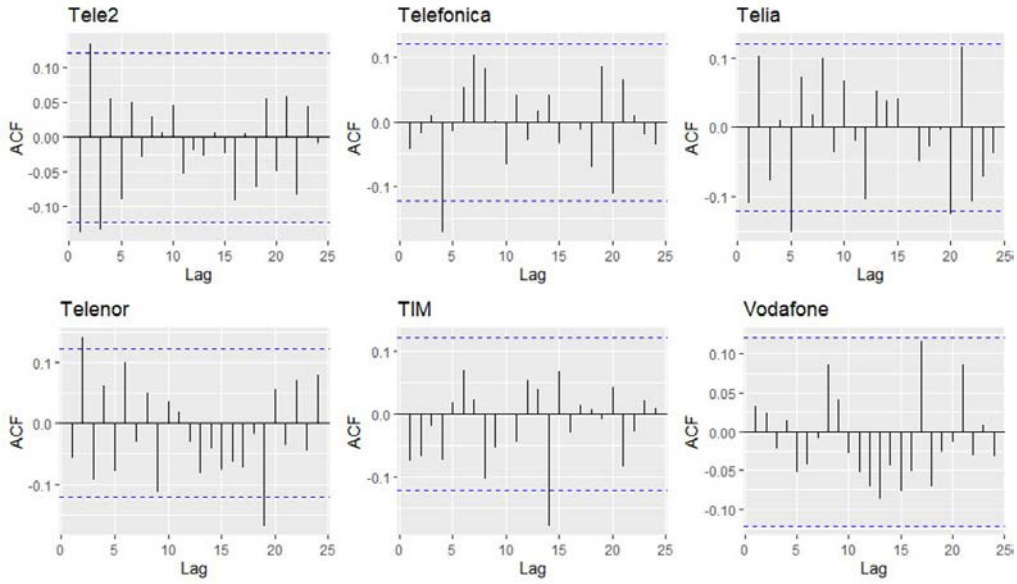


Figure A7 ACF residuals (spot beta at 1 of April 2024)

To obtain a more quantitative picture and comparison between the 14 comparable, the Ljung-Box test and the Breusch-Godfrey test[186] are also considered in the next table A3. In the table for each comparable and for both: i) the beta spot at 1 of April 2024, ii) the rolling beta estimated over a five year time window;[187] the p-values of the two test are reported. For the rolling beta estimation the average values over five year time windows is given. In figures A8 and A9 the corresponding values along the time series used for estimating the average on rolling beta are given.

	Spot beta (last value)		Rolling beta (averages values)	
	P-value (spot value)Lj-test	P-value (spot value) BG-test	P-value (mean value over five years) LJ-test	P-value (mean value over five years) BG-test
DT	0.2018534	0.2450729	0.4820919	0.4381438
Digi	0.8084865	0.832105	0.887363	0.9032991
Elisa	0.1795438	0.4469483	0.1588575	0.2171312
KPN	0.4904098	0.5997946	0.5918783	0.6744184
NOS	0.219205	0.3679438	0.4685886	0.5403408
Orange	0.7480467	0.6984097	0.6547852	0.5727904
Prox	0.001382532	0.001680859	0.1704049	0.1948183
Tele2	0.2112696	0.7134058	0.04974815	0.2202573
TIM	0.4383975	0.466708	0.2899315	0.2366837

[186] the Ljung-Box test and the Breusch-Godfrey test consist of the verification of absence of global correlation with respect to a certain number of lags.

[187]

Telef	0.3848935	0.4157294	0.3051446	0.3488748
TA	0.03050324	0.09442257	0.01643673	0.009106271
Telenor	0.02755957	0.206756	0.1651185	0.3077096
Telia	0.02658562	0.03869778	0.4009454	0.2964496
Vodafone	0.6975925	0.7137356	0.2299608	0.2333468

Table A3 Statistic test for the Ljung-Box test and the Breusch-Godfrey test for 24 lags

Figure A8 –P-value of Ljung-Box Test along the rolling beta (the blue line is the average value reported in table A3)

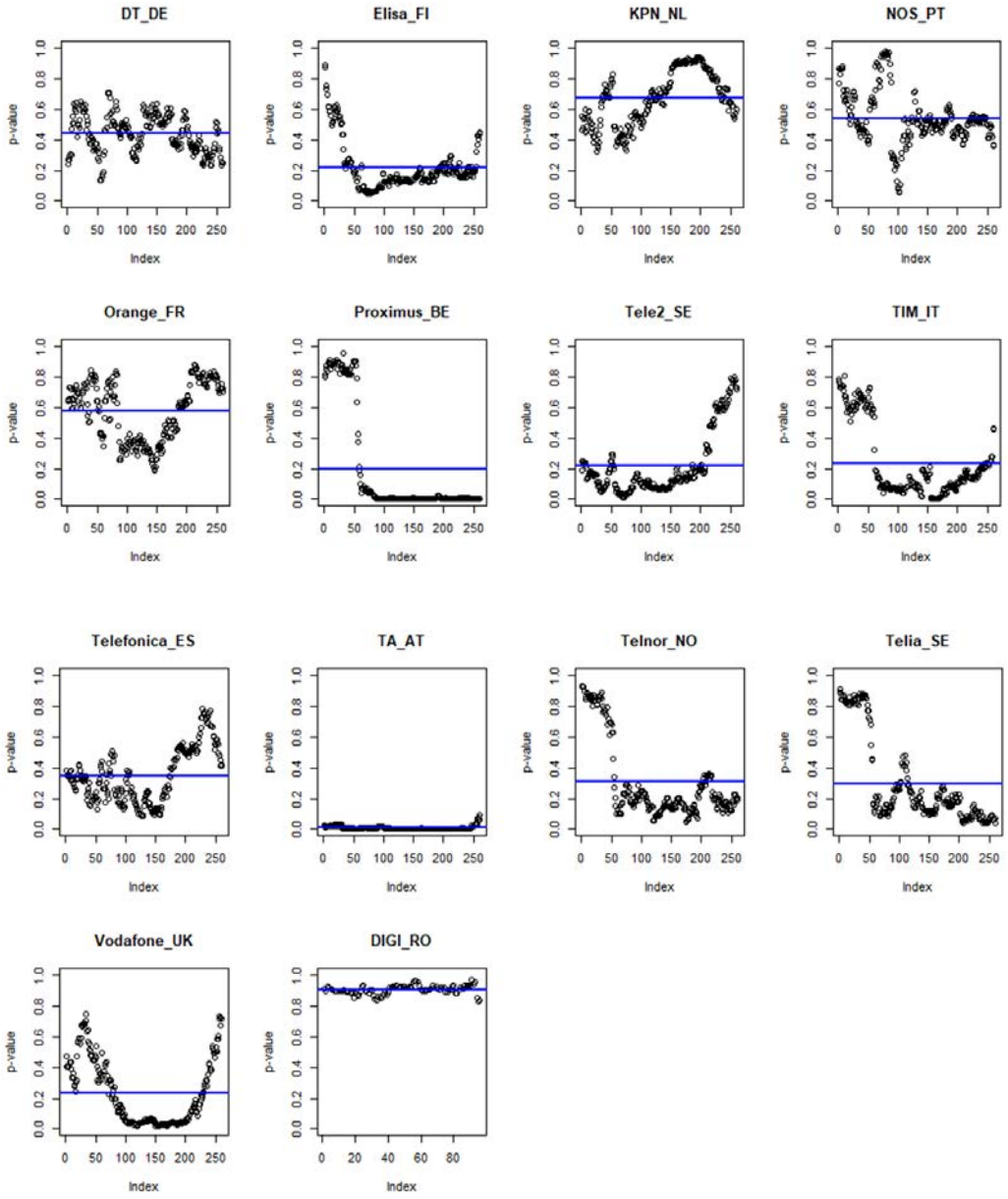


Figure A9 –P-value of Godfrey test Test along the rolling beta (the blue line is the average value reported in table A3)

The p-values from the Ljung-Box and Breusch-Godfrey test applied on 24 lags[188] show on average on the time windows considered that no systematic autocorrelation is present in the residual. Proximus, Telekom Austria show a small level of autocorrelation due to their increased volatility during the last year when last year report only Proximus and Telekom Austria and Tele2 show this situation. It is possible to observe that in the long run the quality of the statistical data is on average better than the spot value for all the peers, as the number of failures of the test is marginal along the time series for the most part of the operators and on average all operators in principle pass the test.

In the following picture the test is done considering different lags from 1 to 24 for the spot beta at 1 of April 2024. The statistical test fails at 95 % on average only for Proximus and partially also for Telekom Austria, Tele2 and Telenor as last year report, considering a level of confidence at 99 % also for those operators the test don't fails for the most part of the lag and so the null hypothesis of no autocorrelation cannot be rejected. This analysis shows that in every case the level of autocorrelation in the residuals is low so that we can still consider the beta estimation to be reliable and unbiased.

[188] 24 lags are generally accepted as maximum inspection for the test.

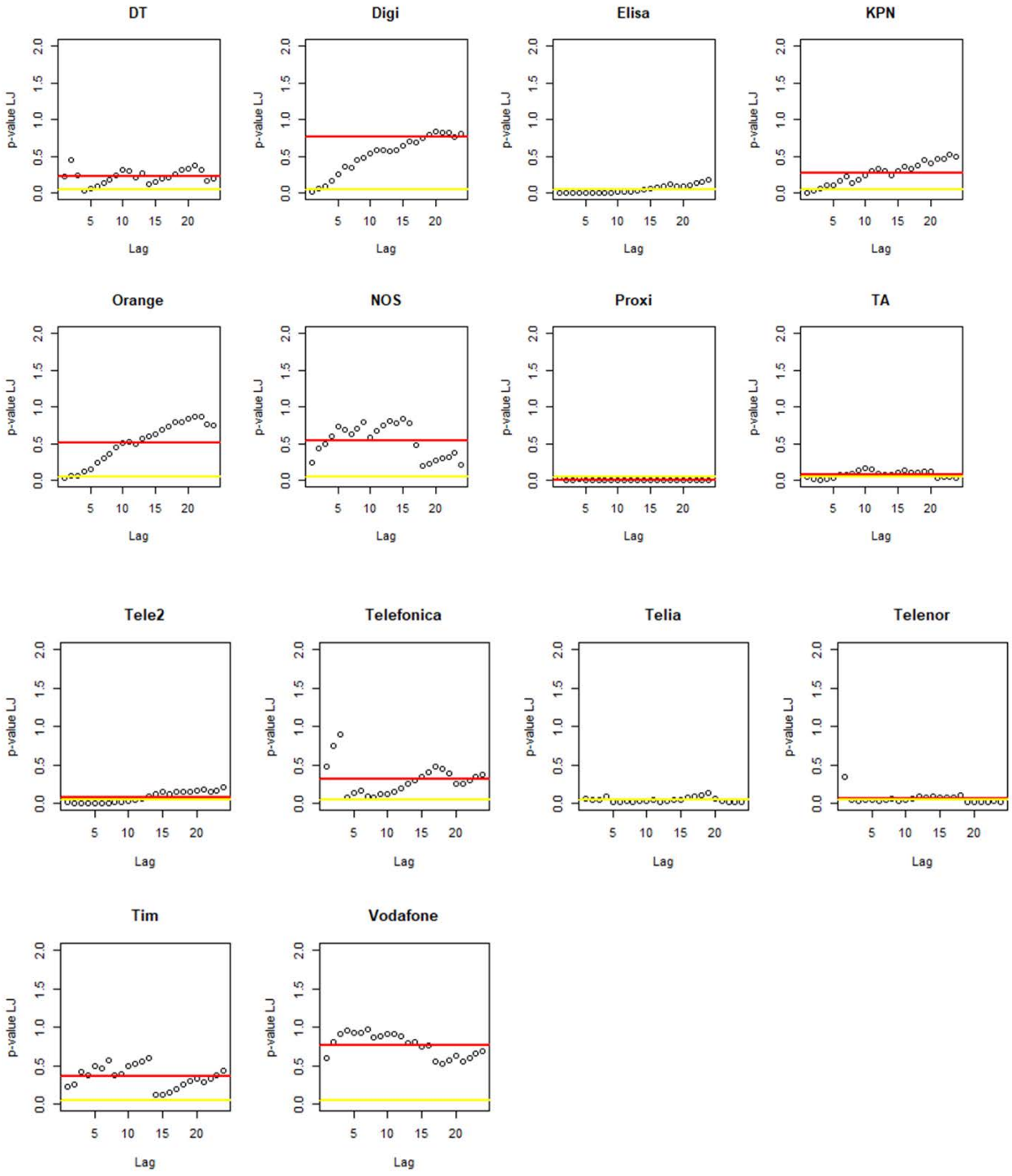


Figure A9: p-values of Ljung-Box test for lag from 1 to 24 (yellow line: the 0.05 limit for null hypothesis evaluation; red line: average p-value over the 24 lags)

The increased volatility that has caused a reduction in the quality of the OLS estimator in comparison to last year, can be understood looking at the squared residuals in the picture below, specifically after the first pandemic induced lockdown in March 2020, which was applied in many European countries, the picture refers to the data for the spot beta at 1 April 2024.

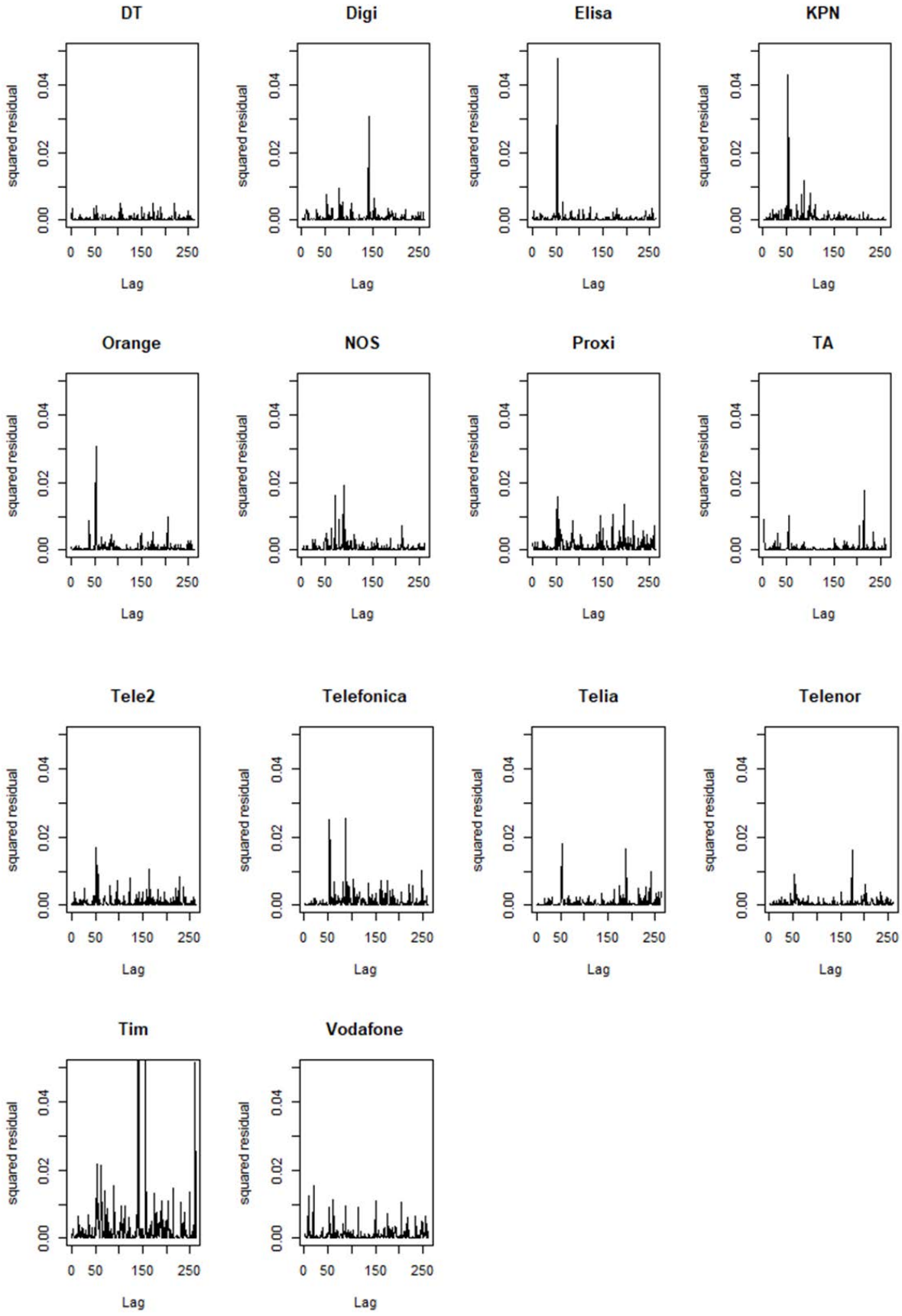


Figure A10: Squared residual representation of spot beta at 1 April 2024

Another relevant test is to check if conditional heteroscedasticity in the residual is present. The presence of the Arch effect in the residual when there is no autocorrelation in the residual is an indication that outliers are not independent. In presence of conditional heteroscedasticity, an uncorrelated time series can still be serially dependent due to a dynamic conditional variance process. A time series exhibiting conditional heteroscedasticity—or autocorrelation in the squared series—is said to have autoregressive conditional heteroscedastic (ARCH) effects.

For this reason, the ARCH Engle's test is carried on. The test is the Lagrange Multiplier test which aims to fit a linear regression model for the squared residuals and examines whether the fitted model is significant. So, the null hypothesis is that the squared residuals are a sequence of white noise, namely, the residuals are homoscedastic. This means that, under the ARCH framework, large shocks tend to be followed by another large shock. The Arch effect can be detected considering the following model

$$a_t^2 = \alpha_0 + \alpha_1 a_{t-1}^2 + \cdots + \alpha_m a_{t-m}^2 + e_t \qquad t = m+1, \ldots., T$$

Where e_t is the error term m is the lag order of the model and T the sample size with a_t the residual of the model considered. The test wants to verify the $\alpha_i = 0\ (i = 1, \ldots, m)$ in the previous linear regression.[189] In line with past year the test is applied before on the spot beta and then this year for the rolling beta as well.

With this analysis an Arch effect in the residual can be detected for the most part of the lags in NOS, that "fail" the test of absence of conditional heteroscedasticity in comparison to last year when last year also others peers (i.e. TA, Proximus) showed the same behaviour.[190] In every case the level of "arch effect" can be considered low without the need to apply any adjustment to the equity beta estimated by the OLS as it can be seen in the following.

[189] The test evaluates the F statistic as ((SSR_0-SSR1)/m)/(SSR_1/(T-2m-1))) with SSR_0=∑(a_t-omega)^2 and SSR_1=∑e_t^2 with t from m+1 to T and omega is the sample mean a_t^2 which is asymptotically distributed as chi-squared distribution with m degrees of freedom under the null hypothesis. "Analysis of Financial Time Series" Wiley R.S. Tsay (2004)

[190] The considered operators are those with an Egel test with an average failure of 24 lags.

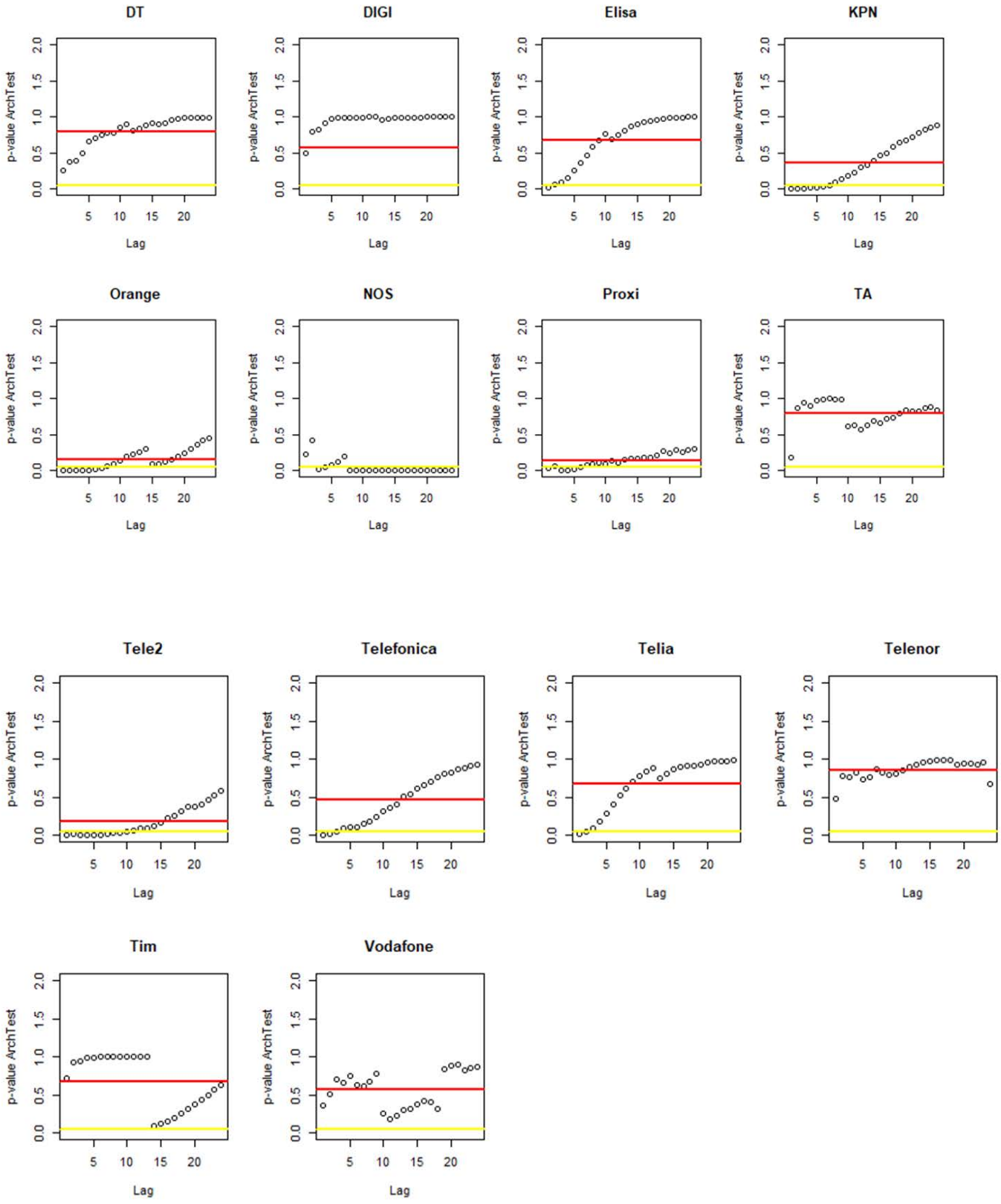


Figure A11 P-values of arch test for different order (lags) in the Egel's test model

In table A5 the p-value of the corresponding outcome of the Arch test evaluated at 24 lags is reported separately for the spot beta at 1 April 2024 and on average over the time window of the rolling beta. As for the other test before the p-value reported for the rolling beta refers to the average p-value detected over the time windows of five year and weekly sampling period. In figure A11 the corresponding evolution over the time windows of five years of the p-value is reported from which the average for the rolling beta is derived. Also for this test it is possible to observe that on average over the five year time window it is passed for all operators with respect to the spot value where three operators fail the test.

	Beta (spot value)	Rolling beta (average)
	Arch test p-value 24 lags (spot)	Arch test p-value 24 lags (average)
DT	0.9876395	0.9050803
Digi	0.9988298	0.9990098
Elisa	0.9978927	0.7952421
KPN	0.8877467	0.8926947
NOS	0.0001666582	0.1237186
Orange	0.4537143	0.3804753
Proximus	0.3003011	0.07731294
Tele2	0.5877699	0.6994629
TIM	0.6310784	0.4354077
Telefonica	0.9301923	0.3296223
Telekom Austria	0.8447002	0.1677003
Telenor	0.6715786	0.5794915
Telia	0.9820497	0.4543012
Vodafone	0.8733157	0.3983093

Table A5 Statistic test for the Arch test for 24 lags for rolling beta and spot beta

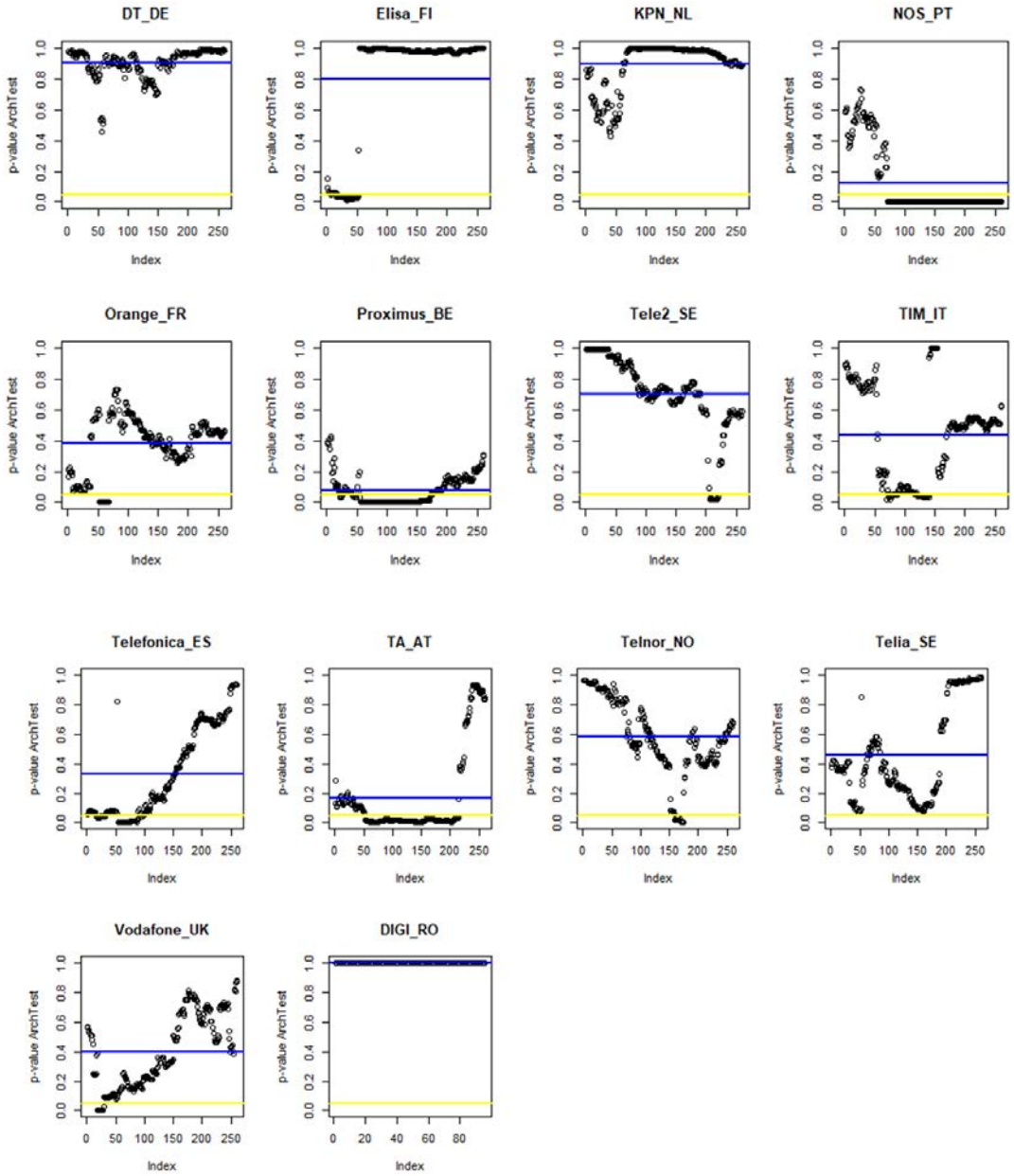


Figure A11 P-values of arch test for point in time (24 lags) in the Egel's test model the blue line report the average value also reported in Table A5. The Yellow line provides the threshold of the test failure

To strengthen the assertion that the beta estimation in every case is not biased in a significant way, as in previous years we have estimated the Beta including in the error term of the regression the "Arch" effect and adjusted the regression estimation by a weighted least-squares, with weights equal to the reciprocals of the conditional variances of the Arch/Garch model estimated with respect to the time series of the standard residuals.

The fit of the residuals with a suitable Arch model has followed the AIC[191] "Akaike Information Criteria", the best model has been selected choosing the one with the lower Akaike Information Criteria parameter considering different GARCH(p,q) models with p,q from 1 to N.
The regressions lines have been recalculated through a weighted least square with weights equal to the reciprocal of the conditional variance of the Arch/Garch[192] model estimated with relevant order. It provides the following results for a beta adjusted for one peer that fails the statistical Engle's test for the spot beta at 1 of April 2024.[193] The adjustment calculated provides always an adjustment in absolute term lower than 0.05 as reported in the following.

	EQUITY BETA	EQUITY BETA ADJUSTED	VARIATION	Adjustment in the error term
NOS	0.62	0.57	0.05	Garch(1,1)

Table A6 Adjustment of spot beta on Arch/Garch effect for the three peers that fail the test (Table A5)

This is consistent with the literature that shows small adjustments in situations where there is conditional heteroscedasticity in the CAPM beta estimation.[194]

The estimated betas for companies with illiquid stocks tend to be unusually low and statistically less reliable. As a result, it is also necessary to assess the liquidity of stocks when selecting comparator companies. Failure in liquidity merit figures is also a reason for the failure of some statistical tests previously carried on. As liquidity is a difficult concept to define and is subject to interpretation, it is useful to look at a wide range of measures. In particular, the following liquidity measures were considered other than considering the free float reported in table A1 for each comparable.

Bid–ask spread as a percentage of closing price. This is the difference between the lowest price at which an asset is offered for sale in a market and the highest price that is offered for purchase of the asset. The lower the bid–ask spread, the more liquid the stock. A relatively narrow bid–ask spread could be a sign that there are a large number of buyers and sellers in the market. The merit figure has been evaluated considering the data, reported by Bloomberg with respect to the maximum and minimum price of the days.

Share turnover. This is a measure of stock liquidity calculated by dividing the total value of shares traded over a period of time by the average market capitalization of the stock for the

[191] AIC rewards goodness of fit (as assessed by the likelihood function), but it also includes a penalty that is an increasing function of the number of estimated parameters. The penalty discourages overfitting, because increasing the number of parameters in the model almost always improves the goodness of the fit.

[192] The Garch model is a generalization of the Arch model when the estimation of the variance of the error term includes both autoregressive term the squared error and of the variance itself. With Garch (p,q), p is the order of the Autoregressive variance and q is the maximum order of Autoregressive term of the square error.

$$\sigma_t^2 = \omega + \alpha_1 \epsilon_{t-1}^2 + \cdots + \alpha_q \epsilon_{t-q}^2 + \beta_1 \sigma_{t-1}^2 + \cdots + \beta_p \sigma_{t-p}^2 = \omega + \sum_{i=1}^{q} \alpha_i \epsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i \sigma_{t-i}^2$$

[193] D. Ruppert, "Statistics and Data analysis for financial engineering" Springer 2015.

[194] Armitage, S & Brzeszczynski, J 2011, 'Heteroscedasticity and interval effects in estimating beta: UK evidence', *Applied Financial Economics*, vol. 21, no. 20, pp. 1525-1538.

period. The higher the share turnover, the more liquid a stock is. For example, a high trading volume would indicate that a stock can be bought and sold easily.

In the picture below the five years average of Bid Ask Spread and Share Turnover are provided for the previous set of comparable. Telecom Austria have lower values with respect to the others considering the share turnover, which means a low level of liquidity - this is already seen in the analysis of autocorrelation of residual and free float. The value reports also comparable data considering the values for 2023 of last year report on comparable merit figure.[195]

	Bid-Ask spread	Share tourn over
DT_DE_23	4.23%	1.07%
DT_DE_24	4.18%	0.95%
Digi_RO_23	4.43%	0.13%
Digi_RO_24	4.26%	0.16%
ELI_FI_23	4.17%	1.12%
ELI_FI_24	3.97%	1.03%
KPN_NL_23	4.47%	1.74%
KPN_NL_24	4.07%	1.65%
NOS_PT_23	4.86%	0.74%
NOS_PT_24	4.76%	0.72%
ORA_FR_23	4.05%	1.37%
ORA_FR_24	4.02%	1.31%
PRO_BE_23	5.65%	1.25%
PRO_BE_24	5.68%	1.24%
T2_SE_23	4.80%	1.66%
T2_SE_24	4.72%	1.70%
TI_IT_23	8.00%	2.84%
TI_IT_24	8.07%	3.12%
TEL_ES_23	5.65%	1.93%
TEL_ES_24	5.70%	1.75%
TA_AT_23	4.51%	0.09%
TA_AT_24	4.15%	0.09%
TEN_NO_23	3.97%	0.57%
TEN_NO_24	3.98%	0.55%
TIA_SE_23	3.90%	1.40%
TIA_SE_24	4.07%	1.43%
VO_UK_23	5.40%	1.16%
VO_UK_24	5.54%	1.12%
Average_23	4.86%	1.22%
Average_24	4.80%	1.20%

Table A8

[195] The Bid-ask spread is evaluated considering the high and lower price in the same trading day.

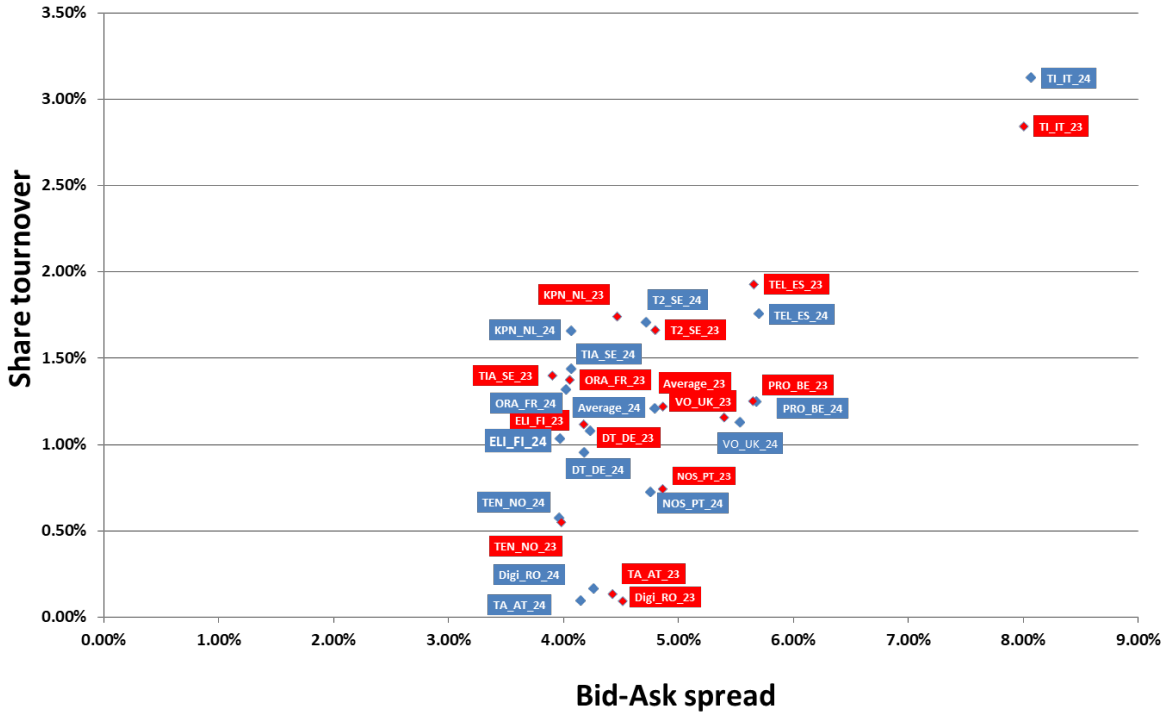


Figure A13 Bid-ask spread and Share turnover

In the following some comparable merit figures obtained from analyzing the balance sheets and income statement of the companies included in the peer group are given.[196]
Specifically four areas of analysis are included with the indicators considered: i) Profitability; ii) Financial Coverage; iii) Enterprise value; iv) Investments.
All three indicators provide an insight on the revenues, and financial conditions that also influence the corresponding level of beta, gearing evolution, that can, as well as, provide explanation the corresponding choices on merger and acquisition or separation activities.

The profitability are covered by the following indicators:

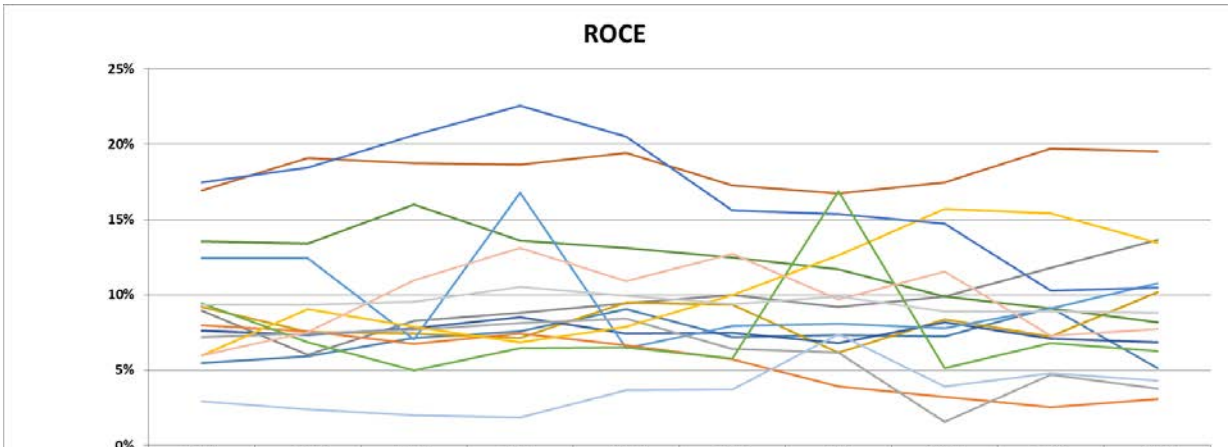
- ROCE (return on capital employed) evaluated as ebit/(total asset-current liability): earning before interest and tax / capital employed

-

- Return on capital employed can be especially useful when comparing the performance of companies in capital-intensive sectors, such as utilities and telecoms. This is because it analyzes profitability related to a company's shareholders' equity and debt, neutralizing financial performance analysis for companies with significant debt. Ultimately, the calculation of ROCE tells the amount of profit a company is generating per 1 Euro/own currency of capital employed. The more profit per $Euro/own currency a company can generate, the better. Thus, a higher ROCE indicates stronger profitability across company comparisons.

[196] The data are retrieved from Bloomberg from the standardized Financial Analysis section (Data is adjusted to remove the impact of abnormal items (as defined by Bloomberg). Data have been standardized for consistent accounting treatment and presentation across companies).

Investors tend to favor companies with stable and rising ROCE levels over companies where ROCE is volatile or trending lower.

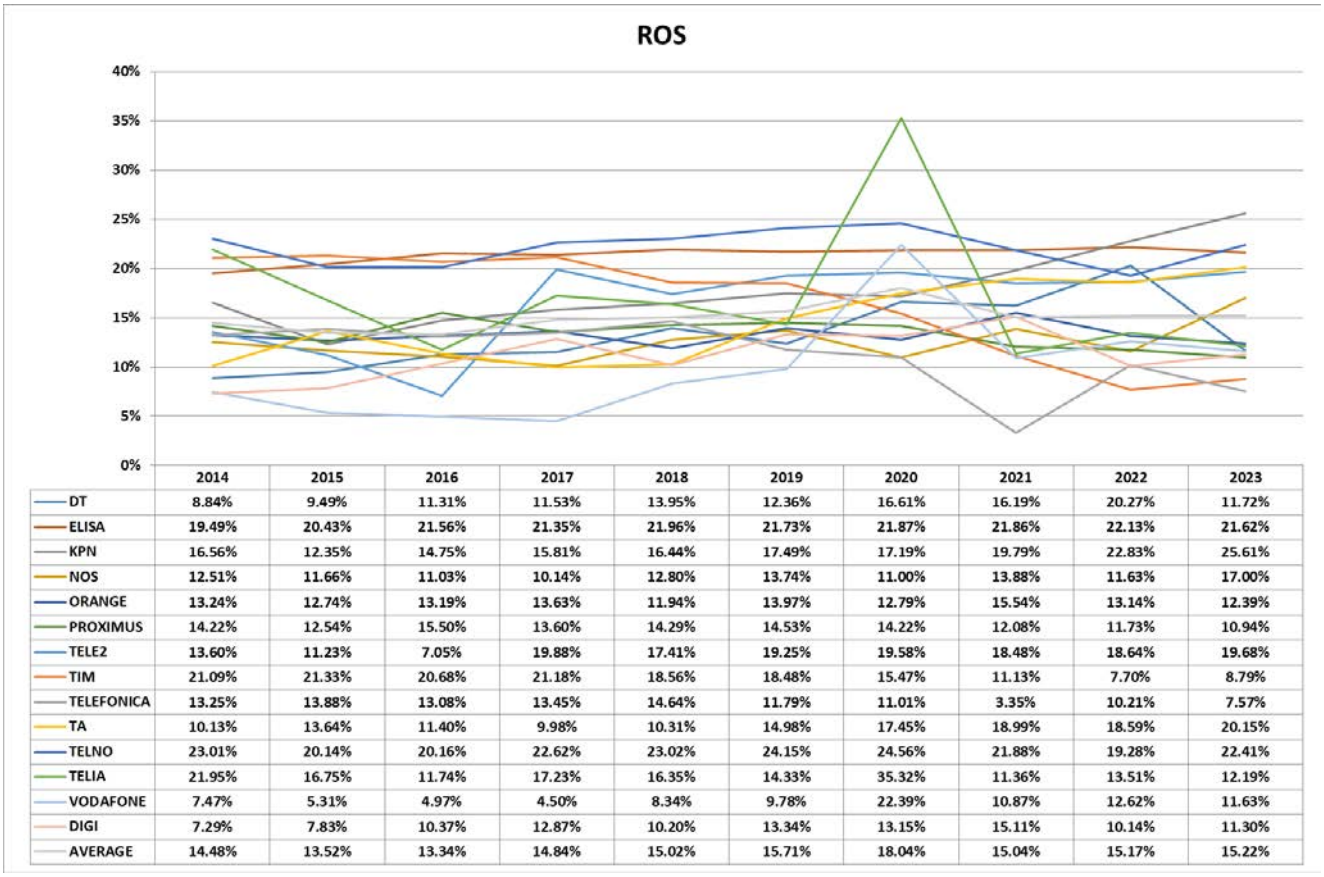


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DT	5.48%	5.95%	7.16%	7.58%	9.08%	7.22%	7.37%	7.25%	9.14%	5.16%
ELISA	16.93%	19.11%	18.74%	18.65%	19.46%	17.29%	16.76%	17.45%	19.72%	19.52%
KPN	8.96%	6.01%	8.28%	8.82%	9.47%	9.98%	9.20%	9.92%	11.82%	13.64%
NOS	9.23%	7.53%	7.43%	7.16%	9.50%	9.37%	6.15%	8.38%	7.25%	10.18%
ORANGE	7.64%	7.34%	7.79%	8.53%	7.45%	7.51%	6.81%	8.18%	7.10%	6.88%
PROXIMUS	13.55%	13.40%	16.03%	13.60%	13.11%	12.49%	11.69%	9.90%	9.10%	8.18%
TELE2	12.43%	12.45%	7.05%	16.79%	6.47%	7.96%	8.09%	7.79%	9.14%	10.77%
TIM	7.99%	7.61%	6.77%	7.45%	6.69%	5.71%	3.95%	3.23%	2.54%	3.11%
TELEFONICA	7.21%	7.44%	7.72%	8.13%	8.44%	6.44%	6.16%	1.57%	4.72%	3.80%
TA	6.01%	9.08%	7.88%	6.84%	7.88%	9.99%	12.64%	15.74%	15.40%	13.48%
TELNO	17.45%	18.45%	20.59%	22.56%	20.52%	15.61%	15.39%	14.75%	10.29%	10.46%
TELIA	9.46%	6.86%	5.03%	6.49%	6.52%	5.76%	16.89%	5.16%	6.81%	6.28%
VODAFONE	2.96%	2.40%	2.03%	1.88%	3.66%	3.72%	7.39%	3.95%	4.82%	4.31%
DIGI	5.99%	7.54%	10.95%	13.15%	10.91%	12.73%	9.72%	11.58%	7.30%	7.76%
AVERAGE	9.38%	9.37%	9.53%	10.54%	9.94%	9.41%	9.87%	8.92%	8.94%	8.82%

It is possible to observe that on average the ROCE is reducing, but not in a dramatic way, with some exceptions.

- ROS (Return on Sale) evaluated as Ebit/revenues: earning before interest and tax / Revenues

- The ROS (Return on Sale) provide information about the efficiency of a company as it provide information on how much revenues are transformed in earnings.



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DT	8.84%	9.49%	11.31%	11.53%	13.95%	12.36%	16.61%	16.19%	20.27%	11.72%
ELISA	19.49%	20.43%	21.56%	21.35%	21.96%	21.73%	21.87%	21.86%	22.13%	21.62%
KPN	16.56%	12.35%	14.75%	15.81%	16.44%	17.49%	17.19%	19.79%	22.83%	25.61%
NOS	12.51%	11.66%	11.03%	10.14%	12.80%	13.74%	11.00%	13.88%	11.63%	17.00%
ORANGE	13.24%	12.74%	13.19%	13.63%	11.94%	13.97%	12.79%	15.54%	13.14%	12.39%
PROXIMUS	14.22%	12.54%	15.50%	13.60%	14.29%	14.53%	14.22%	12.08%	11.73%	10.94%
TELE2	13.60%	11.23%	7.05%	19.88%	17.41%	19.25%	19.58%	18.48%	18.64%	19.68%
TIM	21.09%	21.33%	20.68%	21.18%	18.56%	18.48%	15.47%	11.13%	7.70%	8.79%
TELEFONICA	13.25%	13.88%	13.08%	13.45%	14.64%	11.79%	11.01%	3.35%	10.21%	7.57%
TA	10.13%	13.64%	11.40%	9.98%	10.31%	14.98%	17.45%	18.99%	18.59%	20.15%
TELNO	23.01%	20.14%	20.16%	22.62%	23.02%	24.15%	24.56%	21.88%	19.28%	22.41%
TELIA	21.95%	16.75%	11.74%	17.23%	16.35%	14.33%	35.32%	11.36%	13.51%	12.19%
VODAFONE	7.47%	5.31%	4.97%	4.50%	8.34%	9.78%	22.39%	10.87%	12.62%	11.63%
DIGI	7.29%	7.83%	10.37%	12.87%	10.20%	13.34%	13.15%	15.11%	10.14%	11.30%
AVERAGE	14.48%	13.52%	13.34%	14.84%	15.02%	15.71%	18.04%	15.04%	15.17%	15.22%

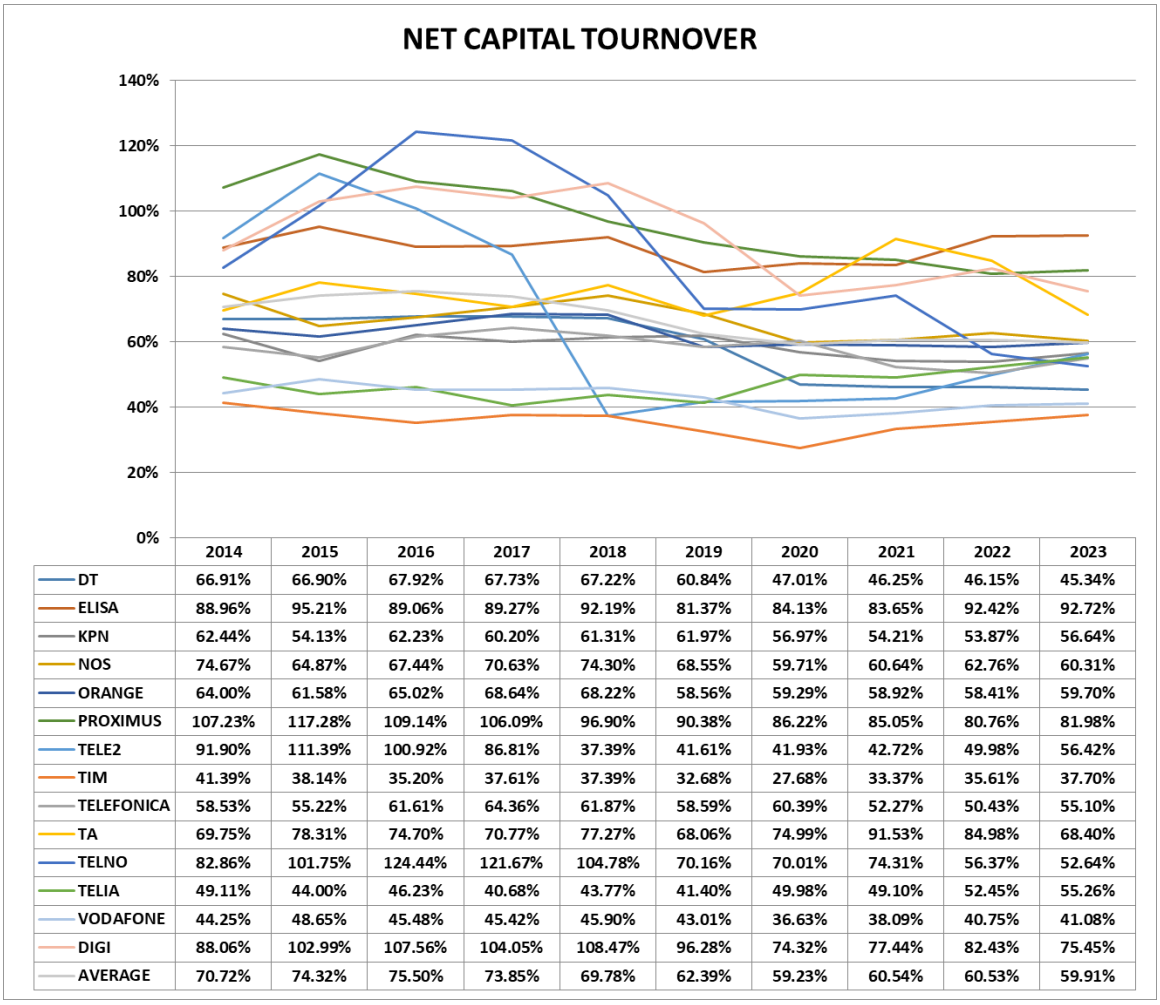
It is possible to observe that ROS is more stable, it doesn't show a specific trend with respect to ROCE, that means that operators are pushing mainly on efficiency on current costs to generate earnings.

- Turnover of net capital employed: revenues/(total asset-current liability-cash and cash equivalent).

-

- This index provides information about the ability of the company to build up revenues with respect to the corresponding net capital employed. Generally, an higher ratio provides information on efficiency with respect to the capital employed. The product between the Turnover and ROS provides information on the corresponding Return on invested capital (ROIC)[197].

[197] ROIC can be calculated as ROCE excluding cash and cash equivalent from the capital employed.



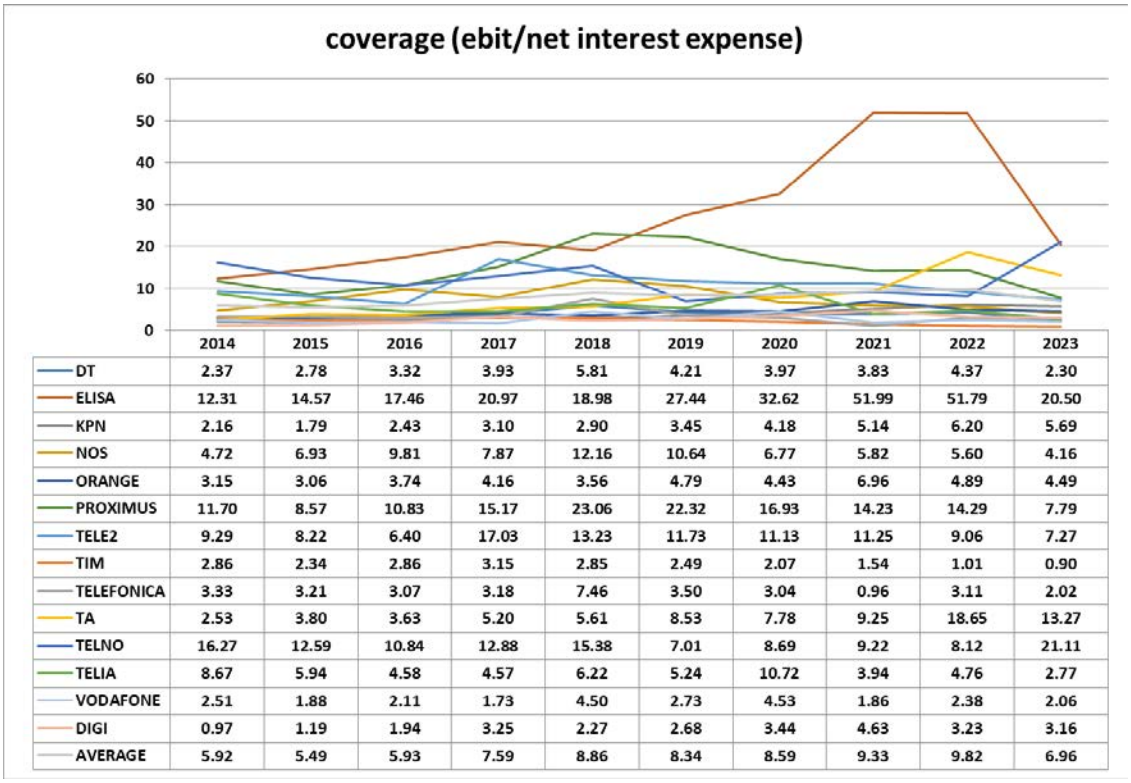
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DT	66.91%	66.90%	67.92%	67.73%	67.22%	60.84%	47.01%	46.25%	46.15%	45.34%
ELISA	88.96%	95.21%	89.06%	89.27%	92.19%	81.37%	84.13%	83.65%	92.42%	92.72%
KPN	62.44%	54.13%	62.23%	60.20%	61.31%	61.97%	56.97%	54.21%	53.87%	56.64%
NOS	74.67%	64.87%	67.44%	70.63%	74.30%	68.55%	59.71%	60.64%	62.76%	60.31%
ORANGE	64.00%	61.58%	65.02%	68.64%	68.22%	58.56%	59.29%	58.92%	58.41%	59.70%
PROXIMUS	107.23%	117.28%	109.14%	106.09%	96.90%	90.38%	86.22%	85.05%	80.76%	81.98%
TELE2	91.90%	111.39%	100.92%	86.81%	37.39%	41.61%	41.93%	42.72%	49.98%	56.42%
TIM	41.39%	38.14%	35.20%	37.61%	37.39%	32.68%	27.68%	33.37%	35.61%	37.70%
TELEFONICA	58.53%	55.22%	61.61%	64.36%	61.87%	58.59%	60.39%	52.27%	50.43%	55.10%
TA	69.75%	78.31%	74.70%	70.77%	77.27%	68.06%	74.99%	91.53%	84.98%	68.40%
TELNO	82.86%	101.75%	124.44%	121.67%	104.78%	70.16%	70.01%	74.31%	56.37%	52.64%
TELIA	49.11%	44.00%	46.23%	40.68%	43.77%	41.40%	49.98%	49.10%	52.45%	55.26%
VODAFONE	44.25%	48.65%	45.48%	45.42%	45.90%	43.01%	36.63%	38.09%	40.75%	41.08%
DIGI	88.06%	102.99%	107.56%	104.05%	108.47%	96.28%	74.32%	77.44%	82.43%	75.45%
AVERAGE	70.72%	74.32%	75.50%	73.85%	69.78%	62.39%	59.23%	60.54%	60.53%	59.91%

In this case equivalently with respect to ROCE there is a clear reduction trend on this indicator showing that investments are still relevant, but there is much difficulty on converting new capital employed in corresponding new revenues.

The coverage indicators provide information on the financial stability issues for this purpose two related indicators are reported:

- Coverage ratio 1: Ebit/ net interest expense

- This indicator provides information about how much earnings are used to pay financial interest. A value lower than one means that the earnings are used to pay interest expenses instead to remunerate equity investors.



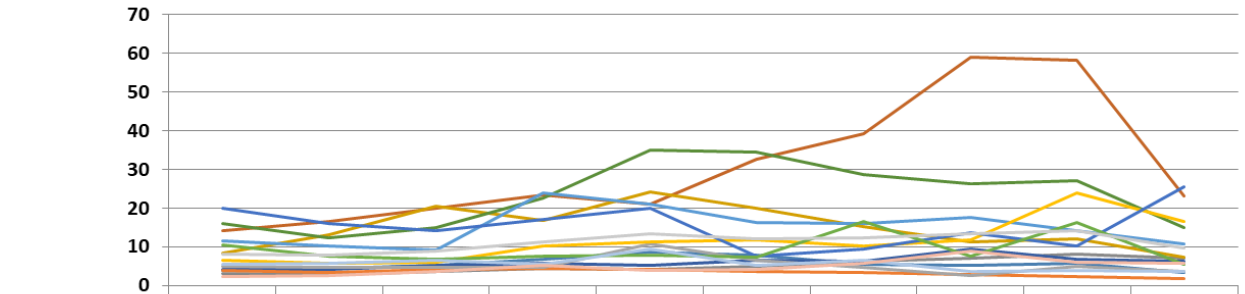
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DT	2.37	2.78	3.32	3.93	5.81	4.21	3.97	3.83	4.37	2.30
ELISA	12.31	14.57	17.46	20.97	18.98	27.44	32.62	51.99	51.79	20.50
KPN	2.16	1.79	2.43	3.10	2.90	3.45	4.18	5.14	6.20	5.69
NOS	4.72	6.93	9.81	7.87	12.16	10.64	6.77	5.82	5.60	4.16
ORANGE	3.15	3.06	3.74	4.16	3.56	4.79	4.43	6.96	4.89	4.49
PROXIMUS	11.70	8.57	10.83	15.17	23.06	22.32	16.93	14.23	14.29	7.79
TELE2	9.29	8.22	6.40	17.03	13.23	11.73	11.13	11.25	9.06	7.27
TIM	2.86	2.34	2.86	3.15	2.85	2.49	2.07	1.54	1.01	0.90
TELEFONICA	3.33	3.21	3.07	3.18	7.46	3.50	3.04	0.96	3.11	2.02
TA	2.53	3.80	3.63	5.20	5.61	8.53	7.78	9.25	18.65	13.27
TELNO	16.27	12.59	10.84	12.88	15.38	7.01	8.69	9.22	8.12	21.11
TELIA	8.67	5.94	4.58	4.57	6.22	5.24	10.72	3.94	4.76	2.77
VODAFONE	2.51	1.88	2.11	1.73	4.50	2.73	4.53	1.86	2.38	2.06
DIGI	0.97	1.19	1.94	3.25	2.27	2.68	3.44	4.63	3.23	3.16
AVERAGE	5.92	5.49	5.93	7.59	8.86	8.34	8.59	9.33	9.82	6.96

In this case it is possible to observe that on average there is not a clear trend, but the level of financial sustainability is generally high with some exceptions, and the index is clearly supported in period with lower interest rate.

-

- Coverage ratio 2: EBITA/ interest expense

- This indicator is very close to the previous one, but in this case the index provides a more effective information with respect to the capability of the company to pay passive interest on debt, independent with respect to the chance to effort investment in immaterial asset in future as the previous coverage index; in this case amortization are excluded (i.e. intangible assets including goodwill).



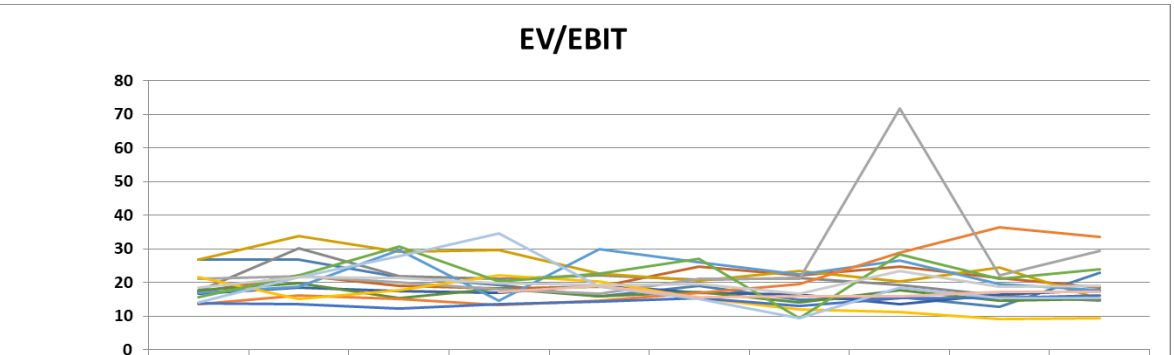
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DT	4.05	4.56	5.25	6.79	8.59	7.79	5.64	5.28	5.69	3.43
ELISA	14.17	16.55	20.03	23.41	21.14	32.71	39.31	59.02	58.19	23.11
KPN	3.17	2.94	3.80	4.44	4.27	5.05	6.19	7.11	8.25	7.14
NOS	8.31	13.06	20.65	16.76	24.23	19.93	15.18	11.19	12.02	7.36
ORANGE	4.31	4.29	5.26	5.75	5.19	6.66	6.32	9.44	6.96	6.41
PROXIMUS	16.16	12.44	15.10	22.52	35.03	34.46	28.61	26.34	27.00	15.00
TELE2	11.52	10.23	9.09	24.03	21.07	16.45	15.97	17.58	14.24	10.90
TIM	4.03	3.33	4.13	4.49	4.15	3.74	3.44	2.90	2.28	1.87
TELEFONICA	4.93	4.76	4.73	4.75	10.92	6.55	4.80	2.71	5.09	3.71
TA	6.63	5.84	6.04	10.21	11.21	11.94	10.34	11.93	23.87	16.52
TELNO	20.11	16.16	14.15	17.08	19.94	7.60	9.60	13.64	10.39	25.51
TELIA	10.63	7.76	6.80	7.67	8.01	7.47	16.52	7.69	16.35	5.52
VODAFONE	5.59	5.66	6.52	5.63	9.60	5.24	6.54	3.59	4.06	3.63
DIGI	2.34	2.67	3.78	5.26	4.06	4.32	5.67	8.94	6.10	5.71
AVERAGE	8.28	7.88	8.95	11.34	13.39	12.14	12.44	13.38	14.32	9.70

In the following the EV/EBIT multiple is considered for comparison between peers.

The indicator is estimated as follows:

- EV/ EBIT: Enterprise value/ Earning before interest and tax. Enterprise value is obtained as: EV= Market cap+ Total liabilities- cash and cash equivalent

- This indicator is used by market analysts and investors to determine the value of a company. It compares the company's profit with its market valuation. Comparison among companies using the EV/EBIT multiple provides better results than traditional profitability ratios like the return on invested capital (ROIC).
  The EV/EBIT multiple allows investors to compare companies with different tax rates and different levels of debt. EV/EBIT multiple normalizes the effect of dissimilar capital structure; hence, companies with different capital structures can be put on an equal base for comparison of earnings yields.
- Furthermore, the use of EBIT as a profitability measure eliminates the distorting effects of tax rate benefits. The enterprise value takes into consideration the debt value and market capitalization. Thus, it rewards the companies carrying less debt and high cash and disapproves of the companies with less cash and high debt.



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DT	26.70	26.76	21.59	19.21	16.00	18.94	14.94	15.55	12.89	22.88
ELISA	17.07	22.19	18.98	18.27	18.64	24.60	22.07	24.65	21.30	18.61
KPN	17.49	30.30	21.91	20.97	22.03	20.88	21.27	19.36	16.12	14.64
NOS	26.71	33.81	29.25	29.68	22.64	20.64	23.51	20.36	24.56	15.12
ORANGE	16.74	18.48	17.32	16.87	19.30	17.00	16.36	13.49	16.35	17.69
PROXIMUS	17.59	19.83	15.48	18.28	15.86	17.29	14.02	17.64	14.54	15.13
TELE2	16.89	18.74	29.74	14.59	30.00	25.98	22.44	26.61	19.47	17.80
TIM	13.43	16.15	15.17	13.31	14.69	16.87	19.55	28.98	36.48	33.54
TELEFONICA	21.12	21.93	19.98	17.93	16.76	20.97	20.97	71.70	22.09	29.38
TA	21.49	15.15	17.58	22.03	20.35	15.40	12.08	11.27	9.24	9.49
TELNO	13.90	13.58	12.13	13.50	14.36	15.26	13.14	15.46	15.37	16.17
TELIA	15.56	22.06	30.65	20.43	22.63	27.18	9.32	28.30	20.97	23.93
VODAFONE	14.14	21.63	27.84	34.47	18.65	15.18	9.31	18.40	15.48	15.25
DIGI				17.30	19.04	15.57	15.82	15.99	17.29	17.10
AVERAGE	18.37	21.59	21.36	19.77	19.35	19.41	16.77	23.41	18.72	19.05

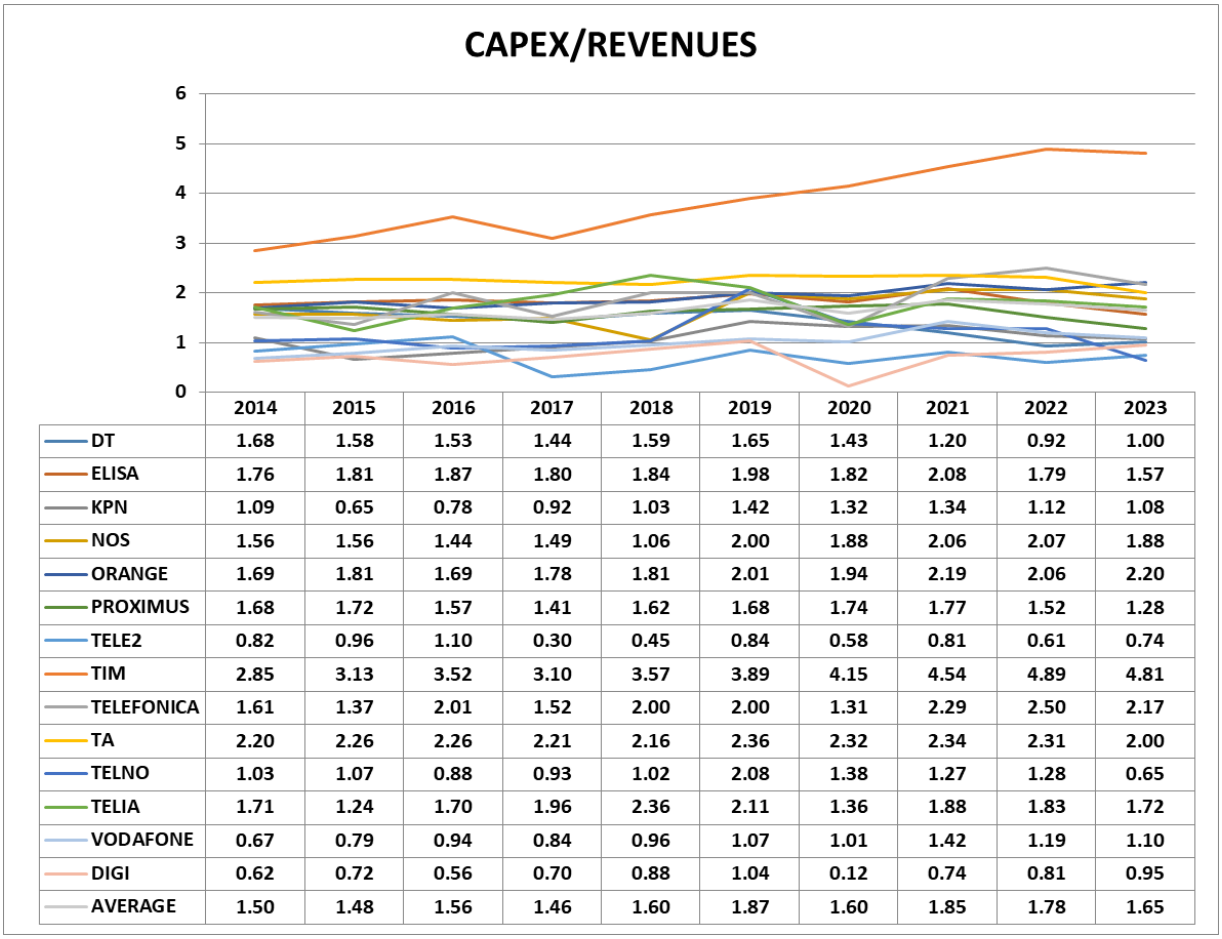
In the following the corresponding indicator on capital Investment is derived based on the ratio between the capex/revenues.

The indicator is estimated as follows:

- Capex/revenues: (Property, Plant & Equip_n- Property, Plant & Equip_n-1+Depreciation_n)/ Revenues_n. Capex is estimated from the balance sheet information about level of depreciation of year n and differences between property plant and equipment of the years n and n-1.[198]

- This indicator is useful to understand the level of investment in capex (equipments, spectrum, as well as civil infrastructures etc. in relation to the revenues) so capital effectively used for the core business independent from the full net capital resource as considered in the net capital turnover indicator.

[198] https://corporatefinanceinstitute.com/resources/financial-modeling/how-to-calculate-capex-formula/



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DT	1.68	1.58	1.53	1.44	1.59	1.65	1.43	1.20	0.92	1.00
ELISA	1.76	1.81	1.87	1.80	1.84	1.98	1.82	2.08	1.79	1.57
KPN	1.09	0.65	0.78	0.92	1.03	1.42	1.32	1.34	1.12	1.08
NOS	1.56	1.56	1.44	1.49	1.06	2.00	1.88	2.06	2.07	1.88
ORANGE	1.69	1.81	1.69	1.78	1.81	2.01	1.94	2.19	2.06	2.20
PROXIMUS	1.68	1.72	1.57	1.41	1.62	1.68	1.74	1.77	1.52	1.28
TELE2	0.82	0.96	1.10	0.30	0.45	0.84	0.58	0.81	0.61	0.74
TIM	2.85	3.13	3.52	3.10	3.57	3.89	4.15	4.54	4.89	4.81
TELEFONICA	1.61	1.37	2.01	1.52	2.00	2.00	1.31	2.29	2.50	2.17
TA	2.20	2.26	2.26	2.21	2.16	2.36	2.32	2.34	2.31	2.00
TELNO	1.03	1.07	0.88	0.93	1.02	2.08	1.38	1.27	1.28	0.65
TELIA	1.71	1.24	1.70	1.96	2.36	2.11	1.36	1.88	1.83	1.72
VODAFONE	0.67	0.79	0.94	0.84	0.96	1.07	1.01	1.42	1.19	1.10
DIGI	0.62	0.72	0.56	0.70	0.88	1.04	0.12	0.74	0.81	0.95
AVERAGE	1.50	1.48	1.56	1.46	1.60	1.87	1.60	1.85	1.78	1.65

It is possible to observe that in line with the capital turnover indicator, there is a general increase that is mainly affected by a general reduction of revenues with an high level of the corresponding capex investment sustained.

To better figure out the determinants behind the risk represented in the equity beta parameter an econometric panel data estimation is reported as follows. The objective is to understand how accounting measures are correlated with the corresponding market risk (i.e equity beta) in a statistical significant way considering the present BEREC peer group. The models estimated are based on the following main specification: the dependent variable is the equity beta estimated on three possible time windows (one, two and five years).[199] The estimation for one year and two years are based on a dayly sampling period instead the five year is based on a weekly data as the relevant time and sampling period considered in the notice.
The following panel data model is considered:

Equity_beta_i_k= C+ β1 CAPEX_i-1_k + β2 ROCE_i-1_k + β3 MC_i-1_k + β4 COV1_i-1_k +β5 EV1_i-1_k+ constant_k[200]+ constant_i[201]+ error_term (where i is the year of the data and k identifies the peer).

[199] We have considered also different time windows to better undestand if the statistical significance between the relevant predictors and the corresponding dependent variable is affected by the time windows chosen for the equity beta, even if Berec is concentrated on a specific five years time windows for the relevant estimation.
[200] Fixed effect over peers: eterogenity over peers.
[201] Time fixed effect: eterogenity over years.

In the following table a short description of the indicator and a summary of the main statistics are reported. The number of observations in such balanced panel are 130 obtained as 10 years of data for 13 operators.[202]

	Description
CAPEX	Capex/Revenues
ROCE	Return on capital employied : EBIT/(total asset-current liabilities)
MC	Yearly market cap in Euro currency
COV1	EBIT/net interest expence
EV1	Enterprice value / ebit
EBETAONE	Is the equity beta estimated regressing the return of the security with the return of the market index (BKXP have been used as market index) using daily sampling period and one year of time windows. It refers to the average value of the corresponding year I obtained from a rolling regression over the year.
EBETATWO	Is the equity beta estimated regressing the return of the security with the return of the market index (BKXP have been used as market index) using daily sampling period and two years of time windows. It refers to the average value of the corresponding year I obtained from a rolling regression over the year.
EBETAFIVE	Is the equity beta estimated regressing the return of the security with the return of the market index (BKXP have been used as market index) using daily sampling period and five years of time windows. It refers to the average value of the corresponding year I obtained from a rolling regression over the year.

Descriptive statistics

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
ROCE	130	0.1	0.05	0.02	0.1	0.1	0.2
COV_1	130	7.9	7.9	1.0	3.1	10.6	52.0
EV_1	130	19.7	7.3	9.2	15.3	22.1	71.7
CAPEX	130	1.7	0.8	-0.1	1.1	2.0	4.9
MCEUR	130	22.7	24.0	1.5	5.6	26.7	138.0
EBETAONE	130	0.7	0.3	0.2	0.5	0.9	1.4
EBETATWO	130	0.7	0.3	0.2	0.5	0.9	1.4
EBETAFIVE	130	0.8	0.2	0.3	0.6	0.9	1.2

The selection of the indicators has been done in a way to reduce at maximum multicollinearity problem looking at VIF (Variance Inflation Factors) figures.
The model selection process have been done considering many different models: i) simple pooled OLS; ii) one way fixed effect model (FE1); iii) one way random effect model (RE1), 4) a two way fixed effect model (FE2); 5) a two way random effect model (RE2).

[202] DIGI is excluded as no information are available for the time series considered as quoted on the market only from the 2017.

Since the Pooled OLS estimator ignores the panel structure of the data, it provides consistent and efficient estimates only if there is no unit-specific and time-specific heterogeneity across observations (i.e. the error term is uncorrelated with regressors).
If this is not the case, a one-way fixed or random effects transformation may be a better choice, since it allows the impact of unobserved and time-invariant factors (effects) that are specific to each peer (e.g. effects relating to the geographical localization, management competence, etc.) to be assessed.
In the (one-way) fixed and random effects approach the error term (ε) is divided into two components: a unit-specific error (constant_k), which does not change over time (i.e. the individual effect), and an idiosyncratic error (εik) which is observation-specific (i.e. varies over units and time).
The key difference of the fixed and random effects estimator is in the assumptions about constant_k. In the FE1 model we assume each peer to have a constant individual-specific effect shifting the dependent variable up or down by a fixed amount; that is, contant_i is now part of the constant term.
In this way, each unit (peer) has a different intercept term, though all regression coefficients (slopes) are the same.
While the fixed effects model treats the individual-specific effects (constant_k) as a variable that is allowed to be correlated with the observed regressors, in the RE1 approach we assume any unobserved individual heterogeneity (constant_k) to be a random variable which is distributed independently of the explanatory variables. As a consequence, individual effects are treated as a part of the composite error term.
Given that the one-way fixed and the random effects specification do not fully eliminate the possibility of omitted-variable bias, we also performed a two-way fixed and random effects model, which allow to estimate both peer-specific and time-specific effects.
For each of the regression equations above, we also considered potential heteroskedastic and autocorrelation effects using robust covariance estimation technique HAC (Heteroskedasticity Autocorrelated Consistent) to improve the significance of estimates.

In order to select the most appropriate estimator, we implemented a sequential choice process which relies on various specification tests as reported in the following table.[203]
First, to choose between the pooled OLS regression and one-way fixed effects model, we used an F-Test, where the null hypothesis implies that the POLS model is the appropriate specification (no significant difference across units).
Second, to examine whether the pooled OLS model is more appropriate than the one-way random effects model, we performed a Breusch-Pagan LM (Lagrange Multiplier) test, where the null hypothesis is that the pooled OLS estimator is adequate against the random effects model (no error variance across units).
An F-test is then performed on FE1 and FE2 models to understand if the time effect are needed and finally to understand if random specification is better than fixed effect specification, the Hausman test has been also performed, showing that RE is preferred only when a one year time windows estimation of the beta is considered, instead FE is better in the other two specified models. In the following table the results of the tests are reported and in red the outcomes of the tests are also given.

[203] Panel Data Econometrics Y. Croissant, G. Millo Wiley

	Model	Specification test	Null hypotesis	Alterantive Hypotesis	Test Statistics	p-value
Test I	EBETAONE	Ftest	POLS	FE1	F=7.6237	3.67E-10
	EBETATWO	Ftest	POLS	FE1	F=10.178	2.90E-13
	EBETAFIVE	Ftest	POLS	FE1	F=14.507	< 2.2e-16
Test II	EBETAONE	BPTest	POLS	RE1	chisq = 36.188	1.79E-09
	EBETATWO	BPTest	POLS	RE2	chisq = 44.803	2.18E-11
	EBETAFIVE	BPTest	POLS	RE3	chisq = 58.175	2.40E-14
Test III	EBETAONE	Ftest	FE1	FE2	F = 11.638	< 2.2e-16
	EBETATWO	Ftest	FE1	FE2	F = 14.719	< 2.2e-16
	EBETAFIVE	Ftest	FE1	FE2	F = 17.146	< 2.2e-16
Test IV	EBETAONE	Hausman	RE	FE	chisq = 7.7132	0.1728
	EBETATWO	Hausman	RE	FE	chisq = 93.983	< 2.2e-16
	EBETAFIVE	Hausman	RE	FE	chisq = 87.068	< 2.2e-16

In the following the results of the panel data estimations are given considering before a standard estimation of the covariance matrix of the error term and then including for the estimation of the SE and p-values a robust double clustering estimation of the error terms. The simple pooled estimation for the three models is reported for comparison. We can observe that in case of one year estimation the random effect models indicate that “Coverage” is statistical significant with a negative coefficient in line with the general understanding that an higher finatial coverage ratio will provide a lower systematic risk. This condition is not any more evident if the estimation of the beta is done on a five year time windows where in such case the ROCE is more statistical significant and positive correlated in line with the fact that ROCE is a parameter that is closer to the corresponding WACC. In a five years estimation the dimension of the company is more relevant and negative correlated. The corresponding level of capex instead seems to have less relevant impact this can be better understood in all cases when robust estimation of the error term is included.

Results

	Dependent variable:						
	EBETAONE			EBETATWO		EBETAFIVE	
	Pool	R1	R2	Pool	F2	Pool	F2
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CAPEX	0.071**	-0.047	-0.082*	0.078***	-0.040	0.107***	0.029
	(0.031)	(0.045)	(0.048)	(0.028)	(0.040)	(0.019)	(0.026)
ROCE	-0.243	0.484	0.629	0.116	0.573	0.392	1.547***
	(0.804)	(0.898)	(0.918)	(0.731)	(0.673)	(0.504)	(0.438)
COV_1	-0.010**	-0.012***	-0.012***	-0.012***	0.00003	-0.010***	-0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)
MCEUR	0.002	0.002	0.002	0.002*	-0.002*	0.002***	-0.002***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
EV_1	-0.002	-0.002	-0.002	0.001	0.0004	0.002	0.001
	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
Constant	0.679***	0.824***	0.857***	0.605***		0.547***	
	(0.150)	(0.173)	(0.179)	(0.136)		(0.094)	
Observations	130	130	130	130	130	130	130
R2	0.186	0.111	0.124	0.237	0.049	0.378	0.209
Adjusted R2	0.153	0.075	0.088	0.206	-0.191	0.353	0.009
F Statistic	5.665*** (df = 5; 124)	15.512***	17.486***	7.686*** (df = 5; 124)	1.062 (df = 5; 103)	15.068*** (df = 5; 124)	5.431*** (df = 5; 103)
Note:							*p<0.1; **p<0.05; ***p<0.01

Results

	Dependent variable:						
	Poolone	R1one	R2one	Pooltwo	F2two	Poolfive	F2five
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CAPEX	0.071	-0.047	-0.082	0.078	-0.040	0.107***	0.029
	(0.062)	(0.067)	(0.061)	(0.054)	(0.031)	(0.020)	(0.024)
ROCE	-0.243	0.484	0.629	0.116	0.573	0.392	1.547***
	(0.660)	(0.756)	(0.776)	(0.765)	(0.751)	(0.411)	(0.585)
COV_1	-0.010***	-0.012***	-0.012***	-0.012***	0.00003	-0.010***	-0.002
	(0.003)	(0.003)	(0.002)	(0.004)	(0.001)	(0.002)	(0.002)
MCEUR	0.002	0.002	0.002	0.002	-0.002*	0.002*	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
EV_1	-0.002	-0.002	-0.002	0.001	0.0004	0.002	0.001
	(0.004)	(0.005)	(0.005)	(0.004)	(0.003)	(0.002)	(0.002)
Constant	0.679***	0.824***	0.857***	0.605***		0.547***	
	(0.155)	(0.243)	(0.263)	(0.184)		(0.089)	
Note:						*p<0.1; **p<0.05; ***p<0.01	

Annex 4: Table of bond indices

Country	Thicker Bloomberg Barclays Index Global index	
Bulgaria	I11095US	Bulgaria Global Aggregate Index
Croatia	I03354US	Croatia Global Aggregate Total return Index Unhedged
Cyprus	I03355US	Cyprus Global Aggregate Total return Index Unhedged
Czech Rep.	I03356US	CzechRep Global Aggregate Return Total return Index
Estonia	I13197US	Estonia Global Aggregate Return Total return Index
Greece	I03361US	Greece Global Aggregate Total return index Unhedged
Hungary	I03362US	Hungary Global Aggregate Total return index Unhedged
Latvia	I09101US	Latvia Global Aggregate Total return index Unhedged
Lithuania	I06240US	Lithuania Global Aggregate Total return index Unhedged
Luxemburg		
Malta		
Poland	I03368US	Poland Global Aggregate Total return index Unhedged
Romania	I13198US	Romania Global Aggregate

Slovakia	I06239US	Slovakia Global Aggregate Total return index
Slovenia	I03370US	Slovenia Global Aggregate Total return index
Iceland	I11096US	Iceland Global Aggregate

The choice of the index for the bond return evaluation of Eastern European countries, Iceland and Luxemburg has been based on the family of homogeneous Bloomberg Barclays Global Aggregate indexes[204]. This choice is mainly guided by the fact that the Global Bloomberg Barclays index has a longer time series available at country level. The bond index return has been evaluated (consistent with last year's report) using, for each country, the time series of the last price with a monthly sampling period, in line with the DMS time series, as P_t/P_(t-1) -1 with P_t the price at Year t and P_(t-1) the price in the Year t-1.

In this year's report the index chosen includes longer data series. The eligibility criteria of bonds' components in the Global aggregate index is mainly based on investment grade. Classes of indexes based on Emerging Market[205] or Inflation linked Indexes were excluded.

[204] https://data.bloomberglp.com/professional/sites/10/Bloomberg-Barclays-Methodology1.pdf

[205] Emerging market debts are specific indexes where the members are chosen based on certain rules and reviewed annually.

Annex 5: Evolution of the BEREC Peer Group

In the Staff Working Document the European Commission presented, by way of illustration, the following companies that it considered to be consistent with the criteria[206]:

Figure 6 Illustrative list of peer group companies in the SWD

Company	Country	S&P rating
TDC A/S	DK	BBB-
Elisa Oyj	FI	BBB+
Orange S.A.	FR	BBB+
Koninklijke KPN	NL	BBB-
BT Group plc	UK	BBB+
Telenet	BE	BBB
Tele 2	SE	BBB
Telekom Austria	AT	BBB
Telecom Italia	IT	B+
Vodafone Group plc	UK	BBB+
Telia Company AB	SE	A-
Proximus S.A.	BE	A

This illustrative list has been subsequently reviewed and amended by BEREC through the application of the five criteria as set out in the SWD together with the clarifications issued by the EC. The following is a high level summary of the inclusions and exclusions made to the Illustrative list of peer group companies in the SWD since 2020. As Telenet delisted in 2023 it was removed from the peer group the 2024 Report. No new companies were added to the peer group.

[206] Table 25 of the SWD – "Electronic companies from relevant EU Member States with investment grade (2017)".

Company	**Included / excluded**	**WACC parameters Report**	**Reasoning**
TDC A/S	Excluded	2020	Delisted in 2018
Deutsche Telekom	Included	2020	All major strategic decisions are taken and significant proportions of their total revenues are generated within the Union.
Telefónica	Included	2020	All major strategic decisions are taken and significant proportions of their total revenues are generated within the Union.
NOS[207]	Included[208]	2020	Complies with the SWD
Vodafone Group plc	Included	2020	While it is currently headquartered in the United Kingdom it continues to have extensive activities in several EU member states and generates a significant proportion of its revenue from operations in the EU in comparison to its UK operations.
BT Group plc	Excluded	2021	The United Kingdom has left the EU, is not a member of the EEA and the majority of its revenues are earned outside of the EU/EEA
Telenor Group	Included	2021	Meets each of the five criteria
DIGI Communications N.V.	Included	2022	Complies with the SWD
Telenet Group Holdings N.V.	Excluded	2024	Delisted in 2023

[207] https://www.bloomberg.com/news/articles/2020-04-05/lisbon-court-seizes-nos-stake-held-by-angola-s-dos-santos
[208] BEREC is aware that the conduct of judicial proceedings may affect the future tradability of NOS shares. BEREC makes no further comment in this regard.

BEREC also examined other fixed line operators for possible inclusion in the peer group. However, when applying the five criteria above (as modified) none met the minimum requirement of complying with at least four of the five criteria and were therefore not included. While it noted that some companies in Central and Eastern Europe are publicly traded, they do not have a five-year trading history or have a credit rating and therefore are not included. In particular, the following should be noted:

- ***Telekom Slovenije*** is publicly traded and meets certain criteria[209], but the company does not have a credit rating and therefore is not to be included in the peer group.

- ***4iG (Hungary)*** is a leading IT systems integrator in Hungary and publicly traded on the Budapest Stock exchange since 2004. While it has a BB credit rating issued by Scope, for consistency with the other companies in the peer group credit ratings issued by Fitch, Moody's and Standard & Poor's are used. Therefore, 4iG has not been included in the 2024 WACC peer group.

In order to ensure that the peer group is representative of the entire EU/EEA, BEREC also examined whether or not the members of the peer group had significant investments in fixed line operators in Central and Eastern Europe. In doing so, BEREC considered that where this is the case the peer group members' parameters would also incorporate some of the underlying parameters of its investments. Many members of the peer group were found to have made significant investments into Eastern European fixed line operators.[210]

While BEREC notes that it does not offer a one-to-one comparison, it does offer some assurance that telecom assets in Central and Eastern European companies are included in the overall calculations of beta and also debt premiums. BEREC expects that as Central and Eastern European capital markets become more mature over time, more data may become available in the future which will allow the incorporation of companies from this region into the peer group. This will be assessed on an annual basis.

[209] Listed on a stock exchange; owns/invests in electronic communications infrastructure; main operations in the EU/EEA; not involved in substantial mergers and acquisitions.
[210] Chapter 7, Table 13.

Annex 6: EC comments on WACC notifications of NRAs

NOTIFICATION	COUNTRY	MARKET	Date of uploading	Notification	Brief Description	Date of EC comments	Comment Letter	EC's comments	CLOSED	STATUS	English version
HU/2023/2422	Hungary	Others: Market 18	27/01/2023	**Case HU/2023/2422:** market for wholesale broadcasting transmission services in Hungary	NMHH's notification concerns update of the cost calculation, **including the WACC value** in the wholesale market for broadcasting transmission services, to deliver broadcast content to end-user	24/02/2023	Article 32(3) of Directive (EU) 2018/1972	NO COMMENTS	27/02/2023	Closed (without comment)	HU-2023-2422 Adopted_EN.pdf
IT/2023/2435	Italy	Market 1	27/03/2023	**Case IT/2023/2435:** Markets for wholesale local access provided at a fixed location, wholesale central access provided at a fixed location and wholesale dedicated capacity in Italy - Remedies	The current notification relates to the definition of prices for access services to the fixed networks for years 2022 and 2023. It includes as well an **update of the WACC value and the Risk Premium**. In the last analysis of the concerned markets, the prices were set on the basis of a BULRIC+ methodology until December 2021, but in the absence of any other decision they continue to be applied.	26/04/2023	Commission Comments pursuant to Article 32(3) of Directive (EU) 2018/1972	**3.1. Predictability of the regulatory framework** **3.2. The setting of the WACC** **3.3. Calculation of Risk Premium**	27/04/2023	Closed (with comments)	IT-2023-2435 Adopted+Corrigendum_EN.pdf

PL/2023/2441	Poland	Others: WACC	24/05/2023	**Case PL/2023/2441:** Market for wholesale local access provided at a fixed location and wholesale central access provided at a fixed location for massmarket products – Re-examination of the Weighted Average Cost of Capital (WACC)	The draft measure concerns the WACC used by Orange Polska S.A. (OPL) for the calculation of the regulated costs of providing telecommunications access to its copper and fibre infrastructure. UKE revisited its decision setting the copper and fibre WACC values at the requests of the Polish Chamber of Commerce for lectronics and Telecommunications (KIGEiT) and OPL.	19/06/2023	Commission Comments pursuant to Article 32(3) of Directive (EU) 2018/1972	**Transformation of gearing.** The Commission calls on UKE to follow the WACC Notice when calculating the copper WACC. Specifically, UKE should use values for the "share of debt" and the "share of equity" that are consistent with the approach set out in the WACC Notice and the approach used by other NRAs.	20/06/2023	Closed (with comments)	PL-2023-2441 Adopted EN.pdf
FR/2023/2455	France	Others: WACC	14/9/25023	**Case FR/2023/2455**: Cost of capital for regulated services in France	The draft measure concerns the update of the WACC methodology and values. ARCEP sets the nominal pre-tax WACC at 5.5% and the real pre-tax WACC at 3.3% for all regulated fixed activities (including access to civil engineering infrastructure). The new WACC values are to be applied for cost accounting and price control (i.e., setting of tariffs) for the financial year 2024 (1 January 2024 to 31 December 2024)..	13/10/2023	Commission Comments pursuant to Article 32(3) of Directive (EU) 2018/1972	**3.1. Calculation of the risk-free rate**. The Commission recognises that if NRAs propose a duly justified alternative approach in line with the regulatory objectives set out in the Code and reflecting the current national macroeconomic situation, such approach could be pursued.	16/10/2023	Closed (with comments)	FR-2023-2455 Adopted_EN.pdf

DE/2023/2457	Germany	Market 1	28/09/2023	**Case DE/2023/2457:** Market for wholesale local access provided at a fixed location - Ancillary collocation services and **the weighted average cost of capital**	The draft measure concerns the charges of Telekom Deutschland GmbH (TD) for ancillary collocation services. The collocation relates to the local loop. In addition to setting the rates for ancillary services, **the draft measure sets the WACC for all rate approval decisions** from 1 July 2023 until 30 June 2024.	27/10/2023	Commission Comments pursuant to Article 32(3) of Directive (EU) 2018/1972	**3.1. Calculation of the WACC.** the Commission would like to reiterate that the Notice aims at fostering the development of the internal market by promoting consistent regulatory approaches across the EU. Therefore, NRAs are called upon to follow the Notice except in duly justified circumstances. In justified cases, the alternative approach taken should be aligned with the regulatory objectives set out in the Code and reflect the current national macroeconomic situation.	30/10/2023	Closed (with comments)	DE-2023-2457 Adopted_EN_Redacted.pdf
CZ/2023/2458	Czech Republic	Others: WACC	02/10/2023	**Case CZ/2023/2458:** Weighted average cost of capital in Czechia	CTU proposes new WACC values for the year 2024. These will be used in all relevant prospective regulatory activities, such as price control measures and reference offers. CTU sets two WACC values, one for legacy and another for Next Generation Access (NGA) and Very High Capacity Network (VHCN) infrastructure.	30/10/2023	Article 32(3) of Directive (EU) 2018/1972 – No Comments	NO COMMENTS	31/10/2023	Closed (without comment)	CZ-2023-2458 Adopted_EN.pdf.pdf

HR/2023/2459	Croatia	Others: WACC	13/10/2023	**Case HR/2023/2459:** Weighted Average Cost of Capital in Croatia	HAKOM propose to set the value of the WACC for services on a public communications network at 4.82 %. Further, it proposes to set an additional risk premium for services via fibre-based access networks at 1.59%. These values will apply once the decision is adopted. HAKOM plans to update the values annually.	10/11/2023	Article 32(3) of Directive (EU) 2018/1972: No comments	NO COMMENTS	13/11/2023	Closed (without comment)	HR-2023-2459 Adopted_EN.pdf
PT/2023/2462	Portugal	Others: WACC	18/10/2023	**Case PT/2023/2462:** Weighted Average Cost of Capital in Portugal	The notified measure is ANACOM's yearly update of the WACC value. ANACOM proposes to set the value of the WACC for services on a public communications network at 4.6962%.	17/11/2023	Article 32(3) of Directive (EU) 2018/1972: No comments	NO COMMENTS	20/11/2023	Closed (without comment)	PT-2023-2462 Adopted_EN.pdf

ES/2024/2487	Spain	Others: WACC	04/01/2024	**Case ES/2024/2487**: Weighted Average Cost of Capital (WACC) in Spain	The draft measure concerns the update of the WACC methodology and values. The new WACC values are to be applied in the cost accounting for the financial year 2023 for undertakings designated as having significant market power (SMP). CNMC sets one WACC value for integrated fixed operator and one value for the broadcasting market.	02/02/2024	Commission Comments pursuant to Article 32(3) of Directive (EU) 2018/1972	**Calculation of the risk-free rate:** The Commission notes that the CNMC deviates from the Notice methodology by calculating the risk-free rate as the weighted average yield of government bonds over two different periods to better reflect current macroeconomic conditions. At the same time, the Commission recognises that if NRAs propose a duly justified alternative approach in line with the regulatory objectives set out in the Code and reflecting the current national macroeconomic situation, such approach could be pursued	05/02/2024	Closed (with comments)	ES-2024-2487 Adopted_EN.pdf

SI/2024/2488	Slovenia	Others: WACC	15/01/2024	**Case SI/2024/2488:** Weighted Average Cost of Capital (WACC) in Slovenia	The draft measure concerns the update of the WACC methodology and values for the legacy and NGA infrastructure of the operators designated as having significant market power (SMP) on all relevant markets. The new WACC values are to be applied starting 1 March 2024.	13/02/2024	Commission Comments pursuant to Article 32(3) of Directive (EU) 2018/1972	**Calculation of the risk-free rate** The Commission notes that AKOS deviates from the Notice methodology by calculating the risk-free rate as the arithmetic average yield of government bonds over two different periods to better reflect current macroeconomic conditions. The Commission would like to recall that NRAs should take into account the Notice in devising their national measures and contribute to the development of the internal market by promoting consistent regulatory approaches. At the same time, the Commission recognises that if NRAs propose a duly justified alternative approach in line with the regulatory objectives set out in the Code and reflecting the current national macroeconomic situation, such approach could be pursued. In this context, the Commission invites and encourages	14/02/2024	Closed (with comments)	SI-2023-2488 Adopted_EN.pdf.pdf

								AKOS to fully follow the Notice methodology in its next WACC reviews in order to follow the objectives envisaged by the Notice.			

EL/2024/2492	Greece	Others: Market 4/2014	14/02/2024	**Case EL/2024/2492**: Wholesale high-quality access provided at a fixed location and wholesale trunk segments of leased lines in Greece - Remedies	The notified draft measure refers to EETT's Bottom-Up Long Run Incremental Cost (BU LRIC+) model for products and services in the wholesale high-quality access market and the market for wholesale trunk segments of leased lines, together with the corresponding calculated prices and the Weighted Average Cost of Capital (WACC) value. Additionally, the notification includes the calculation of one-time charges for Ethernet services in the high-quality access market.	13/03/2024	Commission Comments pursuant to Article 32(3) of Directive (EU) 2018/1972	**3.1. Timely imposition of the remedies and transparency** **3.2. Adhering to the regulatory principles of WACC calculation** The Commission notes that EETT, in its WACC calculation, has deviated from the prescribed methodology outlined in the WACC Notice by adopting a calculation of the risk-free rate using the weighted average yield of government bonds over three distinct periods. This method is intended to reflect the period of the Greek debt crisis and the current macroeconomic conditions more accurately. Additionally, the ommission urges EETT to utilize the most current data available; in this context, for some parameters EETT has used data from the 2022 BEREC Report while a more recent 2023 version was readily available. Additionally, the Commission urges EETT to apply the updated WACC across all markets and	14/03/2024	Closed (with comments)	EL-2024-2492 Adopted_EN.pdf

								products that are subject to price control to ensure regulatory consistency.			

PL/2024/2496	Poland	Others: WACC	04/03/2024	Case PL/2024/2496: Weighted Average Cost of Capital (WACC)	The draft measure concerns the update of the WACC methodology and values for the legacy and NGA regulated infrastructure of the operators designated as having significant market power (SMP), here Orange Polska S.A. (OPL). The new WACC values are to be applied once the decision is adopted.	03/04/2024	Commission Comments pursuant to Article 32(3) of Directive (EU) 2018/1972	**Transformation of the equity beta:** the Commission invites UKE to consider carrying out this transformation for its WACC calculation to be fully in line with the WACC Notice.	04/04/2024	Closed (with comments)	PL-2024-2496 Adopted_EN.pdf
IT/2024/2497	Italy	Market 1	14/03/2024	Cases IT/2024/2497: Markets for wholesale local access provided at a fixed location, for wholesale dedicated capacity and wholesale central access provided at a fixed location for mass-market products in Italy	The notified draft measure concerns the fifth cycle of review of access markets in Italy. An assessment of the structural separation notified by TIM on the 25 November 2020 pursuant to article 50 of the Code is also included. On the other hand, the most recent project of separation notified to AGCOM in December 2023, which is instrumental to the sale of the TIM business branch covering the network assets, is not assessed in this notification. Following a detailed	15/04/2024	Commission Comments pursuant to Article 32(3) of Directive (EU) 2018/1972	**1. Geographic market analysis** **2. Consistent approaches to price control obligations** **3. WACC: The Commission recalls its previous comments addressed to AGCOM and invites it toreview its approach and emphasises that harmonization of the WACC methodology** **4. Provisional measures**	15/04/2024	Closed (with comments)	IT-2024-2497 Adopted_EN_Redacted + corrigendum.pdf

					market analysis conducted by AGCOM, some areas of the country are deregulated both in market 1 and market 2, while in the rest of the markets a set of differentiated remedies is applied according to different competitive conditions in the analyzed municipalities. Moreover, following the three criteria test, the entire market for wholesale central access is found to be competitive on a forward-looking basis and proposed for deregulation.						

DE/2024/2500	Germany	Others: Market 4/2014	28/03/2024	**Case DE/2024/2500:** Charges for wholesale high-quality access provided at a fixed location in Germany	The draft measure concerns the wholesale high quality access provided at fixed location (market 4/2014). It approves the charges for specific services offered by Telekom Deutschland GmbH (TDG) on that market.	25/04/2024	Commission Comments pursuant to Article 32(3) of Directive (EU) 2018/1972	**1. Calculation of the WACC:** The Commission notes that BNetzA deviates from the Notice methodology when determining the risk-free rate used for calculating the WACC. In justified cases, the alternative approach taken should be aligned with the regulatory objectives set out in the Code and reflect the current national macroeconomic situation. **2. Retroactive application of the charges:** The Commission acknowledges BNetzA's reasons for the retroactive approval of the charges. Nevertheless, the Commission requests that BNetzA, whenever possible, avoids setting charges with retroactive effect, as this leads to regulatory uncertainty for market players.	26/04/2024	Closed (with comments)	DE-2024-2500 Adopted_EN.pdf