

Report on the Risk-free Rate when Determining the Cost of Equity and the Cost of Debt in Telecommunication Rate Regulation

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In Telecommunication Rate Regulation**

I.	Background	7
I.1	The present state of WACC estimation in Germany.....	7
I.2	The Mandate	8
I.3	The use of averaging in rate regulation.....	9
I.4	Institutional and economic fundamentals	10
I.5	Procedure and structure of the report.....	13
II.	Responses to the questions and other important results.....	18
II.1	Question 1 and its context.....	18
II.2	Question 2 and its context.....	20
II.3	Question 3 and its context.....	21
II.4	Question 4 and its context.....	21
II.5	Question 5 and its context.....	22
III.	Government bonds and their characteristics	23
III.1	Market practices in the US and in Europe	23
III.2	Government bond yields and their determinants	26
III.2.1	Default risk	28
III.2.2	Exchange rate and inflation risks.....	32
III.2.3	Convenience yield and its impact.....	35
IV.	The risk-free rate, its estimation and regulatory determination in the equity area	40
IV.1	Distortions of competition because of risk-free rate settings.....	41
IV.2	Alternative options for setting the risk-free rate	43
V.	The risk-free rate and its role in estimating the cost of debt.....	45
VI.	Bibliography.....	47
VI.1	Books and academic papers	47
VI.2	Commissioned Reports	50
VI.3	Documents supplied by regulators , parties of regulatory proceedings, institutions and consulting firms.....	52
VI.4	Bundesnetzagentur (BNetzA) Ruling-Chamber decisions and legal decisions	53
Annex A:	The CAPM and the estimation problems associated with it.....	54
Annex B:	The calculation of fixed-interest government bond yields	59
Annex C:	The default risk and its classification by ratings.....	62
Annex D:	Smoothing and stabilising mechanisms.....	68
Annex E:	The Credit Default Swap (CDS) premium and the CDS spread.....	76
Annex F:	Euro exchange rates of selected EU currencies.....	82
Annex G:	Deutsche Telekom AG (DTAG) interest load.....	85

List of Figures:

Figure 1	Yield spreads between government bonds and government-guaranteed bonds issued by government entities in Germany and France in basis points, 1999 to early 2014	37
Figure B1	Comparison of YTM of 10-year zero-coupon Bunds and the average of all Eurozone triple A government bonds from January 2016 to July 2021	60
Figure C1	Moody's rating classes for the valuation of debtors and their significance	63
Figure C2	S&P rating classes for the valuation of debtors and their significance	64
Figure D1	The observed risk-free rate in the UK (effective yield of inflation-indexed zero-coupon bonds with a time to maturity of 10 years) and the risk-free rates determined by UK Regulatory Authorities.	69
Figure D2	Arithmetic and geometric mean of historical yield time lines for the real UK return on equity by DMS vs. determination of real return on equity by UK Regulatory Authorities	71
Figure E1	Relationship between default risk and CDS-Spreads with different recovery rates.....	77
Figure E2	5-year Credit Default Spreads, 2007 to 8/2021 for several European countries.....	79
Figure E3	10 year Credit Default Swaps for selected EU Member States and their ratings in July 2020.....	80
Figure F1	Exchange rate Danish Krone (DKK) and Euro between 1999-2021.....	82
Figure F2	Exchange rate Bulgarian Lev (BGN) and Euro from 1999-2021.....	82
Figure F3	Exchange rate Swedish Krona (SEK) and Euro from 1999-2021	83
Figure F4	Exchange rate Hungarian Forint (HUF) and Euro from 1999-2021	83
Figure F5	Exchange rate Croatian Kuna (HRK) and Euro from 1999-2021	84
Figure F6	Exchange rate Norwegian Krone (NOK) and Euro from 1999-2021.....	84

List of Tables:

Table 1	Summary and Supplement of BEREK Tables 1 and 2	28
Table C1	S&P's estimated cumulative default risk of government bonds	65
Table C2	Number of newly generated government bond ratings in different time periods	66
Table C3	S&P determinants for a government bond rating	67
Table D1	Effect of averaging on the risk-free rate	73
Table G1	DTAG interest load of Euro denominated bonds	85

List of Abbreviations:

BEREC	Body of European Regulators for Electronic Communications
BNetzA.....	Bundesnetzagentur (Federal Authority responsible for regulating German network operators)
BK	Beschlusskammer (Ruling Chamber of BNetzA)
BoR.....	Board of Regulators (of BEREC)
Buba	Bundesbank (Central Bank of Germany)
Bunds.....	Bundesanleihen (German government bonds)
CADES.....	Caisse d'Amortissement de la Dette Sociale, a French government . agency
CAPM.....	Capital Asset Pricing Model (by Sharpe (1964) and Lintner (1965))
CDS	Credit Default Swap
DG Connect.	Directorate-General for Communications Networks, Content and Technology
DMS	Dimson/Marsh/Staunton (authors of the Credit Suisse Global Investment Returns Yearbook)
DTAG.....	Deutsche Telekom AG
ECB	European Central Bank
EU.....	European Union
FN.....	Footnote
GDP.....	Gross Domestic Product (value of all products and services produced within a country)
HICP	Harmonised Index of Consumer Prices
IMF.....	International Monetary Fund
ISDA.....	International Swaps and Derivatives Association
ISIN	International Securities Identification Number
KfW.....	Kreditanstalt für Wiederaufbau (German state-owned investment and development bank)
MRP	Market risk premium (or risk premium of securities)

NRA	National Regulatory Authority
OECD	Organisation for Economic Co-Operation and Development
Ofgem.....	Office of Gas and Electricity Markets (British Regulation Authority)
Ofwat.....	The Water Services Regulation Authority (British Regulation Authority, formerly: Office of Water Services)
OATs.....	Obligations assimilables du Trésor (French government bonds)
S&P	Standard and Poor's Corporation (an international finance service provider)
SWD	Staff Working Document (accompanying the document 'Communication from the Commission')
T-bonds	Treasury Bonds (US government bonds with a primary time to maturity of 20 or 30 years)
T-notes	Treasury Notes (US government with a primary time to maturity of between 2 and 10 years)
T-bills	Treasury Bills (US government bonds with a primary time to maturity of currently up to 52 weeks)
TKG.....	Telekommunikationsgesetz (German Telecommunications Law)
UK.....	United Kingdom
UKRN.....	United Kingdom Regulators Network
US.....	United States (of America)
WACC.....	Weighted Average Cost of Capital
YTM.....	Yield to maturity (effective interest rate)

I. Background

I.1 The present state of WACC estimation in Germany

The rates for certain services provided by operators of public telecommunications networks with substantial market power are subject to approval by the Federal Network Agency (Bundesnetzagentur, BNetzA), see § 30 (1) of the German Telecommunications Act (Telekommunikationsgesetz, TKG). In doing so, BNetzA observes § 30 (3) of the TKG and in particular allows an adequate return on investment of the capital employed. Since operators finance their activities with equity and debt, BNetzA regulates the Weighted Average Cost of Capital (WACC).

Important input factors are the risk-free rates for equity and debt. Other important parameters in the WACC calculation are the beta, the market risk premium, the debt premium as well as the equity and debt capital weights, tax factors and the expected inflation rate.

From 2010 to 2019 BNetzA followed the recommendations in Stehle (2010) when setting the WACC in the fixed and mobile segments. These were based on the German legal requirements, the scientific knowledge and the data availability at the time. In the ten years it has been in use, these recommendations have often been intensively discussed but have never been challenged in court.

The Communication from the European Commission ‘*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*’ of 6th November 2019 (2019/C375/01, hereafter ‘*Commission Notice*’ or ‘*WACC Notice*’) strongly encourages National Regulatory Authorities (NRAs) to determine WACC parameters for legacy infrastructure according to the methods described in this document. The Commission Notice points out that, in the future, a large part of the data required for the calculations will be provided by the ‘*Body of European Regulators for Electronic Communications*’ (BEREC) and should be used.

The BEREC data are contained in the BEREC reports of 12th June 2020 and of 10th June 2021. The English version of the 2021 report had the title ‘*BEREC Report on WACC parameter calculations according to the European Commission’s WACC Notice of 6th November 2019, BoR (21) 86. We will refer to them as ‘BEREC (2020)’ and ‘BEREC (2021)’*’.

Another important document in this context is the ‘*Commission Staff Working Document accompanying the document Communication from the Commission*’ (SWD (2019)).¹ This docu-

¹ https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=62834.

ment often refers to Brattle (2016), a report prepared for DG Connect, the responsible EU department. In this report the scientific perspective is emphasised even more than in SWD (2019), in which the effort to agree on a common approach among NRAs in the future is more pronounced.

The Commission Notice was issued with the objective to harmonise the approaches of NRAs regarding legacy infrastructure, i. e. with a highly sensible objective. However, strict compliance with the EU guidelines and using BEREC data by BNetzA would lead to a result that Deutsche Telekom AG (DTAG) considers to be incompatible with the requirement of § 32 (3) Number 4 TKG for a stable economic environment for German network operators and with other aspects of German legislation. In a letter from the attorneys Dolde Mayen & Partner dated 07.07.2021 DTAG has seriously questioned certain aspects of the EU-BEREC approach.

I.2 The Mandate

Our mandate for a short report reads:

“In the context of the initial situation and the criticism presented above, the following fundamental questions arise, that shall be answered by the expert from an economic point of view:

- 1. Is it correct that the combination of a German risk-free rate and European averages for other parameters (particularly the MRP) could systematically result in a regulatory allowed return for DTAG that is too low?*
- 2. Could this problem be remedied by using an (average) European risk-free rate?*
- 3. Could a European risk-free rate be integrated in the calculation of the return on equity and debt or is a differentiation (European risk-free rate when calculating the return on equity capital and German risk-free rate when calculating the return on debt) permissible and economically viable?*
- 4. How could a European risk-free rate be estimated (e. g. as a simple arithmetic mean of member state values / GDP weighted average of the member state values / or even the lowest value from the Member States)?*
- 5. Could the problem raised in question 1 be solved differently (e. g. by extending the 5-year averaging period to a 10-year averaging period for the German risk-free rate)?”*

Prof. Stehle was commissioned in July 2021. The report was jointly prepared by Prof. Stehle and Prof. Betzer. The final version was submitted to the client in August 2021.

We were not asked to comment on the WACC parameters beta, market risk premium, debt premium, weights, tax factors and expected inflation. This would not have been possible for us in the short time available.

I.3 The use of averaging in rate regulation

The question, under what circumstances averaging is appropriate, is one of the most important issues in our report.² Our colleague Pablo Fernandez is generally very critical, often his criticism is justified. In his view, regulators too often calculate averages: “*Another two common peculiarities of many regulators are their penchant for a) calculating averages and b) calculating averages of averages.*”³ This criticism is not justified.

Averages are used in many facets of life to describe a set of numbers and/or to simplify calculations. An example is the calculation of the average interest burden of DTAG from bonds denominated in Euro in Annex G. In principle, the benefit of calculating averages must be examined in each individual case. Due to the declining costs for calculating averages it must be assessed, in particular, whether there is any benefit at all associated with averaging or whether a different description of the set of numbers would be more appropriate.

However, averaging often serves to arrive at scientifically recognised conclusions. In the context of WACC determination, the most important such application is the estimation of the expected value of a quantity that is classified as a random variable, i. e. the number that the random variable takes on average. It is, and has been for many decades, one of the most important methods of stochastics. Under appropriate assumptions, the expected value is the best estimate of the future value of the random variable. Two important examples are beta estimation and market risk premium estimation. For example, when estimating beta, it is assumed that the true beta is identical for all operators in the peer group, but each individual beta randomly deviates from the mean. The mean of the peer group betas is therefore the best estimate for the true beta. In estimating the market risk premium, it is assumed that the random variable ‘annual return of the market portfolio’ is independent and identically distributed over time. The arithmetic mean of this random variable is the best estimate for the return in the following year. When estimating the risk-free rate it might be useful to assume that the yields of Eurozone countries with triple A rated government bonds randomly deviate from the true risk-free rate within the EU. In that case, it might make sense to use the average yield of all Eurozone triple A bonds as the best estimator for the risk-free rate.

A second important reason for averaging in rate regulation is related to the setting of the allowed WACC by NRAs. Here, unlike in the WACC application area capital budgeting by firms, in which the interest rate on a specific date is used, often average interest rates for the past five or ten years are used. The averages are used as part of a long-term strategy to maintain stable economic conditions for network operators and their customers. This is not a matter of estimation but of smoothing, with the aim of preserving stable economic conditions in times of a

² SWD (2019) also discusses the appropriateness of calculating averages in several parts of the document.

³ Fernandez (2019), p. 1.

sharply decreasing risk-free rate. Here, the aim of averaging is that the avoidance of a too sharp decline of the allowed WACC is associated with only minor disadvantages for customers in the long-term. For more details, see the next section and Annex D.

An important argument in our report is, that the yields of government bonds with different ratings differ because of an important economic reason, the default risk. It is therefore not appropriate to describe these yields by their average. The same applies to the yields of government bonds in non-Eurozone EU Member Countries.

I.4 Institutional and economic fundamentals

YIELDS: In the following, we only consider fixed interest securities, in particular those that are issued or guaranteed by governments. When we speak of the yield of such securities we refer to the yield to maturity or the effective interest rate. Yields or effective interest rates are dependent, inter alia, on the remaining term to maturity. In the following, we always assume a residual term of 10 years, which is commonly used in rate regulation. Often, average yields over several years are used as a basis in rate regulation; the BEREC data always uses a five year averaging period. Hereinafter, we refer to the average yield for fixed interest securities with a residual time to maturity of 10 years, calculated using the past five years, as BEREC-yield. Yield calculation is discussed in Annex B.

CAPM and RISK-FREE RATE: It is undisputed that in the equity area the WACC is based on the Capital Asset Pricing Model by Sharpe (1964) and Lintner (1965), for which we always use the acronym CAPM. This model requires the ‘risk-free’ rate as a central input factor. Ideally, when using this model, it should be a real risk-free rate and all calculations should be in real terms, cf. Annex A. However, in practical applications a nominal risk-free rate is usually used in the EU, this is reasonable from the theoretical perspective. Nominal risk-free means that it is certain, that the promised payments will be made on time and in the correct amount. A bond with a time to maturity of 10 years is therefore only risk-free if it is certain that all interest payments over the entire 10 year time period will be made on time and, in particular, the principal, will be repaid in 10 years. However, risk-free only means that the promised payments will be made without fail. Changes in the value of the risk-free government bonds during their term are not ruled out. A more detailed treatment of the CAPM is given in Annex A.

CAPM - AREA of APPLICATION: For the estimation of the risk-free rate that is to be used, the capital market, for which the CAPM is used, must be defined. In the context of this report this is without doubt the EU-wide capital market of the Member States. When using the CAPM it is implied that this is a homogenous market, i. e. all bidders and suppliers have equal access

to all securities and there are no sub-markets within this market to which some market participants have better access to than others. In other words, the pricing of individual securities is determined by EU-wide supply and EU-wide demand for individual securities. National borders cannot be taken into account in an EU-wide application of the model.

More complex models with certain impediments to the free flow of capital exist, but they have not yet been applied in practice and, in our view, such an application is not yet possible for a few years to come. We also examine these in Annex A.

THE RISK-FREE RATE in the EU CAPITAL MARKET: There is academic consensus that, in an EU-wide capital market in the sense of the CAPM, there can be several risk-free securities but only one risk-free rate. If, for example, both German and Dutch government bonds are classified as risk-free, then both – if all characteristics, especially the time to maturity, are identical – must have the same yield (to maturity), that is, the same effective interest rate.

As an example of risk-free securities within the EU, German federal bonds (Bundesanleihen or so-called ‘Bunds’) are usually provided in the academic literature; this example is also given in Brattle (2016) and in the SWD.⁴ For many years, Bunds have been awarded, almost uninterruptedly, the best credit rating, triple A, by leading rating agencies. Occasionally it is also recommended to use an average value of all Eurozone triple A bonds or all EU triple A bonds to estimate the risk-free rate. We do not recommend the latter average, based on the arguments in Section III.2.2. The former average is further discussed, inter alia, in Section IV.

In view of the sensible goal of EU-wide method harmonisation of NRAs concerning legacy infrastructure, in our opinion an average of at least AA rated Eurozone members would also be viable. We do not favour the inclusion of non-Eurozone EU Member States, even if they have a good credit rating.

DEFAULT RISK: The estimation of default risk through ratings is discussed in detail in Annex C. Government bonds with a rating that does not start at least with AA, cannot be classified as risk-free because it is not certain that the contractually agreed payments can be made on time and in the correct amount throughout the entire term. The default risk can only be determined precisely by using complex models, as payment dates can be delayed and/or payments can be reduced. ‘Haircuts’ for EU Member States are likely to be considerably lower than 100 %.

⁴ Cf. Brattle (2016, p. 27 et seq.) and Staff Working Document (SWD, 2019, p. 17, 46 and especially p. 51 et seq.).

Greece's private creditors who held their securities until the 'bitter end', lost 'only' 53.5 % in 2012.⁵ Investors who decided to sell prior to maturity at that time had to bear substantial, possibly even higher losses. An important characteristic of default risk is that the likelihood of default can change considerably at short notice. The default risk over the next 10 years can be seen as the main reason why the yields of 10-year government bonds of some EU Member States have, in the past and for many years, been 1-2 % higher than the yields of Bunds or other triple A rated Member States' bonds.

EXCHANGE RATE/INFLATION RISK: Only some of EU Member States have opted for a common currency and belong to the Eurozone. Several countries – we use the term state and country mostly synonymously – have retained their national currency within the framework of their EU membership. Eurozone investors have to bear an exchange rate risk when they invest in non-Eurozone EU Member Countries' securities. Exchange rate risk and inflation risk associated with it may also contribute to the yield disparity of 10-year government bonds.

SMOOTHING MECHANISMS: Large unexpected reductions in the allowed WACC may represent a change in the regulatory environment of network operators which is not coherent with § 32 (3) Number 4 TKG. Like other national and international Regulatory Authorities, BNetzA has always been committed to smooth, i. e. mitigate, excessive negative impacts of the regulatory framework conditions associated with the WACC determinations.

In BNetzA's telecommunications section, the WACC was set from 2010 to 2019 based on a precisely specified calculation method, described and justified in Stehle (2010). (1) Subjective upward or downward adjustments or (2) determination of input parameters based on the regulator's discretion or (3) method changes in case the prescribed WACC estimate leads to results that contradict the stable regulatory environment required by law were not provided for in the determination of the WACC from 2010 onwards and, as far as we know, were never up for discussion. The procedure was devised in such manner that results would conform to stable framework conditions. The regulatory risk was therefore very low.

The method used from 2010 to 2019 contained two smoothing mechanisms:

- exponential smoothing and
- a 10-year averaging period for the risk-free rate as an alternative to a risk-free rate on a specific date or to a five-year average.

⁵ Cf. Wieland (2015): <https://www.lto.de/recht/hintergruende/h/eug-urteil-t7913-staatsanleihen-griechenland-verlust-rendite-gewinn/>

Both mechanisms used by BNetzA in recent years have the consequence that the associated reductions, i. e. the smaller reductions of the allowed WACC compared to the regulatory WACC without smoothing, go together with smaller future increases in the WACC. From the customer's viewpoint, smoothing results in higher allowed WACCs in the short-term, but leads to lower increases of the allowed WACC in the long- term.

Most smoothing mechanisms known to us and used by Regulatory Authorities in the past lead to higher allowed WACCs in the short-term without negatively affecting the long-term allowed WACC, i. e. without requiring an adjustment over time. In our view, the smoothing mechanisms used by BNetzA from 2011 to 2020 should therefore be the ones to be favoured, if BNetzA were, like us, to consider that a smoothing procedure is appropriate right now.

We consider the classification of all bonds within the EU Member Countries as being risk-free to be a smoothing mechanism on the way to a fully integrated European capital market, which severely disadvantages DTAG and similar operators in triple and double A rated countries. A Europe-wide integrated capital market certainly already exists at present for the operators in the BEREC peer group, but possibly not yet for small and medium sized operators in small EU Member States. However, since DTAG primarily competes with the large operators in the BEREC peer group, the classification of all EU Member States' bonds as risk-free puts DTAG at a considerable competitive disadvantage in comparison to other operators of the BEREC peer group.

Moreover, classifying all EU Member States' bonds as risk-free is not ideally suited as a smoothing mechanism because the economically justified yield differences between EU countries will probably persist for many years to come. When implementing a smoothing mechanism on this basis, the current reduction in the cost of equity, which is too low, would not be compensated for by a less pronounced increase of the cost of equity in the long-term.

1.5 Procedure and structure of the report

In order to answer the five questions posed, a detailed examination of the valuation and the yields of government bonds is essential. Ultimately, however, our report is meant to answer the question of how the risk-free rate should be determined, from an economic point of view, in the context of legacy fixed network regulation.

PROCEDURE: It is evident from our point of view that a WACC reduction from 3.64 % to 2.39 %⁶ cannot be considered to be a stable regulatory environment. Therefore we touch only

⁶ Regarding these figures see FN 7.

briefly on this aspect when answering question 1 in Section II.1. It is also obvious that in a WACC calculation based on the Commission Notice only an increase in the risk-free rate and/or a mark-up or adjustment can be considered to reduce the decrease from 3.64 % to 2.39 %.

Answering the five mentioned questions from an '*economic point of view*' is not easy. The relevant theories may be 'crystal clear'; however, the Commission Notice has made the legal framework very complex, since the German legal requirements also continue to apply. In addition, a number of scientific sub-fields of finance and essential institutional aspects have to be dealt with, e. g. Credit Default Swaps (CDS) and ratings.

To show

- that, for economic reasons, only the interest rate of Bunds or an average of triple A Eurozone bonds may be considered as a genuine risk-free rate in the EU and especially in Germany, i. e. on no account an average EU interest rate in which all rating groups are included,
- only the use of a 10-year average of the interest rate for Bunds is economically viable and also appropriate as a smoothing mechanism in Germany from a regulatory point of view, and
- the use of a 10-year average is even more important in the debt than the equity component,

we proceed as follows:

We place in-depth discussions of relevant models, institutional circumstances and data related questions in Annexes. In the main part, the Sections III to V, we mention and explain only the scientific findings and institutional circumstances that are most relevant in the context of our report.

STRUCTURE OF OUR REPORT: The following Section II contains the answers to the five questions posed as well as a short summary of other important findings of our report.

In the main part of our report, we cover:

In Section III: Government bonds and their characteristics. In Section III.1, we look at market practices. Section III.2.1 focusses on the fact that the government bonds of several Eurozone countries are subject to a default risk that may seem low in absolute terms, but is economically very relevant from an investor's point of view. The government bonds of non-Eurozone Member States pose an additional exchange rate risk for domestic investors from Eurozone countries and often are exposed to a greater inflation risk than bonds within the Eurozone, which we will

discuss briefly in Section III.2.2. The mentioned risks lead to noticeable differences in the yields to maturity for EU Member Countries' 10-year government bonds, often of several percentage points. Additionally, in Section III.2.3. we go into further detail regarding the impact of liquidity, transaction costs and other aspects of government bond yields, e. g. the safe-harbour-argument and the 'convenience yield'.

In Section IV: The risk-free rate, its estimation and significance for the cost of capital. Here, the focus lies on:

- That, when using the CAPM, only triple A rated securities of the Eurozone can be classified as risk-free and only their interest rates should be used by NRAs of all EU Member Countries as risk-free rates in the WACC calculation. If NRAs of countries, that are not triple A rated, use the domestic interest rate when calculating the WACC, then their domestic operators may possibly obtain a competitive advantage.
- That the use of an average rate across all EU Member Countries makes no sense from neither an academic nor a regulatory perspective.
- That a 10-year average is ideally suited as a smoothing mechanism.

In Section V: The risk-free rate and its significance when estimating the cost of debt. Here, the focus lies on the fact that DTAG has been financing itself with debt capital, partly on a very long-term basis, for many years. In hindsight, 10 years ago it would, of course, have made sense to use only short-term financing, but we nevertheless consider the financing decisions made 10 years ago to have been economically correct, based on the information available at the time. The bonds, some of which still have a time to maturity of several years, are associated with a high interest liability, which has to be considered when estimating the risk-free rate. When looking at the debt capital, the 10-year average is therefore not a smoothing measure but a purely economic determination.

CITATIONS and BIBLIOGRAPHY: We try to document all findings, arguments, opinions and recommendations taken from other sources in such a way that readers can easily and quickly understand our arguments and reasoning. We therefore always indicate the exact page and/or section we refer to. More and more documents are available on the Internet. We only provide the URL if a document cannot be found by simple searches.

We subdivide the Bibliography in Section VI, into

- Books and academic papers (Section VI.1)
- Commissioned Reports (VI.2)

- Documents supplied by regulators, parties of regulatory proceedings, institutions and consulting firms (IV.3)
- BNetzA Ruling-Chamber decisions and legal decisions (VI.4)

We deem such a subdivision to be expedient, but the classification of individual documents is not always easy.

Some of the issues discussed here have been dealt with in the academic community for a long time, often for 30 or more years. The most recent publications often strongly build on earlier publications. We mention this in the text and provide the respective earlier authors and the year of publication, but do not include them in the Bibliography.

AUTHORSHIP of INSTITUTIONS' STAFF: In academia, contributions are almost always published under the name of the author, not the institution, which is often the case in practice. Concerning the contributions by institutions' staff covered here, e. g. staff of central banks, regulatory authorities or consultancies, we generally assume that they reflect the views of their institution. To simplify matters, we cite such contributions in the text, if possible, by the name of the author and institution the first time they are mentioned as well as in the Bibliography but thereafter in the text by the name of the institution only.

ACADEMIC RESULTS, ACADEMIC OPINIONS:

For almost all questions that arise in the context of estimating the cost of capital in rate regulation, there exists a large number of documents that contain results of studies and opinions. If we rely on established academic findings, we normally do not only consult the academic literature but above all the latest editions of 'world-wide' leading finance textbooks.

Regarding this, the following should be mentioned:

- *Brealey, R. A./Myers, S. C./Allen, F. (2020): Principles of Corporate Finance, 13th Ed., New York: McGraw-Hill Education.*
- *Welch, I. (2017): Corporate Finance, 4th Ed., Los Angeles, CA: Ivo Welch.*
- *Berk, J./DeMarzo, P. (2019): Corporate Finance, 5th Ed., Harlow: Pearson Education.*
- *Koller, T./Goedhart, M./Wessels, D. (2020): Valuation, 7th Ed., Hoboken: Wiley.*
- *Ross, S./Westerfield, R.W./Jaffe J.F./ Jordan, B.D. (2018), Corporate Finance, 12th Ed., McGraw-Hill Education.*

Brattle (2016) rely in several places on earlier editions of Brealey et al. (2020).

The mentioned academic literature covers in detail particularly the capital budgeting decision and WACC estimation as well as the CAPM and its application in practical investment decisions. Furthermore, the calculation of the cost of debt and the related assessment of credit risk respectively the rating of corporations or sovereigns are explained. Brealey et al. (2020) also includes a brief example for estimating the cost of equity in the US regulatory regime (in its Section 4.3, p. 87 et seq.). However, the other textbooks do not cover the regulatory context.

The textbooks often help us to correctly evaluate the various scientific developments. Concerning the estimation of the risk-free rate in the EU however, the leading textbooks provide little direct help. For us it was very helpful, that several highly trustworthy institutions provide high quality data free of charge, above all Eurostat, the ECB, the OECD and DeStatis. It was also very helpful that several renowned peers, amongst them Damodaran, regularly publish data and their assessment of it. None of the renowned peers is a true expert in all areas covered here, but many felt nonetheless called upon to provide their opinion. These opinions must therefore be reviewed.

There is also a variety of commissioned reports on all issues dealt with here. We rely mainly on reports that are published and have been discussed in consultation procedures. Generally, we do not take into consideration ‘Secret reports’, i. e. reports that are only known to the direct parties of proceedings but not to other, possibly critical, observers.

We carefully take into consideration decisions of NRAs, if they are available in German or English, particularly if they are NRAs with a long-standing experience and can be expected to make their decisions based on scientific findings.

II. Responses to the questions and other important results

All answers and further commentaries will be substantiated in further detail in Section III et seq.

II.1 Question 1 and its context

“Is it correct that the combination of a German risk-free rate and European averages for other parameters (particularly the MRP) can systematically result in a regulatory allowed return for DTAG that is too low“

Preliminary remark 1:

In our view, the resulting WACC (2.39 %) is questionable with regard to the long-term stability of the economic environment.⁷ A reduction from 3.64 % to 2.39 %, i. e. in absolute terms by 1.25 percentage points or 34 % in relative terms has not occurred since 2009. The greatest reduction to date since then occurred from 2019 to 2020, it was 17.1 %. The decreases in the years before were under 10 %, most of them noticeably below 10 %, signaling how stability of the economic environment should be interpreted. We believe the legal stability requirement to be economically correct and viable. The full application of the Commission Notice and its interpretation by BEREC within the framework of the BNetzA regulatory decisions is, in our view, problematic in this context.

Preliminary remark 2:

DTAGs comparative disadvantage does not result from the use of European averages for the other important parameters, MRP and Beta. It results solely from classifying government bonds that are not at least double A rated as being risk-free in the context of the CAPM. Risk-free means that the contractually agreed interest and principal repayments are made timely and in the correct amounts. History tells us that not all government bonds are risk-free in this sense. A less than double A rating signals that the default risk can be estimated to be at least 1 - 2 %, leading to a sometimes economically noticeable increase in the interest rates of the countries concerned.

Answer: The application of the German risk-free rate in the context of the legacy regulation of DTAG in a manner envisaged by the EU method leads to a systematically too low allowed WACC for DTAG.

⁷ The WACC values are mentioned and explained in detail in the draft consultation of BK3c-21/004 of 28.07.2021 on p. 40. The value of 3.64 % was determined as the mean between the previous and the new calculation method, e. g. in the decisions BK3c-20-013 and BK 2a-20/021. 2.39 % would be the value determined when using the BEREC rate, see table on p. 34 in the draft consultation BK3c-21/004, column 3.

Reasoning:

- It can be assumed that several important DTAG competitors will be allowed significantly higher regulatory 'risk-free rates' and therefore WACCs because of the Commission Notice and its interpretation by BEREC. They may therefore obtain a competitive advantage that causes concern not only with regard to a common European market, in particular the creation of increasingly comparable conditions for investments in electronic communication networks, but also in view of the stability required by the second half-sentence of TKG § 32 (3) Number 4 "*also with a view to the situation as regards competition in the telecommunications markets*". This aspect is likely to persist in the years to come; we believe it to be systematic.
- In competing for financial funds of private and institutional investors, DTAG is not only competing with foreign telecommunications operators but also with the regulated domestic network operators in the area of electricity, gas and rail infrastructure, where the demand for capital will also be very high in the years to come. It can be expected that the mentioned sectors will be allowed significantly higher risk-free rates and therefore WACCs because of their 10-year averaging period that for them has been applied all along and will continue to be applied in the near future. This will also put DTAG at a disadvantage. We also consider this aspect to be systematic.

Our recommendation:

From a scientific point of view, there is no doubt that with a narrow interpretation of risk-free within the EU market, currently only German and other triple A rated Eurozone countries' government bonds can be classified as risk-free. In a somewhat broader interpretation, government bonds of Eurozone countries with at least double A rating could also be classified as risk-free and an average of the countries with at least double A rating could be formed. However, this average would then have to be binding for all EU countries, which is not feasible in the short-term.

In order to smooth the substantial drop of the WACC associated with the use of a five-year average of the German government bond yields with a residual term of 10 years and in order to alleviate the competitive disadvantage for DTAG, we favour first and foremost to use a ten-year instead of a five year average (approximately 0.65).

II.2 Question 2 and its context

“Could this problem be remedied by using an (average) European risk-free rate?”

Answer:

The BEREC report BoR (21) 86 does not propose to use a European (average) risk-free rate, and no such rate is calculated in this, nor in the predecessor report BoR (20) 116. As already mentioned under II.1, there are proposals to use an average of triple A rated countries but also an average of at least double A rated countries would be acceptable as a compromise on the way to a uniform regulation. It does not make economic sense to include countries with lower ratings.

However, to our knowledge, the calculation of an average risk-free rate including all EU countries is mentioned in various places, e. g. in the letter from Dolde Mayen and Partner dated July 7, 2021 in FN 1 on p. 5: *“1.1 % is the average of the respective national values determined by BEREC for the EU Member States“*. We have calculated the weighted average value to be approximately 0.75.

We believe that even the calculation and application of a weighted average is not economically viable, and we firmly reject the unweighted value. This is because averaging the German risk-free rate and the rates of countries with a rating starting with B which are exposed to default risk is not an economically justifiable estimate of the risk-free rate according to the CAPM. When using the unweighted approach, countries with a rating starting with B, i. e. countries with highly risky government bonds, have too much influence on the result. This influence is reduced somewhat by the weighting, but this does not make the averaging economically meaningful.

In addition, such a method would at best be justifiable if all countries were to use this average. If some countries are allowed a much higher ‘risk-free rate’, the systematic disadvantage of DTAG in comparison to its competitors from these countries will persist, maybe at a somewhat reduced but still significant extent.

II.3 Question 3 and its context

“Could a European risk-free rate be integrated in the calculation of the return on equity and debt or is a differentiation (European risk-free rate when calculating the return on equity capital and German risk-free rate when calculating the return on debt) permissible and economically viable.”

Answer:

The European risk-free rate used for calculating the return on equity, i. e. the yield of German Bunds or alternatively the average of countries with a triple A or at least double A rating, must also be used as the basis for calculating the return on debt. A differentiation between equity and debt has to be rejected based on the available scientific knowledge.

If, as already mentioned, a 10-year average is to be used for equity, the same procedure must be followed for debt.

However, the use of a 10-year average is even more important for the estimation of the cost of debt than for the cost of equity. This is because it was and is economically sensible for DTAG to finance itself with long-term debt capital and because the company was also encouraged to do so by the previous regulation. It should be possible for DTAG to service a very large fraction of its pre 2016 debt, which was raised in an economically sensible manner, by using funds included in the allowed WACC.

II.4 Question 4 and its context

“How could a European risk-free rate be estimated (e. g. as a simple arithmetic mean of member state values / GDP weighted average of the member state values / or even the lowest value from the Member States)?”

Answer:

The European risk-free rate is very close to the lowest value of the EU Member States. For more details, see the answer to question five.

II.5 Question 5 and its context

“Could the problem raised in question 1 be solved differently (e. g. by extending the 5-year averaging period to a 10-year averaging period for the German risk-free rate)?”

Answer:

From a scientific perspective, we believe the use of a 10-year averaging period for the German risk-free rate to be the most sensible approach in the current situation. For various reasons, the European risk-free rate may be a little bit higher than the Bund yield, maybe around 0.2 percentage points, but we do not consider the scientific work on this subject to be sufficiently conclusive at the moment. The report by Frontier Economics et al. (2021), commissioned and just published by BNetzA’s Electricity and Gas section, contains a careful account of the current state of this discussion. The progress of this discussion should be closely monitored in the coming years.

III. Government bonds and their characteristics

After a brief discussion of market practices when trading fixed income securities in Section III.1, we consider how default risk, other risks and market practices affect government bond yields in Section III.2. After all, when averaging, it is important to know what goes into the average.

To almost all issues discussed in Section III, there are many contributions by academics and central banks or their staff. We discuss these only in passing in Sections III.1 to III.2.2. Section III.1 contains basic knowledge about the markets considered here. In Sections III.2.1 and III.2.2 we argue almost exclusively on the basis of data provided by BEREC. This data provides a good basis for the issues addressed in these two sections. In Section III.2.3, on the other hand, we have to rely on academic literature, central bank publications and the latest reports commissioned by the NRAs.

III.1 Market practices in the US and in Europe

Government bonds are used by all countries to contribute to the supplementary financing of their government budgets. Given the high level of government debt, there is a large global market for the bonds of many countries. Even the smallest details play an important role and are taken into account by large, especially institutional investors in their portfolio decisions and, as a result, can influence pricing. In practice, calculations are often done in basis points in this market, 1 basis point = 0.01 percentage points.

The world-wide most important government bonds are issued by the US Treasury. Treasury notes (T-notes) have an original maturity between 2 and 10 years, T-bills currently up to 52 weeks, T-bonds have an original maturity of 20 or 30 years. With regard to maturity, there is usually no differentiation in the English language in Europe between notes and bonds.

Important aspects in the features of government bonds are:⁸

THE TERM: Hereafter, we only consider non-callable fixed interest government bonds with a 10-year time to maturity. When we talk about yield, we always refer only to yields on bonds with a 10-year time to maturity. In Annex B we also briefly discuss Zero-Coupon bonds and inflation-indexed bonds. The latter are classified in UK regulation as the correct risk-free bonds and are used to set the risk-free rate.

⁸ The market for government bonds is covered in several, regularly issued publications. Cf. e. g. the yearly OECD publication, last published: <https://www.oecd.org/finance/Sovereign-Borrowing-Outlook-in-OECD-Countries-2020.pdf>. The finer details of T-bonds, T-notes and T-bills are discussed on https://www.treasurydirect.gov/in-div/research/indepth/tbonds/res_tbond.htm.

THE CURRENCY DENOMINATION: Eurozone Member States mostly issue their government bonds in Euro, i. e. all contractual payment obligations are denominated in Euro, while those of the remaining EU Member Countries are mostly denominated in their home currencies. Some countries issue only in their home currency, e. g. Norway,⁹ or almost exclusively in their home currency, e. g. Denmark and Germany. Some EU countries also use foreign currency bonds denominated in Euro or US dollars in addition to their home currency to a considerable extent, e. g. Sweden and Romania. For countries that issue both the home currency and Euro or US dollars, comparing the home currency yield with the Euro yield helps us to assess the inflation risk of the home currency, which is closely related to the exchange rate risk. Both potentially affect the yield of the government bonds in question.

TIME TO MATURITY, STOCK EXCHANGE LISTINGS, OWNERS and TRADERS: The original times to maturity, i. e. maturities at issue, are sometimes very short, only a few months. In recent years, several countries issued extremely long-running bonds, including Austria, with maturities of up to 100 years. All Bunds with a maturity of more than one year are listed on the stock exchange and can therefore be easily traded. In many countries, only a portion of government bonds is listed on the stock exchange. Many government bonds are not only traded on their home exchanges but also on many foreign exchanges. Bunds with original maturities of 10 and 30 years are issued regularly, usually initially with a volume of around 20 billion; occasionally the volume is increased during the term.¹⁰ In smaller countries, the volumes are usually much lower.

Government bonds are held by private investors, institutional investors (banks, insurance companies, mutual funds) and often by the central banks of other countries as part of their currency reserves.¹¹ They are also often deposited as collateral. Of the Bunds in circulation in 2015, only around 10 % were held by domestic investors. In Belgium, the figure was 41 %. 59 % were held by foreigners, 32 % of which were held by EU investors from other countries.¹² Since the beginning of the 1980s, large private and institutional investors as well as many central banks have started using science-based investment strategies implemented with state-of-the-art computer technology. As a result, pricing is very efficient.

⁹ Norway is not an EU member from a political point of view, but through its accession to the European Economic Area and thus to the EU single market. It is a member from an economic point of view, as are Iceland and Liechtenstein. These three countries are also discussed in detail in BEREK (2021).

¹⁰ Cf. <https://www.deutsche-finanzagentur.de/de/private-anleger/bundeswertpapiere/> and <https://www.deutsche-finanzagentur.de/de/institutionelle-investoren/>.

¹¹ European Central Bank (7/2019) discusses the latest trends in this area relevant to the ECB and provides a good insight into the relevant literature.

¹² Cf. Blommestein (2016, S. 71), data for other OECD countries are available in his paper.

CREDIT DEFAULT SWAPS (CDS): As already briefly mentioned in I.4, economic history teaches us that sovereigns do not always make the contractually promised interest payments in the exact amounts and on the exact dates, so that the yields on some government bonds are not (nominally) risk-free.¹³ A Credit Default Swap (CDS) is a financial instrument or credit derivative with which investors can insure themselves against the default of a debtor. Credit Default Swaps are individually contracted between the protection seller and the protection buyer. The corresponding contracts, which are usually very detailed, are generally based on the standards of the International Swaps and Derivatives Association (ISDA).¹⁴ Investors in the Eurozone who are looking for a virtually risk-free investment, but for some reason want to buy and hold a certain risky government bond of another Eurozone country, can combine the purchase of this government bond with a Credit Default Swap contract and thus very nearly achieve their goals. Credit Default Swaps are therefore suitable as a hedging instrument. If Eurozone investors want to invest their money in US government bonds without risk, forward exchange contracts or currency swaps are the proper hedging instruments, however we will not elaborate further on this.

The ROLE of RATINGS and CREDIT DEFAULT SWAP-SPREADS when ESTIMATING the DEFAULT RISK: Not all investors want to insure themselves against the default of risky government bonds. Usually, at a first glance, the risk appears to be very low and sufficiently manageable. Since risky government bonds usually offer higher yields than risk-free bonds, the question arises whether the default risk is adequately compensated by the higher yield. In this situation, investors usually seek information to better assess the risk and reduce it by taking appropriate measures. For this purpose, a number of methods have been developed in theory and practice. Large institutional investors, which today include Hedge Funds, have teams of people working with their own methods. Two tools have become firmly established in academia and practice to help investors assess default risk: Ratings and Credit Default Swap Spreads.

Ratings have been offered by financial service providers – usually referred to as Rating Agencies – for decades. The best known are Moody's, Standard & Poor's (S&P) and Fitch. At Moody's, the highest rating grade, Aaa, signals that there is virtually no risk of default, while S&P and Fitch signal this by the AAA rating. The highest rating category is often referred to as 'triple A rating'. The next lower traditional rating levels are Aa and AA respectively. For a more precise determination, intermediate levels have been used for years, below AAA comes Aa1 or AA+, then Aa2 or AA-. Below this comes traditionally the A rating, where the fine-tuning is similar. Below this is Baa at Moody's and BBB at S&P – also with fine-tuning – here,

¹³ Damodaran (2021, pp. 17-21) provides a good first insight into the extensively documented history of Sovereign defaults, cites important sources and conducts several own analyses on the following pages.

¹⁴ Deutsche Bundesbank (12/2010) provides a good first insight into the function, market practices and history of Credit Default Swaps.

the direct comparison is somewhat more difficult (see Annex C for a detailed description of the rating categories).

Ratings are prepared by financial analysts based on a variety of data and are set by committees: for large countries sometimes several times a year, for small ones often only once or twice a year. This is reasonable and sufficient for many purposes, considering the high cost associated with the intensive monitoring of an economy.

Credit Default Swap-Spreads and the analysis methods based on them, on the other hand, make it possible to estimate the default risk, in principle, on a daily basis. Financial service providers – the best known in this field is IHS Markit – collect data on Credit Default Swaps, compress them in a suitable way and make them available in extracts and with a time lag free of charge, but primarily supply them to institutional investors at a charge.

III.2 Government bond yields and their determinants

There is numerous literature on government bond yields and their determinants. Traditionally, the most important factors, apart from maturity – which we will not discuss – are default risk, inflation risk, exchange rate risk and the liquidity of government bonds. In the more recent literature – since circa 2011 – liquidity is often considered as a part of the convenience yield, into which other bond characteristics also enter. We discuss these aspects in the following Sections III.2.1 – III.2.3 and complement our discussion in Annex B, C and F.

In Section III.2.1, we deal with default risk, in III.2.2 with exchange rate and inflation risks. In both sections, we refrain from drawing on the academic literature, instead we illustrate the scientifically non-controversial findings with data provided by BEREC (2021). We often refer to Table 1 below, which we use to summarise Tables 1 and 2 from BEREC (2021), i. e. BoR (21) 86. The only important changes are (i) that we arrange countries by rating and local inflation rate, not alphabetically (ii) that we mention the home currency of each country, and (iii) that we have added several columns with additional information. For example, Column (6) contains the current values of the Gross Domestic Products, expressed in Euro. We use this column as an indicator for the size of the markets in which the government bonds are traded. Column (5) contains the current government bond yields, and Column (9) contains the current inflation rate.

The columns of our Table 1 contain:

- Col. 1: The countries and their currencies from BEREC (2021), Tables 1 and 2. Like BEREC (2021), we add Norway and Iceland separately at the bottom of the table, see FN 10. We mark countries that are not part of the Eurozone.
- Col. 2: Moody's country credit ratings from BEREC (2021), Table 2, Column 3. BEREC uses Moody's rating. Moody's traditionally uses uppercase and lowercase letters to denote rating classes; BEREC only uses uppercase letters, as is common with S&P and Fitch. We follow BEREC in this somewhat unusual approach.
- Col. 3: The credit ratings on August 14, 2021, based on Moody's website.
- Col. 4: The BEREC-yields (yield to maturity of 10-year government bonds, five-year average), from BEREC (2021), Table 2.¹⁵
- Col. 5: The current yield (average July 2021) based on the same data source.¹⁶
- Col. 6: The countries' GDPs in 2020, expressed in Euro. Values are from the same source as BEREC values (Eurostat: Gross Domestic Product at market prices [TEC000001] in Euro, as of August 19, 2021).
- Col. 7: A relative measure of GDP per capita, from BEREC, Table 2. This expresses, as a percentage, how GDP per capita differs from its average value across the countries of the EU 27. Germany's relative GDP per capita, 135.2 %, thus indicates that its relative GDP per capita is 32.5 % higher than the average GDP per capita.
- Col. 8: The country's local HICP price index normalised to the 2015 base (2015 = 100), from BEREC (2021), Table 2.
- Col. 9: Estimates for the respective HICP inflation rates in 2021. Source: Austrian Federal Economic Chamber (July 2021). Their sources: European Commission, IMP, World Economic Outlook (an IMF publication) (<http://wko.at/statistik/eu/europa-inflationsraten.pdf>).

¹⁵ These data are discussed in BEREC (2021, p. 11). They are based on the Eurostat series TEIMF050.

¹⁶ Eurostat Code TEIMF050: <https://ec.europa.eu/eurostat/databrowser/view/teimf050/default/table?lang=de>.

Table 1 Summary of BEREK Tables 1 and 2, plus additional information

Sources are described on the previous page.

1	2	3	4	5	6	7	8	9
	MOODY's RATING		YIELD in %		GDP		Inflation	
Country, currency	BEREC (2021)	14.08.2021	BEREC (2021)	Yield July 2021	in Bn. €	per capita	BEREC (2021)	current
Germany, €	AAA	likewise	-0,03	-0,45	3368	135,2	105,80	2,8%
Denmark, Dan. Crown	AAA	likewise	0,10	-0,05	313	180,3	102,90	1,5%
Netherlands, €	AAA	likewise	0,15	-0,38	800	154,4	106,96	1,8%
Sweden, Swed. Crown	AAA	likewise	0,34	0,18	475	153,8	107,63	2,1%
Finland, €	AA1	likewise	0,24	-0,10	236	144,8	103,98	1,5%
Austria, €	AA1	likewise	0,26	-0,13	377	141,9	108,47	2,1%
Luxembourg, €	AA2	AAA	0,12	-0,40	64	342,6	105,93	2,5%
France, €	AA2	likewise	0,37	-0,01	2303	113,6	105,50	1,6%
Czechia, Czech Crown	AA3	likewise	1,27	1,72	215	67,3	111,40	2,7%
Estonia, €	A1	likewise	0,97	0,09	27	68,9	109,80	2,2%
Lithuania, €	A2	likewise	0,35	0,16	49	59,0	110,63	2,3%
Slovakia, €	A2	likewise	0,47	-0,14	92	56,5	108,47	2,1%
Ireland, €	A2	likewise	0,50	0,03	373	248,1	101,20	1,5%
Malta, €	A2	likewise	0,90	0,49	13	83,8	106,37	1,1%
Poland Zloty	A2	likewise	2,62	1,61	523	46,0	108,60	4,2%
Belgium, €	A3	AA3	0,36	-0,03	451	131,9	108,23	2,1%
Latvia, €	A3	likewise	0,45	0,09	29	52,0	108,62	2,0%
Slovenia, €	A3	likewise	0,60	0,14	46	74,2	104,82	1,4%
Bulgaria, Lev	BAA1	likewise	0,97	0,14	61	29,5	106,27	1,9%
Spain, €	BAA1	likewise	1,01	0,33	1122	79,9	103,91	2,1%
Portugal, €	BAA3	likewise	1,71	0,27	202	66,2	103,58	0,8%
Italy, €	BAA3	likewise	1,82	0,75	1652	92,7	103,00	1,4%
Hungary, Forint	BAA3	likewise	2,73	2,83	136	47,0	113,15	4,4%
Romania, Lev	BAA3	likewise	4,05	3,24	218	38,0	110,67	3,2%
Croatia, Croat. Kuna	BA1	likewise	1,95	0,45	49	41,0	103,06	1,5%
Cyprus, €	BA2	likewise	1,92	0,25	21	78,9	99,67	1,4%
Greece, €	BA3	likewise	4,04	0,70	166	52,2	102,46	0,4%
Average			1,12	0,44		103	106,34	2,02%
Iceland, Iceland. Crown	A3		4,39		19	175,9	103,03	3,2%
Norway, Norw. Crown	AAA		1,38		318	199,5	112,8	2,2%

III.2.1 Default risk

In this section, we primarily focus on default risk and its measurement with credit ratings and also on the relationship between credit ratings and sovereign bond yields in the Eurozone. We complement this discussion by including Credit Default Swap-Spreads.

Within the Eurozone, there is no exchange rate risk, as all Eurozone countries have the same currency. There is an exchange rate risk between Eurozone countries and non-Eurozone countries, which is, inter alia, related to differences in inflation rates. We discuss this in Section II.2.2.

Unfortunately, academic textbooks in the field of finance do not (yet) discuss in detail the differences in interest rates between Eurozone Member Countries. Brealey et al. (2020, p. 70) only mention the pun circulating in finance circles around 2015 *“instead of offering a risk-free return, Eurozone government bonds just offered a return-free risk”*.

Jiang et al. (2021) remark in this context: “Textbook finance would imply, that governments in the Eurozone borrow at the same interest rates, after correcting for default risk differences.”¹⁷ We fully agree with this statement. Below we illustrate it with the data in Table 1, i. e. the BEREC data.

Table 1 shows that the BEREC-yields of the two Eurozone countries classified by Moody’s as triple A and thus as virtually risk-free, Germany and the Netherlands, are very close to each other at - 0.03 and 0.10 %.¹⁸

In our view, Luxembourg also belongs to this group, its classification by BEREC, as AA2 is possibly a data error. Luxembourg currently (on 12.08.2021) has the higher triple A rating with all three major rating agencies and has held this for some time. To our knowledge, it has had a triple A rating most of the time in the past, also according to BEREC (2020). Its BEREC-yield (0.12) fits well with the two triple A countries mentioned. The yield similarity of the thus three triple A Eurozone countries is even stronger for the current 10-year yields, which are - 0.45, - 0.38 and - 0.40 % respectively, see Column 5 in Table 1. We believe that the small yield differences are partly related to the factors we discuss in Section III.2.3.

The BEREC-yields of the three Eurozone countries with the next lower rating, double A, i. e. almost risk-free, are somewhat higher, but all are lower than 0.4 %.

- Finland, its rating is AA1, its BEREC-yield is 0.24 %,
- Austria, also AA1: 0.26 %,
- France AA2: 0.37 %.

France’s slightly higher BEREC-yield is consistent with its rating in the middle of AA. Finland and Austria, having a AA1 rating, are in the upper third of the AA rating class. Currently, all

¹⁷ Jiang (2021, p. 4). The purpose of their paper is to supplement the ‘text book opinion’ with the impact of convenience yields, more in Section III.2.3.

¹⁸ Moody’s rating classes, especially the classes Aaa or AAA, AA, A, BAA and BA and the additional classification with 1, 2 or 3 are discussed in Annex C, in particular Table C1.

three yields are slightly negative (- 0.10, - 0.12 and - 0.01). Again, the small yield differences are likely to be related to factors we will discuss in Section III.2.3.

The eight A-rated Eurozone countries Estonia, Lithuania, Slovakia, Ireland, Malta, Belgium, Latvia and Slovenia all have BEREC-yields of between 0.5 and 1 % with the exception of Belgium, i. e. higher yields than the triple A and double A countries. In the case of Belgium (according to BEREC: A3), we firmly believe that there is a data error in the BEREC table. According to the relatively easily accessible Moody's website,¹⁹ Belgium has had an Aa3 rating, which is one rating class higher, since at least the end of 2012. This has been confirmed at least 20 times and has never changed. This also fits better with its BEREC-yield (0.36 %).

Some of the remaining seven Eurozone countries with only an A rating – that is, they are only in the third-highest rating class – are very small. Germany is 100 times larger in GDP terms than Estonia, Malta and Latvia. In addition to the default risk, this probably contributes to their somewhat higher yields. Because of the small size of these countries, their sovereign bonds (and Credit Default Swaps) are likely to be traded in markets that are less liquid in comparison to those of the large Eurozone countries. On the impact of liquidity, see Section III.2.3. Currently, the yields of the seven A rated Eurozone countries are close to zero, with the exception of Malta, the smallest of the included countries in terms of GDP, see Columns 5 and 6. There seem to be good angels at work here, perhaps the ECB and institutional investors, watching to ensure that ratings and yields are in line.

The three Eurozone countries in the fourth-highest rating class, BAA, – Spain Portugal and Italy – all have BEREC-yields between 1 % and 2 % because some default risk exists. In other words, they have noticeably higher yields than the government bonds of the countries in the three higher yield classes.

Default risk also includes redenomination risk. In July 2012, as in other time periods, it could not be totally ruled out that a country in the Eurozone might leave it and revert to its old currency. This particular form of default risk is known as redenomination risk. Redenominations are traditionally associated with substantial devaluations, i. e. substantial losses for the holders of the government bonds concerned, particularly for the holders of bonds which have a different home currency. Redenomination risk is extensively discussed and its relationship with default risk analysed in several recent papers, cf. e. g. De Santis (2019)²⁰ and Cherubini (2019). In

¹⁹ [https://www.moody.com/credit-ratings/Belgium-Government-of-credit-rating-100220/reports?category=Rating and Assessments Reports_rc|Issuer Reports_rc&type=Rating Action_rc|Announcement of Periodic Review_rc|Credit Opinion in Depth_rc](https://www.moody.com/credit-ratings/Belgium-Government-of-credit-rating-100220/reports?category=Rating%20and%20Assessments%20Reports_rc|Issuer%20Reports_rc&type=Rating%20Action_rc|Announcement%20of%20Periodic%20Review_rc|Credit%20Opinion%20in%20Depth_rc), called up on 14.08.2021. BEREC has taken the ratings from Bloomberg, see BEREC (2021), FN 39.

²⁰ De Santis published his work already back in 2015 as an ECB Working Paper and in SSRN. According to Google Scholar it has already been cited over 100 times, a high number of citations for such a specialist publication.

particular, redenomination risk also plays a role in the interpretation of Credit Default Swap contracts because it is sometimes included as a ‘credit event’, and sometimes not. Holders of Credit Default Swaps may therefore not be reimbursed for their losses in the event of a redenomination if they did not read the fine print when signing their contract.

Back to the three Eurozone countries in the fourth highest rating class. Spain is in the top third of the rating class with BAA1; its BEREC-yield is 1.01 %. Portugal and Italy are in the bottom third of the rating class with BAA3, their BEREC-yield is close to 2 %. The current yields of the three countries range from 0.27 % to 0.75 %. Especially for the latter two countries, the markets are paying attention to the default risk estimate. It can safely be assumed that many institutional investors are constantly looking at this estimate concerned with whether the estimate and its utilisation by the markets are economically correct or whether arbitrage profits can be made.

In the case of the two Eurozone countries which are only in the fifth-highest rating category – BA – not only the rating but also the BEREC-yield signals that an economically not insignificant default risk exists: Cyprus (BA2 and 1.92 %) and Greece (BA3 and 4.04 %). The current yields are 0.25 % and 0.75 %.

At first glance, the differences between the BEREC-yields appear small. However, they have a considerable impact on the final value of a long-term capital investment over many years, e. g. when making provisions for retirement.

The relationship between the probability of default and the rate of return has been studied in the academic literature for decades, and progress is still being made. This relationship is also discussed in detail in the leading textbooks, e. g. in Brealey et al. (2020) on p. 67 et seq. Of particular note is Brealey et al.’s Figure 3.9 (p. 68), which shows that triple A rated corporate bonds had higher yields than comparable 10-year T-bonds, since at least 1953. The yield differential varies considerably over time. Until 1985, with the exception of the oil crisis, it was very small, often below 0.5 %. After 1985, it increased almost steadily, reaching almost 2 % during the financial and/or economic crises around 2000 and 2008. Today, this yield difference is treated in academic publications as convenience yield, see Section III.2.3.

We have illustrated the clear relationship between the rating, the probability of default and the yield on government bonds using BEREC data and have confirmed it with current yield data. Lower ratings are associated with economically noticeable higher yields. Classifying the yields of the bonds of countries rated with a simple A, a BAA or a BA as risk-free yields is neither

Unfortunately it took four years for a recognised academic journal to recognise its significance and quality. Of course, the many additional publications on this subject since 2015 contributed to this.

justifiable from a scientific point of view, nor is it reasonable for regulatory WACC estimation. Thus, while an average of BEREC-yields for all EU countries can be calculated, it cannot be interpreted and used as a risk-free rate of return in the CAPM sense.

Investors can hedge the default of government bonds by purchasing Credit Default Swaps in an appropriate manner, see Annex E. While ratings are often reviewed only several times a year, data on Credit Default Swaps are available on a daily basis, although they can be expensive to purchase. Credit default spreads – i. e. percentages – can be calculated from the credit default premiums, i. e. the prices for Credit Default Swaps. From these, complex models can be used to estimate the probability of default on a daily basis, i. e. much timelier than with ratings. We discuss this only briefly in Annex E, but refer to the literature on the subject.

The development of Credit Default Spreads over time for the most important countries in our context is shown in Figure E2 in Annex E. The figure shows that Credit Default prices and hence default probabilities can change considerably in the short-term, especially in connection with economic and/or financial crises. We assume that the financial analysts who prepare the ratings use figures similar to Figure E2. The figure illustrates that while currently default probabilities of all countries are low, their increase, especially in economic and/or financial crises and especially for the ‘usual candidates’, must always be expected, which is taken into account when setting the ratings. The ratings and yields of 10-year government bonds reflect not only the probability of default in the next year but also, more importantly, the possibility of its change within the next 10 years.

III.2.2 Exchange rate and inflation risks

Of the EU countries considered by BEREC, seven have their own currency. For these, BEREC uses the yield in the domestic currency as a basis, even if these countries have also issued Euro denominated bonds in addition to the bonds denominated in their domestic currency.

Two special cases, where exchange rate risks currently play no role, are Denmark and Bulgaria:

Denmark has a triple A rating; it issues virtually only government bonds in the domestic currency.²¹ Its inflation rate is the lowest of all EU countries under review. From a domestic perspective, its government bonds are as risk-free as Bunds are from a German perspective. The

²¹ In 2017 the Danish National bank proudly proclaimed: “For the first time in at least 183 years, the Danish central government has had no foreign currency loans”, cf. https://www.nationalbanken.dk/en/publications/Documents/2017/03/News_no%20foreign%20currency%20loans.pdf . 2020 it announced: “In October 2020, the government issued a government bond in foreign currency for the first time since 2014. The bond was issued in U.S. dollars as a bullet bond maturing on October 27, 2022”, cf. https://www.nationalbanken.dk/en/governmentdebt/centralgovernment_debt/Pages/Foreign-Debt.aspx .

exchange rate between the Danish Crown and the Euro fluctuates slightly, but there is no discernible upward or downward trend, see Chart F1 in Annex F. Its BEREC-yield is only marginally higher than that of the second Eurozone country besides Germany with a triple A, the Netherlands, 0.15 %.

Bulgaria's Lev has been firmly fixed to the Euro for several years. Originally, the Lev was firmly fixed to the DM, 1 Lev = 1 DM. After the introduction of the Euro, the exchange rate was targeted to be 1 € = 1.9558 Lev; since 2006 the central bank has maintained this ratio at almost 100 % with appropriate measures, see Chart F2 in Annex F. Bulgaria's BEREC-yield is fully in line with Spain's BEREC-yield, the other rated BAA1 country, as a consequence it can also not be considered to be risk-free due to the not insignificant default risk.

Exchange rate and inflation risks have a more or less significant impact on the level of the BEREC-yields of the five other non-Eurozone countries and Norway.²² In the following, we will take Sweden, Norway, Croatia, Hungary and Poland as examples (unfortunately, we have forgotten the exchange rate chart for Poland, which we will be happy to supply later).

The influence of exchange rate risk becomes particularly evident when looking at Sweden, which has traditionally had a triple A rating for years, received from all three major rating agencies. From the perspective of Swedish investors, the yield on Sweden's government bonds denominated in the domestic currency can be classified as nominally risk-free. According to Table 1, BEREC's estimate of Sweden's risk-free rate is 0.34 %, while Germany's is - 0.03 %, so the difference amounts to 0.37 percentage points.

The considerable difference (0.37 percentage points) is mainly related to the fact that, from the perspective of foreign investors, Sweden's domestic, in Swedish Kronor (SEK) denominated government bonds are subject to exchange rate risk, i. e. they are not risk-free. At the beginning of 1999, one Euro was worth SEK 9.5, in 2012 SEK 8.2, and on August 4, 2021 SEK 10.2. The interim high in March 2009 was slightly above 11.5 SEK, the interim low in April 2000 was 8.0 SEK. Thus, one Euro tended to buy more and more Swedish Kronor, especially since 2013, and one Swedish Krona tended to buy fewer and fewer Euros. However, there were significant fluctuations over time, see Figure F3. Thus, as the Euro-SEK exchange rate increased between 1999 and August 2021, and especially between 2013 and 2021, Eurozone investors buying SEK-denominated Swedish government bonds tended to mostly earn a Euro return on their investment that was lower than the SEK return on Swedish government bonds. Some investors probably have – based on their skill and/or luck – achieved a return that was higher than the return on the Swedish government bonds, e. g. if they bought the Swedish bonds near the peak

²² Cf. FN 9 and the comments to Column 1 of Table 1.

of the exchange rate in 2009. The same is true for investors from other non-Eurozone countries and for investors outside of the EU.

Sweden lovers based in the Eurozone can alternatively buy Swedish Euro-denominated government bonds and thus achieve a risk-free return if they hold the bonds until its final maturity. This is likely to be very close to the yield of the comparable German government bond in most cases. For example, the Swedish government bond with ISIN XS1756338551 is denominated in Euro. It was issued in 2017, has a coupon of 0.125 % and matures on April 24, 2023. The yield was - 0.59 % on August 4, 2021, according to ARIVA.de, just 0.07 percentage points higher than the German government bond comparable in terms of time to maturity.

Based on standard exchange rate theories – in particular the Purchasing Power Parity Theory – the long-term change in the Euro-SEK exchange rate observed since 1999 is related to the fact that the inflation rate in Sweden was higher than in many Eurozone countries, and in particular higher than in the major Eurozone countries, cf. Table 1, Column 8. The real return earned by Swedish investors on their SEK-denominated government bonds is likely to have been mostly lower than the nominal return on these bonds.

Thus, exchange rate risk and the inflation risk behind it are primarily responsible for Sweden's higher BEREK-yield compared with the triple A countries of the Eurozone. The exchange rate effect has an even greater impact on Norway, which also has a triple A rating but does not belong to the EU. Its exchange rate has been rising almost continuously since 2013, cf. Figure F6. As a result, its BEREK-yield is 1.38 %.

Croatia's BEREK-yield (1.95 %), on the other hand, is likely to be primarily related to its BA1 rating, its exchange rate has been relatively stable since 2013, cf. Figure F5. Its BEREK-yield is close to similarly rated Eurozone countries (Portugal, Italy, and Cyprus).

Again, both default risk and exchange rate risk are likely to play an important role in Hungary's BEREK-yield, which is almost 1 % higher (2.73 %), cf. Figure F4.

An examination of the seven non-Eurozone countries shows that a country's domestic currency can also contribute significantly to the fact that its government bonds cannot be classified as risk-free in the context of the CAPM.

Sweden lovers (or currency speculators) based in Germany can buy Swedish government bonds denominated in SEK as an alternative to buying Euro-denominated Swedish government bonds. A foreign exchange spot transaction must be entered into for the purchase, and foreign exchange forward transactions must be entered into to safely transfer the future interest and principal

amounts paid in SEK into the domestic currency. In most cases, spot and forward transactions are concluded at the same time, in which case they are referred to as a currency swap. The result is a secure Euro yield that is likely to be very close to the yield on German government bonds if the contracts have been carefully matched.

Polish investors who firmly believe in the long-term safety of Bunds, but have slight doubts about whether 10-year Polish government bonds are 100 % safe for the entire term, given Poland's rating (A2), can also combine the purchase of Bunds with currency swaps. If they buy Zero-Coupon Bunds with a remaining maturity of 10 years and link them to a 10-year currency swap, it will result in a nominally risk-free investment, provided the swap-seller is fully trustworthy. The yield calculated from this is a way to estimate the nominal risk-free rate from a Polish perspective.

However, Polish investors could also buy domestic bonds denominated in Zloty and enter into a Credit Default Swap contract. They then have to fully trust the CDS seller. The thus calculated yield is a second way to estimate the nominal risk-free rate from a Polish perspective. Both should lead to almost identical results.

From an academic point of view, the nominal risk-free rates thus estimated would be the basis for a CAPM application in the context of Polish network regulation. They are likely to be significantly lower than Polish government bond yields because they are corrected for the default risk of the Polish government.

The nominal risk-free yields in Euro and Zloty will generally differ. However, if we assume an identical basket of goods for Poles and Germans and, in addition, strict purchasing power parity, then the real risk-free rates in Germany and Poland will be identical, cf. Grauer et al. (1976).

III.2.3 Convenience yield and its impact

Since at least the 1990s, academic literature has been discussing whether other factors, in addition to the probability of default and exchange rate and inflation risks, might enter into the market valuation and thus the yield of government bonds. The intensity of the academic discussion has increased considerably over the past five years; we can only discuss the most important contributions and findings here. These factors have also been addressed in regulatory proceedings in recent years, amongst others by Randl/Zechner (2019) and Frontier Economics et al. (2021).

Amihud published a series of important essays in the 1980s on the impact of liquidity on prices and returns. Amihud/Mendelson (1991) – building on this – looked at US Treasury securities with identical time to maturity that differed in liquidity. They were able to show impressively,

“the yield to maturity is higher on notes, which have lower liquidity” and proudly remarked, *“The results provide a robust confirmation of the liquidity effect in asset pricing”*.

Montfort/Renne (2014) also compared securities with different liquidity for the years 2006-2012 with no difference in currency denomination, default risk, and remaining maturity. Their well-published work has been previously presented at several universities and conferences. Building on Schwarz (2009), they compare in particular bonds of the Kreditanstalt für Wiederaufbau (KfW), these are guaranteed by the Federal Republic of Germany, with Bunds. The basic idea probably originated from Longstaff (2004), who compared bonds issued by the government-guaranteed Resolution Funding Corporation with T-bonds. Such comparisons of government bond yields with government agency yields to examine liquidity issues have been made frequently in recent years.

In case of Bunds, the volumes of individual bonds and the total volume of all outstanding bonds are 3-4 times higher compared to KfW. In addition, Bunds are the only ‘deliverable underlying’ in Eurex Futures contracts. Obviously, the Bund-KfW spread varies significantly over time. Montfort/Renne (2014) therefore tried to identify the determinants of this spread. One of their important conclusions (p. 2113) is: *“Overall, these regression results suggest that liquidity-pricing effects, as proxied by the KfW-Bund spread, have important connections with measures of macro-financial risks. However, this analysis leaves many questions open”*.

Montfort/Renne (2014) unfortunately provide no evidence on how high the Bund-KfW spread actually is and how it varies over time. A similar situation exists in France, where the Caisse d'Amortissement de la Dette Sociale (CADES) is guaranteed by the government. Ejsing et al. (2015) show in their Figure 3 that the KfW-Bund spread and the CADES-OATs spread (French government bonds, Obligations assimilables du Trésor, OATs) varied widely between 1999 and 2013, from zero to over 80 basis points. Their examination is also of particular interest because, among other things, the residual maturity of 10 years is considered.

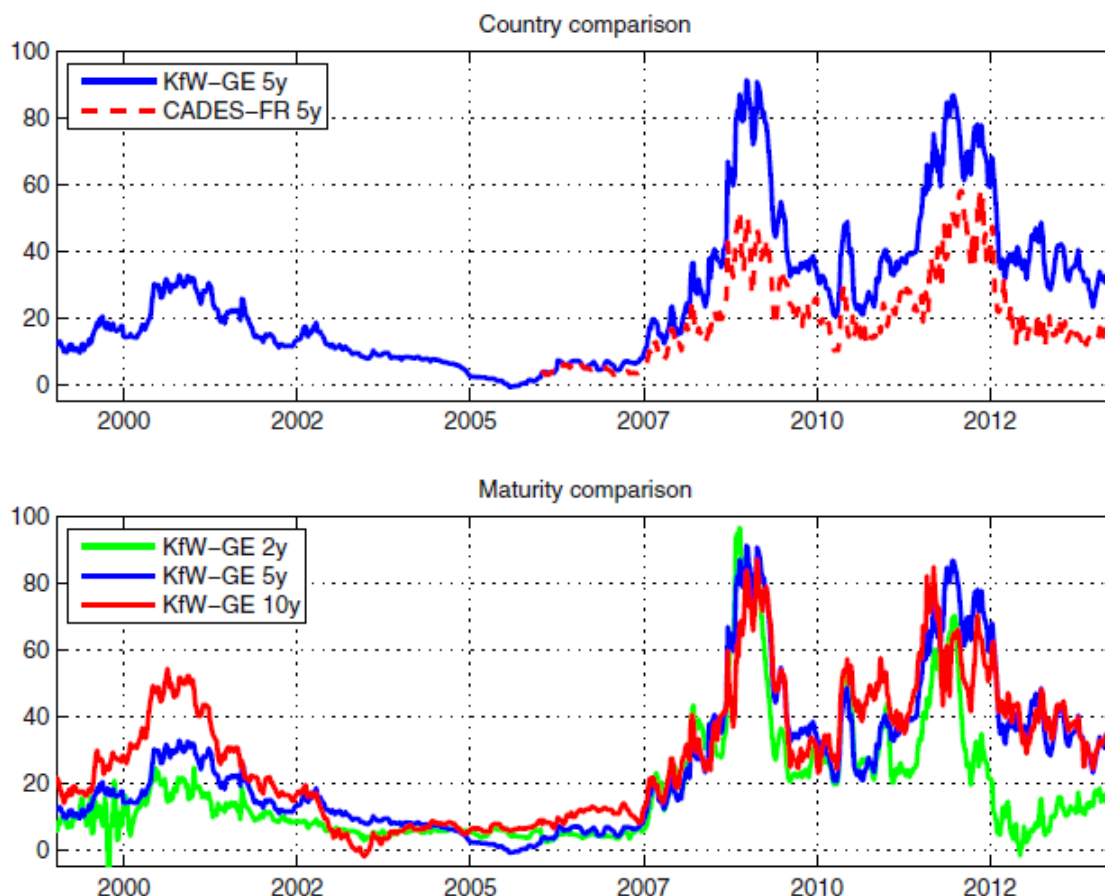


Fig. 3. Agency-sovereign spreads for Germany and France. Note: The figure shows the spreads (in basis points) between agency and sovereign bonds. The upper panel compares the agency-sovereign spread for 5-year maturity for Germany and France (labelled KfW-GE and CADES-FR, respectively). The lower panel compares the agency-sovereign spread for Germany for different maturities. All spreads are computed as weekly averages. The sample period is 4 January 1999 to 25 April 2014 for Germany and 1 January 2006 to 25 April 2014 for France.

Figure 1 Yield spreads between government bonds and government-guaranteed bonds issued by government entities in Germany and France in basis points, 1999 to early 2014

The upper panel shows the KfW-Bund spread and the CADES-OATs spread, both for a residual time to maturity of five years. The lower panel looks at KfW-Bund spreads for different residual maturities.

Source: directly from Ejsing et al. (2015), p. 165.

Ejsing et al. (2015) rightly note that these spreads may also have something to do with capital flows seeking a safe harbour, i. e. with a particular increase in demand for bonds that are considered to be particularly safe in times of economic and/or financial crises. They try to separate the two effects with the help of a model. This, of course, involves assumptions that are open to discussion.

In a well-received paper, Krishnamurthy/Vissing-Jorgensen (2012) compare the yield differential of T-bonds with triple A rated US corporate bonds over the period 1919-2008. They refer to the value investors place on the particular liquidity, safety and other characteristics of US Treasury bonds relative to US triple A corporate bonds as ‘convenience yield’ and estimate the difference in returns to be “73 basis points per year, of which at most 46 basis points are for li-

quidity and at least 27 basis points for safety.” In classifying these values, it should be borne in mind that their study covers almost the entire past 100 years. What other aspects are included in the convenience yield has since been further specified in several papers on its estimation for the US capital market, notably:

- Suitability for use as collateral;
- Suitability as a safe-harbour, flight-to-quality or flight-to-safety vehicle;
- Hedging against redenomination risk.

Therefore, in principle, everything except default risk. Usually this concerns nominal returns, inflation risk is not considered.

Building on Krishnamurthy/Vissing-Jorgensen (2012), a number of papers have been published in subsequent years that address, inter alia, alternative approaches to estimating the convenience yield of T-bonds and their implications, e. g. on sovereign debt financing. These include the just prominently published work of Binsbergen et al. (2021), who base their estimate on stock options and put-call parity²³ and estimate convenience yields for remaining maturities up to three years; their estimate is 40 basis points.

In the past five years, a number of papers have also been published that look at estimating convenience yields for Eurozone government bonds. In the following, we mention primarily long-term estimates. However, some of the short-term estimates, e. g. Geck/Kaserer (2021), contribute to some extent to methodological issues in interesting ways.

Paret/Weber (2019), building on Du et al. (2018), explore the question “*Are Bunds special?*” by comparing Bund yields with government bond yields of the other G11 countries.²⁴ Not all of these countries have had triple A ratings in recent years. Paret/Weber argue in this regard “*their sovereign bonds are still extensively used as collateral and safe saving vehicles by banks and households*” and adjust the yields for exchange rate, liquidity and other effects. They see their question as equivalent to asking: “*is the convenience yield of German government bonds higher than the convenience yield of the other G11 countries?*” In their view, this is supported, for example, by the fact that Bunds are used to a greater extent as collateral than the government bonds of other EU countries. Based on their empirical research, the convenience yield of Bunds increased in comparison to the government bonds of the other G11 countries in recent years and has increased in particular compared to US government bonds. Their prediction is that Bunds are likely to perform even better in such comparisons in the future, which they attribute to an increasing relative scarcity of Bunds.

²³ Cf. Brealey et al. (2021, p. 547 et seq.) – Chapter 20.2 ‘Financial Alchemy with Options’.

²⁴ Australia, Canada, Denmark, Japan, New Zealand, Norway, Sweden, Switzerland, the UK and the US.

Since liquidity premiums and convenience yields vary considerably over time, their regulatory use requires data that include the immediate past and that are likely to be updated regularly in the future. The aforementioned papers that have been published in journals are not based on data for the past three years. Two papers that seem promising at first glance provide data up to the immediate past, however neither has so far been accepted by journals, i. e. they have not yet been positively reviewed: Jiang et al. (2021) and Corradin et al. (2021).

Jiang et al. (2021) base their estimates on data for the nine largest Eurozone countries for 2002 to 2020, adjusting the yields with Credit Default Swaps. Their estimate of the convenience yield for German government securities with a 5-year residual maturity is 0.33 percentage points (Table 1, p. 18).

Corradin et al. (2021) succeed, in part through a close study of Credit Swap contracts, to estimate five components of yields for the period 2015 to the end of July 2020: the expected future short-term risk-free rates and a term premium, ii) the default risk premium, iii) the redenomination risk premium, iv) the liquidity risk premium and x v) a segmentation (convenience) premium. The sum of the last three premiums is 0.32 percentage points (see Table 1, p. 29).

For both sources, it cannot be assumed that the estimates are continuously updated. However, both papers show that the convenience yield of Bunds is considerably higher than that of the other triple A rated Eurozone government bonds.

The high convenience yield of Bunds suggests that BNetzA should consider using the average of the triple A rated Eurozone bonds as the risk-free rate in the medium term. This is somewhat higher than the interest rate for Bunds because of the convenience yields of the other triple A countries in the Eurozone being somewhat lower than those of Bunds.

IV. The risk-free rate, its estimation and regulatory determination in the equity area

Our detailed discussion of the valuation and yields of government bonds in Section III was an important preliminary step in answering the question of how the risk-free rate should be determined in the context of BNetzA's determination of the cost of equity and cost of debt. This determination primarily affects DTAG and its direct and indirect customers within the scope of regulated products. The direct customers of these products primarily include competitors Telefónica and Vodafone. Indirectly affected, of course, are all commercial and residential customers of all fixed network providers.

Closely related to this issue is the question of how the cost of equity and the cost of debt should be determined by the regulatory authorities of other EU countries from a scientific point of view, because DTAG is directly and indirectly affected by these determinations.

We have already stated in Section I.5 and in answering question 1 in Section II.1 that a reduction of the allowed WACC from 3.64 % to 2.39 % cannot be considered to be a stable WACC environment. Furthermore we have stated, that in a WACC calculation based on the Commission Notice, in order to reduce the reduction in the short-term, primarily only the increase of the risk-free rate associated with an extension of the averaging period to 10 years and/or a special surcharge on this interest rate can be considered.

We do not discuss other alternatives below, or only in passing:

- In principle, an extension of the averaging period to, for example, only nine years would also be conceivable. In our view, however, the stability of the economic environment makes sense and would be preferable.
- We also advise against an immediate replacement of Bunds with an average of Eurozone triple A bonds. This would require far more clarification and consultation than continuing the current approach. However, we believe that a medium-term transition to the triple A average makes a lot of economic sense and would politically be a good step toward European regulatory harmonisation. In Annex B we consider, inter alia and for the years 2015 to 2020, the yield difference between Bunds with a remaining maturity of exactly 10 years and the yield average calculated by the ECB on each trading day for all triple A government bonds of the Eurozone with this maturity. The latter is currently only 0.04 percentage points higher if a five-year average is taken. Both values are also usually close to each other.²⁵

²⁵ Figure B1 in Annex B shows the development of the Bunds and the triple A average over time. There is also a link to the relevant ECB chart.

- Using the average BEREK-yield of all EU countries as the risk-free rate is not compatible with a science-based approach. Taking a weighted or unweighted average of national government bond rates does not give an unbiased estimate of the risk-free rate and is therefore not a suitable estimate. This is because many government bond interest rates are significantly higher than the nominal risk-free rate required by the CAPM as a result of default and exchange rate risks, some of which are significantly higher, cf. Section III, in particular Table 1. In addition, under this approach, an increase in the default probability of the government bonds of a single Eurozone country, for example, would increase the risk-free rate of the entire Eurozone, i. e. it would result in a completely unjustified increase from an economic point of view.
- From our point of view, the further use of exponential smoothing would also be an economically reasonable approach, but according to our information, this possibility is not open for discussion.

In the following Section IV.1, we discuss possible distortions of competition associated with inconsistent risk-free rate determinations that deviate from the CAPM in individual Member Countries. In Section IV.2 we discuss the two aforementioned alternative options for setting the risk-free rate at present and in the near future.

IV.1 Distortions of competition because of risk-free rate settings

According to the Commission Notice, a nominal application of the CAPM is to be made under the assumption of an EU-wide integrated capital market in which there is free movement of capital for investors and corporations. In particular, the nominal risk-free rate in the domestic currency is to be used in the WACC determination. This is not identical to the yield on domestic government bonds if the domestic government bonds are at risk of default, the latter is too high. In this case, the nominal risk-free rate in the domestic currency can be estimated in the following way:

- The yield on domestic government bonds can be used as a starting point. The costs of hedging with Credit Default Swaps - i. e. the credit default spread - must be deducted from this. The resulting value is obviously lower than the yield on domestic government bonds, the lower, the higher the default risk. This method is particularly suitable for Eurozone countries with a default risk; for non-Eurozone EU countries it is at least a good step in the right direction.

- Alternatively, the yield of Bunds, the average of Eurozone triple A yields or the yield of another country with a triple A rating can be used as a starting point, especially the T-bond yield. This is to be converted into a yield in the respective desired currency with the help of suitable currency swaps. This approach would be particularly suitable for the triple A countries Norway and Sweden, as there is no default risk with these countries. It would deliver a yield that is higher than the yield on Bunds for the two countries mentioned, but lower than the yield on the home country.

For the other countries, the two approaches must be combined.

In any case, using the home government bond yield when default and/or exchange rate risk exists is not the economically correct approach from a scientific point of view. In all the EU countries we have looked at where such risks exist, the yield on domestic government bonds is higher than the nominal risk-free rate in the domestic currency, and in several countries, it is considerably higher.

If necessary, a convenience yield could be included, but it should not affect this result in any significant way.

If regulators in Eurozone countries whose rating is not triple A are allowed to use the yield on domestic government bonds as the nominal risk-free rate, the allowed cost of equity or the allowed WACC based on it will be too high. The distortion tends to be more pronounced the more the domestic sovereign rating deviates from triple A. For companies based in non-Eurozone EU countries, the same applies in principle, but the arguments are somewhat more complex because of exchange rate risk.

Risks related to the possibility of default of the home country's sovereign bonds and/or exchange rate fluctuations are captured by the CAPM solely by the estimate for the non-diversifiable risk, i. e. the beta value of the company. Risks, which do not affect the beta value of the company, are classified as diversifiable risks and as such do not increase the cost of equity.²⁶

In the event of defaults of government bonds in the context of European or global economic and/or financial crises, such risks are likely to have a beta-increasing effect in some sectors of the economy and a beta-reducing effect in others.²⁷ Long-term beta calculations carried out by us indicate that the betas of companies that are subject to network regulation increase slightly

²⁶ The fact that, according to the CAPM, risks not captured by beta do not lead to an increase in the cost of equity is emphasized by all textbooks. In Brealey et al. (2020, p. 239), a section heading reads „Don't be fooled by diversifiable risk.“ The section ends with „Sometimes, financial managers increase discount rates in an attempt to offset these risks. This makes no sense. Diversifiable risks do not increase the cost of capital.”

²⁷ This is because the average beta value in market value weighting is always equal to one.

in the short-term during major crises, but that their long-term development is only slightly affected.²⁸

If only a single country faces the default of its sovereign bonds, it is likely to be a diversifiable risk in case of small and medium-sized countries. In both cases - small country or global crisis - the default of government bonds is included in the beta calculation. This is also the case, in particular, under the Commission Notice approach.

It can be assumed that DTAG's competitors which are not domiciled in triple A EU countries will be granted higher nominal risk-free rates by their regulatory authorities than are appropriate under the CAPM. This is particularly the case if the home country is not rated at least AA and competitors in their home market are granted the 'risk-free rate' of the home market. Based on the data in BEREC (2021, Table 12 on p. 60), Telefónica, for example, could be granted a risk-free rate more than one percentage point higher than DTAG, Telekom Italia even 1.85 percentage points higher. Considering that the WACC for DTAG, when calculated in accordance with the Commission Notice, is 2.39 %, these differences are considerable. They would undoubtedly represent significant competitive disadvantages for DTAG, especially if they persist for several years.

IV.2 Alternative options for setting the risk-free rate

In our opinion, in order to promote the stable framework conditions required under § 32 (3) Number 4 TKG and to avoid distortions of competition while complying with the guidelines of the Commission Notice, only the following two options can currently be considered when setting the risk-free rate:

- Averaging the risk-free rates in the previous way, i. e. using a ten-year average;
- Applying a mark-up or adjustment to the risk-free rate, see SWD (2019, p. 52 et seq.) or BEREC Regulatory Accounting in Practice Report (2020), Chapter 5, Figure 13, p. 52.²⁹

An important argument against the use of a mark-up or an adjustment is that such adjustments have been used in the past but are not mentioned in the Commission Notice and thus do not appear to be permissible in the future. In addition, the value of such mark-ups is difficult to justify economically. Surcharges that cannot be justified economically have been referred to as

²⁸ Bazhutov et al. (2021).

²⁹ BoR (20) 210.

fudge factors in the textbook by Brealey et al. for many editions and are firmly rejected.³⁰ Finally, an argument against surcharges is that they impose a definitive burden on consumers' costs. There is generally no provision for a future offset, which occurs automatically when a ten-year average is formed, in case interest rates rise again.

We strongly believe that averaging the risk-free rates in the manner applied in the past, i. e. using a ten-year average, is the only economically sensible way to maintain the stable economic environment required by the TKG and to avoid distortions of competition, now and in future. The SWD also recognizes that averaging over several years can be useful in terms of the risk-free rate if it is maintained over the long-term, cf. SWD (2019, p. 32): *“it is relatively more important, from a regulatory policy perspective, to ensure that over the lifetime of the investment the regulated company is appropriately rewarded according to the financial conditions existing over the lifetime of its investment. The use of a longer averaging period is likely to achieve this objective, as long as the regulator commits to using the same averaging period over the lifetime of the investment in its periodical market reviews. On this last point, it seems appropriate to use the same averaging period across market reviews to be consistent with the principle of predictability”*.

³⁰ Cf. Brealey et al. (2020, p. 241 et seq.) and Brattle (2016, p. 23, FN 23).

V. The risk-free rate and its role in estimating the cost of debt

In the early 1960s, financing rules were the hottest topic in German business economics. Probably the most important one was the Matching Principle (Goldene Bilanzregel), which states that short-term assets should be financed on a short-term basis and long-term assets on a long-term basis. It still holds true today and is still discussed in detail in the leading textbooks.³¹

Theoretically, according to Brealey et al. (2020), it is difficult to answer the question of whether the matching principle is the optimal financing policy. However, empirical evidence shows that most managers or firms follow the ‘Matching Principle’ in practice.³² Graham/Harvey (2001), in their survey of top managers, even find that the ‘Matching Principle’ is the only (!) important factor in the choice between short-term and long-term debt capital in the context of corporate financing decisions.

Because the Matching Principle is an important debt financing strategy, the use of a ten-year average of the risk-free rate is even more important for estimating the cost of debt than for equity. This is because,

- it was and is economically sensible for DTAG to finance itself with long-term debt. The main reason for this is that infrastructure investments in the telecommunications sector have long lifetimes of up to 20 or 30 years.³³ In terms of debt capital, such investments should be financed on a long-term basis.
- DTAG was also encouraged to do so by the German regulatory framework before 2020.

DTAG raised its debt prior to 2016 in an economically sensible manner. As a consequence, it should be able to make its interest payments out of the WACC determination, at least to a great extent.

If a ten-year average of ten-year government bonds is used for the determination of the regulatory WACC, as has been the case to date, then it is an economically sensible debt financing strategy for the regulated company to borrow approximately 1/10 of the long-term debt capital required each year, each with a term of approximately 10 years.³⁴ According to our impression, DTAG pursued such a strategy in the period relevant here, but they naturally had to take account of capital requirements and have attempted to take advantage of market opportunities. As a result, DTAG currently still has to service several bonds, some with high interest rates, from

³¹ Cf. e. G. Berk/De Marzo (2019), p. 985, or Brealey et al. (2020), pp. 770-771.

³² Cf. e. G. Beranek et al. (1995) or Stohs/Mauer (1996).

³³ Cf. SWD (2019, p. 32).

³⁴ Brattle (2016) mentions this strategy on p. 86.

the years prior to 2016. Examples include the bond issued in January 2003 with a coupon of 7.500 %, the bond issued in March 2008 at 5.851 %, the bond issued in April 2010 at 4.875 %, the bond issued in October 2010 at 4.500 % and the bond issued in 2013 at 3.250 %.

Our rough calculation for the Euro-denominated DTAG bonds in Annex G show that in 2021 the outstanding volume of these bonds will bear an average interest rate of 1.93 %. If a ten-year average for the risk-free rate (0.65 %) and a debt risk premium of 1.12 percentage points are taken as a basis, this results in an after-tax cost of debt of 1.77 %, which means that the coupon payments could nearly be made. Perhaps it would have been possible to finance more optimally. By contrast, using the five-year average for debt would result in an after-tax cost of capital of only 1.09 % (- 0.03 plus 1.12), in this case only slightly more than half of the coupon payments due on the outstanding debt (the embedded debt) could be met.

Incidentally, DTAG is not the only company that has to refinance high interest rates on its long-term corporate bonds. This also applies to its direct competitors.

If BNetzA uses a 10-year average of the risk-free rate as the basis when determining the cost of debt, DTAG benefits when it raises new debt capital, e. g. for repayment purposes or for network expansion. For new debt capital with a term of 10 years, DTAG currently has to pay interest around 0.3 - 0.4 %. The bond issued in March 2019 with a coupon of 1.750 % and a good volume (1 billion Euro), for example, currently has a remaining term of almost 10 years. It is currently trading at 115 % and thus has an effective interest rate of 0.26 %, 0.73 percentage points more than the comparable Bund. Implicit in the use of the 10-year average is the serious piece of advice that DTAG should build up reserves for the time period in which interest rates rise again and will be higher than the borrowing costs that can then be approved.

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Annex A: The CAPM and the estimation problems associated with it

The Sharpe-Lintner-CAPM

The model published by Sharpe (1964) and Lintner (1965) is today one of the cornerstones of the scientific field ‘finance’. It is based on strong assumptions, which make it possible to derive the CAPM equation. The assumptions are:

- all market participants have identical information and therefore base their decisions on identical probability distributions (homogeneous expectations);
- transaction costs and taxes do not exist;³⁵
- only one time period is considered;
- investors are only interested in the expected value of the (real) return of their total portfolio in the period under consideration and in its variance;
- there exists a real risk-free rate at which investors can borrow and lend (invest) without restriction.

The original Sharpe and Lintner essays do not distinguish between real and nominal. Rational investors have no money illusion; this is a central insight of economics going back to Irving Fisher. As a result, they are interested in the expected value of the real return and an additional assumption is required to guarantee that the real return is calculated identically by all investors. The simplest way is to allow only one consumption good, e. g., wheat, measured in kilograms.

In the CAPM, the following formula is the result of a theoretical analysis of the economic equilibrium in a capital market described by these assumptions.³⁶ The tildes indicate that, from the point of view of the market participants at the beginning of period t , these are random variables, and the expected value operator E indicates that the (mathematical) expected values of these random variables are at the centre of the model. All returns are the values that exist in an economic equilibrium.

$$E[\tilde{r}_{it}] - r_{ft} = \beta_{it} * (E[\tilde{r}_{mt}] - r_{ft}), \text{ where}$$

\tilde{r}_{it} = the real rate of return of stock i in time period t ;

r_{ft} = the real risk-free rate in time period t ;

$$\beta_{it} = \text{cov}(r_{it}, r_{mt}) / \text{var}(r_{mt}) = E[(\tilde{r}_{it} - E[\tilde{r}_{it}]) * (\tilde{r}_{mt} - E[\tilde{r}_{mt}])] / E[(\tilde{r}_{mt} - E[\tilde{r}_{mt}])^2]$$

= the (standardised) measure for the non-diversifiable risk to be born by investors, in short the equity beta of stock i in time period t .

³⁵ For a more precise presentation of the assumptions, derivations and conclusions, cf. e.g. Copeland et al. (2005), p. 559 et seq. The textbooks Brealey et al. (2020) and Ross et al. (2019) do without a formal mathematical derivation, as does the practitioners’ textbook Koller et al. (2020), but explain the relationships in detail, Brealey et al. e.g., on pp. 205-217.

³⁶ Cf. e.g. Brealey et al. (2020, p.206). In textbooks for MBA students the expected value operator is often omitted.

\tilde{r}_{mt} = the real rate of return of the portfolio of all shares within the modelled market in time period t. In practical application, the return of this portfolio is approximated by the rate of change of a broad stock index.

E[.] = the mathematically expected value of the quantity in the square bracket.

The equity beta is therefore the expected value of the product of two random variables.

The term in the round bracket of the CAPM formula is called equity risk premium or market risk premium. We use these terms interchangeably and use the abbreviation MRP. The market risk premium and the beta, both of which are expected values of random variables, are not directly observable, not even retrospectively, so they must be estimated.

Graphical, verbal or mathematical derivations lead to the above equation, which is mathematically exact. However, the quantities in the equation must be specified more precisely before the model can be used to estimate the cost of equity, in particular the time period for which the model is supposed to apply, the capital market and the currency.

The CAPM equation can be derived only if there exists a risk-free rate at which all market participants can borrow and invest in an unrestricted manner. This is explicitly pointed out by Sharpe (1964), the textbooks and by many publications, e. g. also Damodaran (2010, p. 8 et seq.).

100 % real risk-free securities do not exist in practice, nor do nominal risk-free securities. Thus, if the model is used, a selection must be made among the available near risk-free securities. The beta factor and the market risk premium are not directly observable, not even ex post, which makes their estimation considerably more difficult. This is especially true for the market risk premium. Because of the large variation of the random variable 'rate of return of the market portfolio' over time, many observations are needed to obtain a good estimate. Some academics think that 50 years is sufficient, DMS believe that more than 100 years are needed. In the case of the equity beta, on the other hand, most academics believe that data for the past five years are sufficient.³⁷

The logic of the CAPM requires that the time to maturity on which the calculation of the risk premium is based and the time to maturity of the risk-free rate are identical. The r_{ft} is the same. A large number of proposals exist in the academic literature on how to improve the CAPM or

³⁷ From a scientific point of view, the number of observations required for a good estimate depends in particular on the spread of the random variable and its stability over time. It should therefore be determined individually for each random variable. The starting hypothesis expressed in SWD (2019, p. 30) in this regard does therefore not correspond to the scientific view: “When a regulator uses a specific period to derive an average risk-free rate and cost of debt, it would seem appropriate that the same averaging period is used to derive the company's equity beta. In other words, if the regulator relies on a time-window of e.g. 5 years to estimate the risk-free rate and the company's cost of debt, it would seem appropriate to use that same time window to estimate the value of the equity beta.”

replace it with alternative models. Despite the mentioned weaknesses and the difficulties in practical applications, the Sharpe-Lintner CAPM is the only capital market equilibrium model used in regulation.

The main contribution of the model is that only non-diversifiable risk finds its way into the cost of equity, not diversifiable risk, which investors can eliminate by holding a diversified portfolio, see Brealey et al. (2020, chapter 8) and the other textbooks in the field of finance mentioned in section I.4.a. Thus, by using the CAPM, shareholders receive an adequate return for the risk they have to bear.

The international interpretation of the CAPM and international CAPMs

The CAPM can be interpreted as a model describing a national or an international capital market. We refer to the latter case as the international interpretation of the CAPM. Grauer/Litzenberger/Stehle (1976) and Stehle (1977) address the problems associated with the existence of local capital markets and present international variants of the model that address the problems of international capital markets more precisely than the international interpretation of the CAPM. More complex models exist, but are not currently implementable. In her review article, Lewis (2011, p. 438) notes:³⁸ *“Nevertheless, the appeal of the simple model continues until today, as the World CAPM is often used as a benchmark.”* We refer to Grauer et al. (1976) several times in the following, but cannot go into details here. Of particular importance for this report is:

A world-wide interpretation of the CAPM is only possible if the strict form of the purchasing power parity theory holds ‘world-wide’ and all investors have the same consumption preferences. The same principle applies in case of an EU-wide interpretation.

In case local capital markets are totally isolated from each other, a CAPM formula exists for each individual market.

In the case in which, as in the EU, several local capital markets are fully integrated with each other, there is a single CAPM formula for the entire market. This can be used to derive, inter alia, the risk premia of the local submarkets. These depend on the country betas of the submarkets. A country whose country beta is high (low) has a high (low) market risk premium. Thus, the assumption that EU member countries have fully integrated capital markets is fully compatible with the observation of different risk premia across countries. This is equally true for the assumption that a ‘world-wide’ fully integrated capital market exists. And, conversely, that

³⁸ A recent publication that gives a brief overview of international CAPMs is Hollstein (2021). In many cases, even stricter assumptions are used than in Grauer et al., e.g. in Black/Litterman (1992, FN 9, p. 43).

different national risk premiums are not an indication that local capital markets are isolated from each other. Only if country risk premia were not in line with the international CAPM would this be a reason to reject the international CAPM. We are not aware of any such scientific evidence.

In the international CAPM of Grauer et al. (1976), purchasing power parity is assumed in the sense of the strict purchasing power parity theory. This assumption fits better for the EU internal market and the unconstrained investment opportunities within this market than with the assumption of global integration of capital markets.³⁹

In Grauer et al. (1976), in the international interpretation of the CAPM, and in international variants of the CAPM, the market risk premium and beta refer to the international capital market under consideration. Thus, when using an international risk premium, beta must be determined using an international equity index, as in Stehle (2010) and Randl/Zechner (2019). Many consulting firms use the DMS international risk premium and calculate the equity beta based on the local or national equity indices, e. g. Frontier Economics (from 2008, 2012 and D 2016) and NERA. This approach is not consistent with the use of an international CAPM. Many risks that are not diversifiable in a purely national capital market are diversifiable in an international capital market. The betas determined based on an international share index therefore differ from the betas determined using national indices. They may be higher or lower in each individual case.

³⁹ Karolyi/Stultz (2003, p. 979) elegantly summarise the model by Grauer et al. as follows: “Consider a world where goods and financial markets are perfect, so that we have no transportation costs, no tariffs, no taxes, no transaction costs, and no restrictions to short sales. Grauer, Litzenberger and Stehle (1976) modeled such a world using a state-preference framework. We assume further that there is only one consumption good. The consumption good can be a basket of goods where the spending proportions on each good are constant. In such a world, every investor has the same consumption and investment opportunity sets regardless of where she resides. Further, the law of one price holds for the consumption good, so that if $e(t)$ is the price of foreign currency at date t , $P(t)$ is the price of the good in the domestic country, and $P^*(t)$ is the price in the foreign currency, it must be that $P(t) = e(t)P^*(t)$. In such a world, an investor can use the consumption good as the numeraire, so that all prices and returns are expressed in units of the consumption good.”

Alternative CAPMs

Other capital market equilibrium models intensively discussed in the field of finance are the zero-beta CAPM, the tax CAPM, the arbitrage pricing theory, the intertemporal CAPM, the skewness CAPM and the consumption-based CAPM.⁴⁰ Their use can be beneficial if the necessary data exist. Stehle (2003), for example, provides the data basis for implementing the tax CAPM in Germany, which has since been frequently applied by German auditors for business valuation purposes. International implementations or versions of these models do not exist; in particular they have not yet been used by regulatory authorities.

In addition to these theoretically based capital market equilibrium models, there are empirical models, e.g. the ‘Empirical capital market line’ and the Fama-French ‘Three-Factor Model’, which incorporates company size and the book-value-to-market-value-ratio into the return equation.⁴¹

The latter often refer to effects that are not consistent with the CAPM or its theory-based extensions and are therefore referred to as CAPM anomalies. For these, it is often true that they become smaller or even disappear altogether or reverse soon after their ‘discovery’. For example, Stehle (1996) has shown that a ‘size effect’ existed in Germany before 1995. However, this effect has certainly become much smaller or even disappeared completely in the meantime.

⁴⁰ Cf. Brealey et al. (2020, p. 213 et seq.).

⁴¹ Cf. Brealey et al. (2020, p. 215 et seq.).

Annex B: The calculation of fixed-interest government bond yields

The effective yield (also: ‘internal rate of return’, ‘yield to maturity’ (YTM) or simply yield) of a government bond is the interest rate at which the discounted promised future interest payments of the government bond are to equal the present price of the government bond:⁴²

$$P_0 = \frac{Coupon}{1+YTM} + \frac{Coupon}{(1+YTM)^2} + \dots + \frac{Face+Coupon}{(1+YTM)^n},$$

whereby:

P_0 = Current price of the government bond

$Coupon$ = Promised or agreed coupon payment

YTM = Yield to Maturity (YTM) or effective yield of the government bond

Face = Nominal value of the government bond

Naturally, the equation only considers the simple case in which the first interest payment is made exactly in one year, the others at annual intervals. For more complex cases, there are precise rules for calculating yields, e.g. ‘actual/actual (ICMA)’.

In the case of zero-coupon bonds, no annual coupon payments are made; the coupons are zero. The promised yield results from the increase in value compared to the issue price. In technical language, e. g. in Brealey et al. (2020, p.633), zero coupon bonds are also called ‘pure discount bonds’, as the issue price of the bond contains a discount in relation to the nominal value.

When using zero coupon bonds for regulatory purposes, the advantage over bonds with coupons is that no reinvestment assumptions have to be made regarding coupon payments during the term, there is no reinvestment risk.⁴³

The issuance of zero-coupon bonds has only been permitted in Germany since 1985; since 2016, a federal zero-coupon bond with a remaining term of approximately 10 years has been issued approximately once a year. The most recently issued bond with WKN 110256 matures on 15th August 2031 and had a price of 105 % on 17th August 2021, giving a yield of - 0.48 %. The Bundesbank publishes daily estimates for the notional yield of German government bonds with a remaining term of exactly 10 years, back to 1972, on the basis of the Svensson-Method. This was - 0.53 % on 18th August 2021 at 12:04:37 hrs.⁴⁴

⁴² Cf. e. G. Brealey et al. (2020, p. 48) and Koller et al. (2020), p.324.

⁴³ The reinvestment risk described by SWD (2019, p. 46) is therefore eliminated: “*The risk-free rate is the expected rate of return on a risk-free investment. For an investment to be free of risk, the risk of default on payments needs to be zero and there must be no reinvestment risk (i. e. the investor should be able to reinvest future interest payments derived from the investment in the asset at the same rate of return as at the time the asset was first purchased).*”

⁴⁴ Cf. time series BBSIS.D.I.ZST.ZI.EUR.S1311.B.A604.R10XX.R.A.A._Z._Z.A , available on <https://www.bundesbank.de/de/statistiken/geld-und-kapitalmaerkte/zinssaetze-und-renditen/taegliche-zinsstruktur-fuer-boersen-notierte-bundeswertpapiere-650724> .

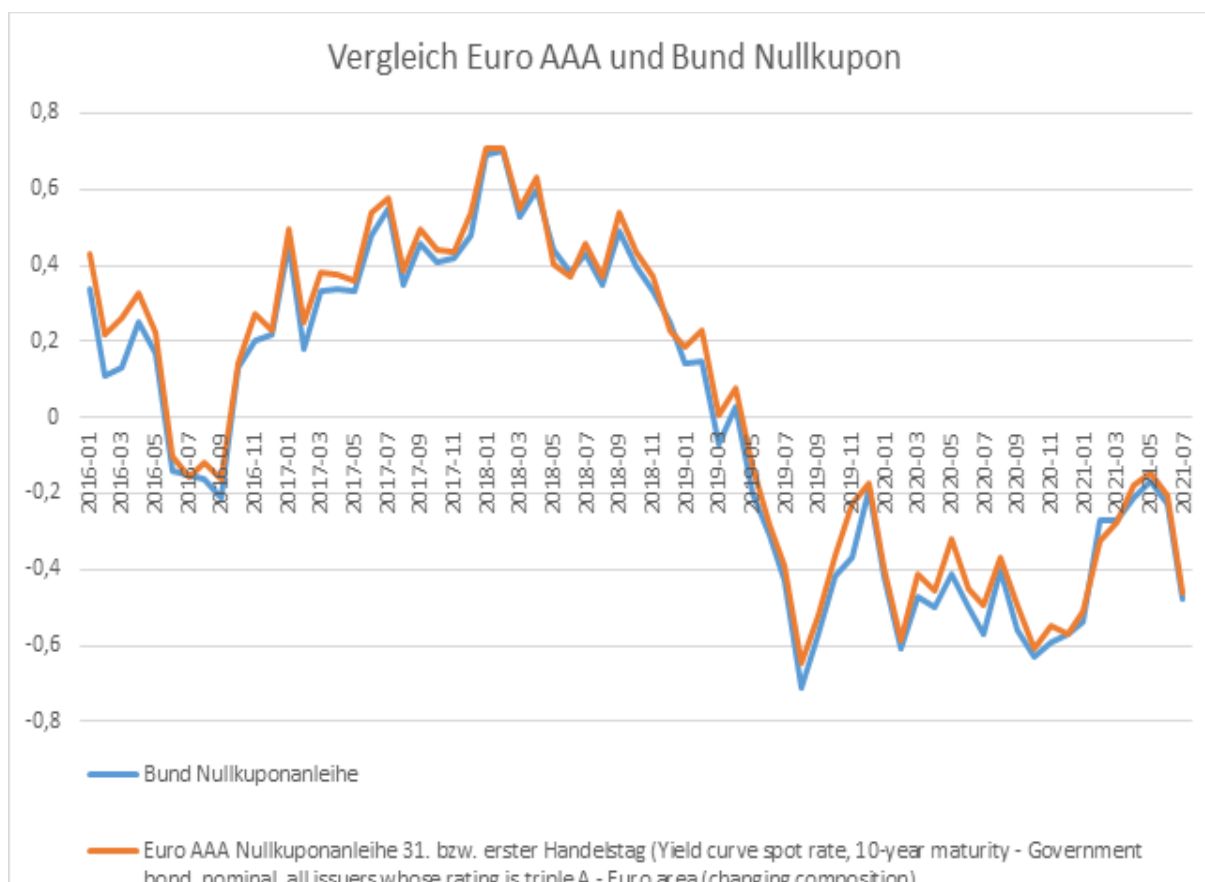


Figure B1 Comparison of YTM of 10-year zero-coupon Bunds and the average of all Euro-zone triple A government bonds from January 2016 to July 2021

Source: Our graph, similar to Frontier Economics et al. (2021), YTM-data from the Bundesbank time series (BBSIS.M.I.ZST.ZI.EUR.S1311.B.A604.R10XX.R.A.A._Z._Z.A_FLAGS, Zinsstrukturkurve (Svensson-Methode) / Börsennotierte Bundeswertpapiere / 10,0 Jahr(e) RLZ / Monatswerte) respective the ECB website (Euro area (changing composition) - Government bond, nominal, all issuers whose rating is triple A - Svensson model - continuous compounding - yield error minimisation - Yield curve spot rate, 10-year maturity - Euro, provided by ECB, YC.B.U2.EUR.4F.G_N_A.SV_C_YM.SR_10Y).

Our calculations based on the data underlying Figure B1 show that the YTM of the Bunds and the YTM of the average of all triple A government bonds from the Euro area differ on average by only 0.04 percentage points per month over the entire period from January 2016 to July 2021.

Bond interest and principal repayments are, of course, only promises. If the probability of default is greater than zero, then the expected value of the effective interest rate is lower than the effective interest rate calculated on the basis of the promises, cf. e. g. Koller et al. (2020, p. 324).

Since 2006, inflation-indexed Bunds have been issued on a regular basis. These have a fixed annual interest payment plus an inflation adjustment and are repaid at least at par plus an

inflation adjustment.⁴⁵ Such securities have been issued in the UK and US since the 1980s, and have been used in the UK for more than 10 years in setting the risk-free rate. Inflation-indexed Bunds are now an established part of the German government's financing strategy. However, their annual share in the auction volume has averaged only about 3 % since 2006. In our view, they are not suitable for use in EU rate regulation, neither now nor in the next few years. D'Amico et al. (2018) discuss the problem of inflation-indexed US bonds (Treasury Inflation-Protected Securities (TIPS)).

⁴⁵ <https://www.deutsche-finanzagentur.de/de/institutionelle-investoren/bundeswertpapiere/inflationsindexierte-bundeswertpapiere/>.

Annex C: The default risk and its classification by ratings

The questions of whether a debtor will fulfil the usually contractually precisely defined future repayment and interest payments on time and in the correct amount, and what deviations from this can occur, are of central importance for creditors. There are many scientific publications on this subject, which deal in particular with the level of the default probability,⁴⁶ the causes of non-compliance with payment obligations⁴⁷ and the consequences of non-compliance.⁴⁸ Mostly, these papers deal with either (1) government bonds (sovereign debt), (2) bonds or loans of non-financial corporations and/or (3) banks.

In practice, the arguments are usually based on ratings. Ratings are produced by financial service providers; the leading ones today are the US companies Moody's, S&P and Fitch, some of which have been offering these ratings for decades. In the following, these companies are referred to as rating agencies. The following table from Moody's Investor Service (2021, p. 6) shows the different rating classes that Moody's uses to rate debtors or financial liabilities with an original maturity of 11 months or longer and their significance.

In the rating classes Aa to Caa, Moody's also appends one of the three digits 1, 2 and 3 to signal to investors whether the debtor is to be classified in the upper (1), middle (2) or lower (3) third of the specific rating class in terms of its credit risk. Moody's ratings are traditionally recognised by the fact that they contain upper and lower case letters, whereas S&P and Fitch only use upper case letters. BEREC quotes Moody's ratings in capital letters only.

⁴⁶ Bi/Traum (2012)

⁴⁷ Jeanneret and Souissi (2016)

⁴⁸ Jeanneret (2017)

Global Long-Term Rating Scale	
Aaa	Obligations rated Aaa are judged to be of the highest quality, subject to the lowest level of credit risk.
Aa	Obligations rated Aa are judged to be of high quality and are subject to very low credit risk.
A	Obligations rated A are judged to be upper-medium grade and are subject to low credit risk.
Baa	Obligations rated Baa are judged to be medium-grade and subject to moderate credit risk and as such may possess certain speculative characteristics.
Ba	Obligations rated Ba are judged to be speculative and are subject to substantial credit risk.
B	Obligations rated B are considered speculative and are subject to high credit risk.
Caa	Obligations rated Caa are judged to be speculative of poor standing and are subject to very high credit risk.
Ca	Obligations rated Ca are highly speculative and are likely in, or very near, default, with some prospect of recovery of principal and interest.
C	Obligations rated C are the lowest rated and are typically in default, with little prospect for recovery of principal or interest.
<p>Note: Moody's appends numerical modifiers 1, 2, and 3 to each generic rating classification from Aa through Caa. The modifier 1 indicates that the obligation ranks in the higher end of its generic rating category; the modifier 2 indicates a mid-range ranking; and the modifier 3 indicates a ranking in the lower end of that generic rating category. Additionally, a "(hyb)" indicator is appended to all ratings of hybrid securities issued by banks, insurers, finance companies, and securities firms.*</p> <p>Note: For more information on long-term ratings assigned to obligations in default, please see the definition "Long-Term Credit Ratings for Defaulted or Impaired Securities" in the Other Definitions section of this publication.</p> <p>* By their terms, hybrid securities allow for the omission of scheduled dividends, interest, or principal payments, which can potentially result in impairment if such an omission occurs. Hybrid securities may also be subject to contractually allowable write-downs of principal that could result in impairment. Together with the hybrid indicator, the long-term obligation rating assigned to a hybrid security is an expression of the relative credit risk associated with that security.</p>	

Figure C1 Moody's rating classes and their meaning

Source: directly from Moody's Investor Service (2021), p. 6

Analogous to the presentation in Moody's Investor Service (2021, p. 6), the following figure from Standard and Poor's (2019, p. 13) shows the different rating classes used by the rating agency S&P for the assessment of debtors or financial liabilities with long-term maturities and their significance. Similar to Moody's, S&P indicates where the debtor is in terms of credit risk in the specific rating class relative to other debtors by adding a plus (+) or minus (-) to the rating classes AA to CCC.

General summary of the opinions reflected by our ratings

Investment Grade	AAA	Extremely strong capacity to meet financial commitments. Highest rating
	AA	Very strong capacity to meet financial commitments
	A	Strong capacity to meet financial commitments, but somewhat susceptible to adverse economic conditions and changes in circumstances
	BBB	Adequate capacity to meet financial commitments, but more subject to adverse economic conditions
	BBB-	Considered lowest investment-grade by market participants
Speculative Grade	BB+	Considered highest speculative-grade by market participants
	BB	Less vulnerable in the near-term but faces major ongoing uncertainties to adverse business, financial and economic conditions
	B	More vulnerable to adverse business, financial and economic conditions but currently has the capacity to meet financial commitments
	CCC	Currently vulnerable and dependent on favorable business, financial and economic conditions to meet financial commitments
	CC	Highly vulnerable; default has not yet occurred, but is expected to be a virtual certainty
	C	Currently highly vulnerable to non-payment, and ultimate recovery is expected to be lower than that of higher rated obligations
	D	Payment default on a financial commitment or breach of an imputed promise; also used when a bankruptcy petition has been filed or similar action taken

Ratings from 'AA' to 'CCC' may be modified by the addition of a plus (+) or minus (-) sign to show relative standing within the major rating categories.

Figure C2 S&P rating classes and their meaning

Source: directly from Standard and Poor's (2019), p. 13

The leading finance textbooks (cf. Brealey et al. (2020), Ross et al., (2018), Berk/DeMarzo (2019) and Koller et al. (2020)) describe in greater or lesser detail the assessment of the quality and the rating of corporate bonds by the three main rating agencies Standard & Poor's, Moody's and Fitch. The most detailed coverage can probably be found in Brealey et al. (2020, p. 622 et seq.). A good insight into the government bond rating discussion in German academia and practice before 2000 is provided by Van Aubel (2000).

Ratings are also extensively discussed in the academic literature, including the question of how ratings are paid for and what problems are associated with them and how good the estimation of default probability by ratings is. All of these questions have been intensely debated for several years.

Damodaran covers ratings and related issues in several publications, most recently in 'Country Risk: Determinants, Measures and Implications - The 2021 Edition'. This document has been published for several years, typically on an annual basis. The publication is primarily aimed at

companies considering investments in specific emerging markets. Country risk encompasses a variety of aspects associated with investments in emerging markets, including the often higher significance of corruption. There is a great need for companies to assess country risk, but scientific penetration is problematic and the options previously discussed by Damodaran have often been heavily criticised, e. g. by Kruschwitz et al. (2010).

Damodaran (2021) describes government bond rating in detail on pages 33-43, focusing in particular on the historical development and determinants of government bond ratings. He also discusses in detail the question of whether the rating actually measures the probability of sovereign default. In this context, he shows in Table 11 of his article the cumulative default probabilities of government bonds estimated by S&P in each rating category from 1975-2020:

Table C1 S&P's estimates of the cumulative default probabilities of government bonds
Source: directly from Damodaran (2021), p.40

Table 11: S&P Sovereign Foreign Currency Ratings and Default Probabilities- 1975 to 2020

Rating	Time (in years)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AAA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
AA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
A	0.00%	0.00%	0.30%	0.80%	1.30%	1.90%	2.50%	3.10%	3.80%	4.40%	5.20%	6.00%	6.80%	7.30%	8.40%
BBB	0.00%	0.40%	1.20%	1.70%	2.20%	2.80%	3.40%	3.70%	4.10%	4.50%	4.90%	5.40%	5.90%	6.90%	7.50%
BB	0.40%	1.40%	2.10%	2.70%	4.10%	5.60%	7.20%	9.10%	10.60%	11.50%	12.20%	12.90%	13.70%	14.60%	15.10%
B	2.60%	6.60%	10.30%	13.70%	16.70%	19.20%	21.90%	24.60%	26.60%	28.50%	30.60%	32.60%	34.00%	35.50%	37.30%
CCC/CC	46.50%	54.20%	62.20%	65.70%	69.10%	76.80%	80.70%	80.70%	80.70%	80.70%	84.60%	84.60%	84.60%	84.60%	84.60%
Investment grade	0.00%	0.10%	0.30%	0.60%	0.80%	1.10%	1.30%	1.50%	1.70%	2.00%	2.20%	2.50%	2.80%	3.00%	3.40%
Speculative grade	3.30%	6.10%	8.60%	10.70%	12.90%	15.10%	17.30%	19.50%	21.20%	22.60%	24.10%	25.30%	26.40%	27.50%	28.50%
All rated	1.20%	2.30%	3.40%	4.30%	5.30%	6.20%	7.20%	8.10%	8.80%	9.40%	10.00%	10.60%	11.10%	11.70%	12.20%

Source: Standard and Poor's

The table shows that government bonds falling into the best rating category AAA did not default in the years under consideration in each of the next 15 years. In the best 'non-investment grade' category BB the relative frequency of a government bond defaulting in the next 5 years after the rating was 4.1 % and in the 15th year after the rating the cumulative default probability was even 15.1 %.

Despite the criticism that rating agencies face, including that their ratings are, on average, upward biased (pp. 41-43), Damodaran's (2021) overall verdict on the predictive quality of government bond ratings is mostly positive. Empirical evidence shows that government bonds with an investment grade rating default significantly less frequently than government bonds that do not achieve an investment grade rating.

On the history of government bond ratings: Moody's began developing ratings for government bonds in the 1920s, so that by 1929 there existed about 50 ratings for government bonds worldwide. Due to the Great Depression and World War II, interest in government bond ratings declined significantly. It was not until the 1970s that the market experienced a renaissance, as the following table from Damodaran (2021), p. 34 shows:

Table C2 Number of newly generated government bond ratings in different time periods
 Source: directly from Damodaran (2021), p. 34

Table 7: Sovereign Ratings – 1975-1994

Year	Number of newly rated sovereigns	Median rating
Pre-1975	3	AAA/Aaa
1975-1979	9	AAA/Aaa
1980-1984	3	AAA/Aaa
1985-1989	19	A/A2
1990-1994	15	BBB-/Baa3

In August 2021, there are ratings for well over 100 countries from Fitch, Moody's and S&P respectively, as a glance at the publicly available website of a German stock exchange newspaper shows.⁴⁹

On the determinants of a government bond rating: A government bond rating is essentially determined by the creditworthiness of the sovereign vis-à-vis its private creditors. S&P ratings mainly include the probability of default, whereas Moody's ratings also take into account the severity of default (through the expected recovery rate). Damodaran (2021) shows in the following table the determinants that govern Standard and Poor's government bond ratings (p. 38):

⁴⁹ Cf. <https://daten.boersen-zeitung.de/index.php?li=312&subm=laender> .

Table C3 S&P determinants for a government bond rating

Source: directly taken from Damodaran (2021), p. 38

Table 10: Factors considered while assigning sovereign ratings

Sovereign Ratings Methodology Profile
<p>Political risk</p> <ul style="list-style-type: none">• Stability and legitimacy of political institutions• Popular participation in political processes• Orderliness of leadership succession• Transparency in economic policy decisions and objectives• Public security• Geopolitical risk <p>Economic structure</p> <ul style="list-style-type: none">• Prosperity, diversity, and degree to which economy is market oriented• Income disparities• Effectiveness of financial sector in intermediating funds; availability of credit• Competitiveness and profitability of nonfinancial private sector• Efficiency of public sector• Protectionism and other nonmarket influences• Labor flexibility <p>Economic growth prospects</p> <ul style="list-style-type: none">• Size and composition of savings and investment• Rate and pattern of economic growth <p>Fiscal flexibility</p> <ul style="list-style-type: none">• General government revenue, expenditure, and surplus/deficit trends• Compatibility of fiscal stance with monetary and external factors• Revenue-raising flexibility and efficiency• Expenditure effectiveness and pressures• Timeliness, coverage, and transparency in reporting• Pension obligations <p>General government debt burden</p> <ul style="list-style-type: none">• General government gross and net (of liquid assets) debt• Share of revenue devoted to interest• Currency composition and maturity profile• Depth and breadth of local capital markets <p>Offshore and contingent liabilities</p> <ul style="list-style-type: none">• Size and health of NFPEs• Robustness of financial sector <p>Monetary flexibility</p> <ul style="list-style-type: none">• Price behavior in economic cycles• Money and credit expansion• Compatibility of exchange-rate regime and monetary goals• Institutional factors, such as central bank independence• Range and efficiency of monetary policy tools, particularly in light of the fiscal stance and capital market characteristics• Indexation and dollarization <p>External liquidity</p> <ul style="list-style-type: none">• Impact of fiscal and monetary policies on external accounts• Structure of the current account• Composition of capital flows• Reserve adequacy <p>External debt burden</p> <ul style="list-style-type: none">• Gross and net external debt, including nonresident deposits and structured debt• Maturity profile, currency composition, and sensitivity to interest rate changes• Access to concessional funding• Debt service burden <p>NFPEs—Nonfinancial public sector enterprises.</p> <p>© Standard & Poor's 2008.</p>

Even though Moody's, Fitch and S&P differ in the details of the individual determinants, all three ratings encompass the economic, political and institutional factors of the respective country.

Annex D: Smoothing and stabilising mechanisms

In order to avoid an excessive drop in the allowed return, that is in the WACC determination at the transition to the next regulatory period, regulators often use smoothing mechanisms. The most important reason for this is to create a stable economic environment for operators. Often, but not always, the mitigations are labelled as such, for transparency reasons this should always be the case. We consider automatic, symmetrically functioning smoothing mechanisms, in particular the use of historical averages for risk-free rates, to be the best and fairest means of creating a stable framework for all parties involved. This is increasingly gaining acceptance at the European level; 10 years ago, the use of an interest rates on a specific date was still the rule. Automatic smoothing mechanisms, including the exponential smoothing used by BNetzA in its telecommunications sector, should be maintained at all costs until the resulting profits of the operators are offset by the losses they incur with this approach due to rising interest rates. We do not recommend smoothing based on the ‘judgement’ of the regulator, especially if it is based on interest rate or share price forecasts by the regulator’s staff.

Since the start of regulation in Europe, risk-free rates and the cost of debt have decreased almost steadily; market risk premia have tended to decrease. Since network operators are not exactly pleased to see decreasing cost of equity or WACC determinations, and regulators often consider a stable economic environment to be very important, a number of measures can be observed, which Stehle (2016) refers to as smoothing mechanisms. We improve and deepen his explanations.

Setting the interest rate in an untraceable way

UK regulators traditionally use the interest rate on a specific date or a forecast for the regulatory period as the risk-free rate. In more recent notifications, a short averaging period is usually used, e. g. one month. Since the real risk-free rate is sought and this does not exist in an ideal way, it is often ultimately determined by ‘judgement’. UKRN (2018, p. 17) briefly notes: “*Regulators set the risk-free rate by reference to yields on government gilts and typically consider forward rates and longer-term average yields*”. In their report for several British regulators, Wright et al. (2018, p. 8 and p. 13) put it more clearly: “*in recent years... most regulators have made reference to market gilts data in their assessments but then have set a different value when setting the RAR [Regulatory allowed return].*” And further: “*Almost all regulators have been slow to bring their estimates of the risk-free rate down as market rates have decreased.*” They support their statement with their figure 4.2, p. 33.

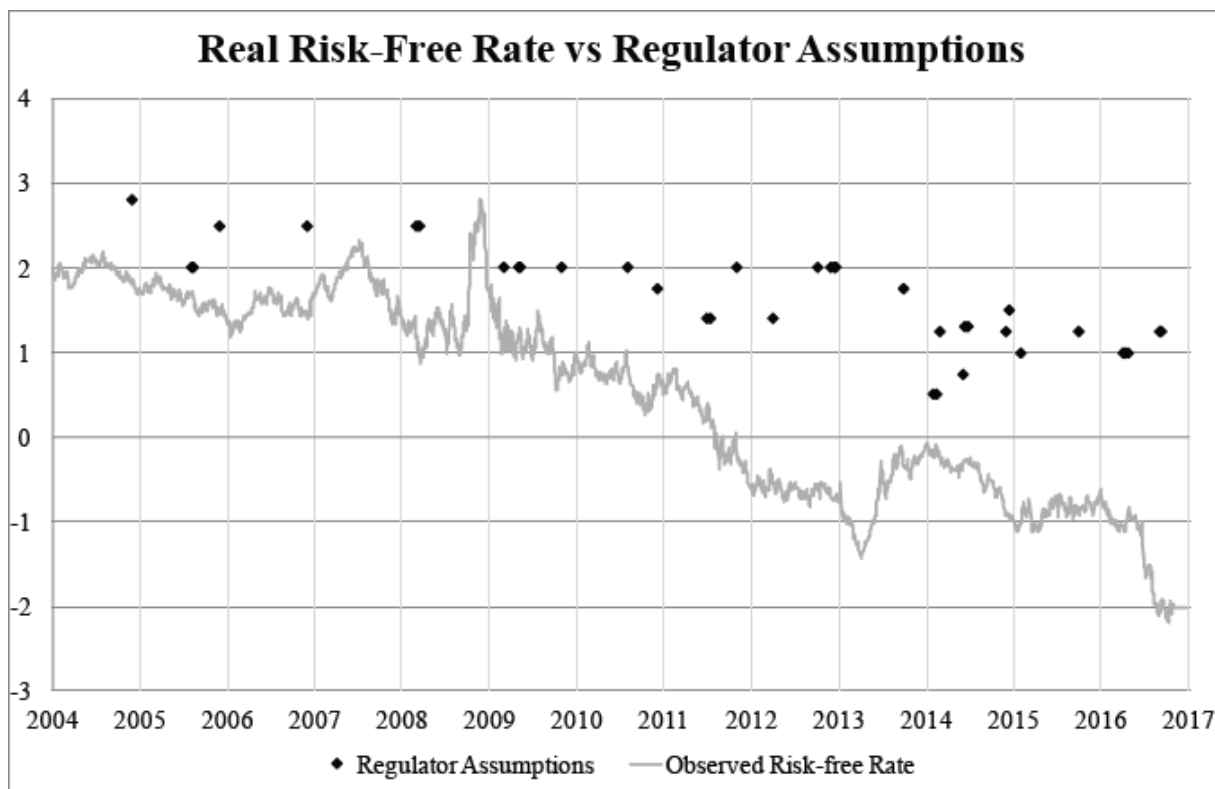


Figure D1 The observed risk-free rate in the UK (effective yield of inflation-indexed zero-coupon bonds with a time to maturity of 10 years) and the risk-free rates determined by UK Regulatory Authorities.⁵⁰

Source: directly from Wright et al. (2018), Fig. 4.2, p. 33.

Ofwat (2019, Allowed return technical appendix, p. 36) mentioned in this context: “Recently, the majority of the UKRN Study’s authors and Citizens Advice (2015) have been critical of the tendency of pre-2017 regulatory estimates to lie significantly above spot yields – often by more than one percentage point.” In the UK, this is usually because the Regulator’s staff consider the spot rates to be ‘unnaturally’ low or that they estimate the spot rates in the coming regulatory period to be higher than the current market rates.

The creative adjustment of the risk-free rate to the wishes of interested parties is, of course, not an activity limited to regulators and assessors. It has also become very popular in the field of business valuation in recent years, cf. Fernandez (2020, p. 7). He aptly writes in this regard: “As interest rates on Government Bonds have decreased, some analysts and consultants in Europe and the US are using what they call ‘Normalized Risk-free Rates’ because they do not like the world as it is (...) The ‘Normalized Risk-free Rate’ is the Risk-free Rate that should exist in a world that these analysts and consultants call ‘normal’, but it is not the world in which we live.”

⁵⁰ Inflation-indexed bonds and zero-coupon bonds are discussed in Annex B.

Experts estimate bandwidths

The approach, that experts commissioned by the regulators estimate bandwidths for the WACC and the regulatory authority does not choose the best estimate or the mean value between the upper and lower limit, but a value that lies above the explicit or implicit mean value, is also occasionally used. Deviations from the mean value reported by the expert commissioned by the regulator may be justified, e. g. with stable framework conditions. Economic Insights (2014) provides a detailed overview of the 'world-wide' use of bandwidths. Unfortunately, it does not address Germany, Austria and Switzerland.

It is noticeable that upward deviations seem to occur more frequently than downward deviations and that a term exists for this: Uplifts. We are not aware of any downward deviation. In the following, we refer additionally to the expert opinions of Frontier Economics, as they have produced a number of reports commissioned by the German and Austrian regulators and always - unlike Randl/Zechner (2019), for example - refrain from providing best estimates. The problem of limits is well argued in Frontier's Electricity and Gas Report for BNetzA in 2008. In this, the limits 0.76 and 0.82 are given for the equity beta, and 4.0 and 5.1 % for the market risk premium (cf. p. 2 and p. 53 et seq.). From this, Frontier calculates the 'classic' range for the risk premium of 3.0 - 4.2 %. This results from the implicit assumption that in the extreme case the upper beta and the upper market risk premium can occur together. However, they justify in detail why it is unlikely that the extreme values coincide and calculate a central range, which they call the core range and recommend it for use: 3.3 to 3.9. BNetzA in 2008 has adhered to the implicit mean value, cf. BK4-08-068.

However, in Frontier's subsequent report for BNetzA in 2011 (p. 24), the specification of a core range is again dispensed with without comment and only the classic, i. e. wide, range is named: 2.35 - 3.57 %. Taking into account the 'special German situation', a risk premium of 3.59 % is set (BK4-11-304, p. 15). Perhaps the strong pressure from network operators and their associations may also have played a role here. In 2016, Frontier estimated the classic range at 2.28 - 3.93 %. The determined value, 3.15 %, is only slightly above the mean (BK4-16-160).

Frontier Economics (2012, p. 2) prominently provides the Austrian NRA E-Control with the following two indications for the final determination within the bandwidth,

- that the principle of error minimisation argues for a positioning in the middle of the bandwidth, and
- *“Using the principle of prudence [could] justify positioning above or below the mean”.*

In discussing the prudence principle, Frontier (2012) explicitly points out in FN 48 on p. 72,

- that both the perspective of the regulated companies as well as the perspective of the consumers must be taken into account; and
- that Frontier has often already used the principle of prudence in favour of the companies in their original estimates.

The references to this in Frontier Economics (Ö 2016) are much shorter. To conclude our consideration of the Frontier Economics ranges, we point out that these are not statistical confidence intervals. Such could not yet be estimated in a satisfactory way.

The fact that even UK authorities do not always find it easy to choose within a bandwidth is shown in the following Figure D2. In this figure, the arithmetic and geometric mean of the historical return time series for the real UK stock return of DMS form the upper and lower limits of the range in which the UK regulators set the real cost of equity.

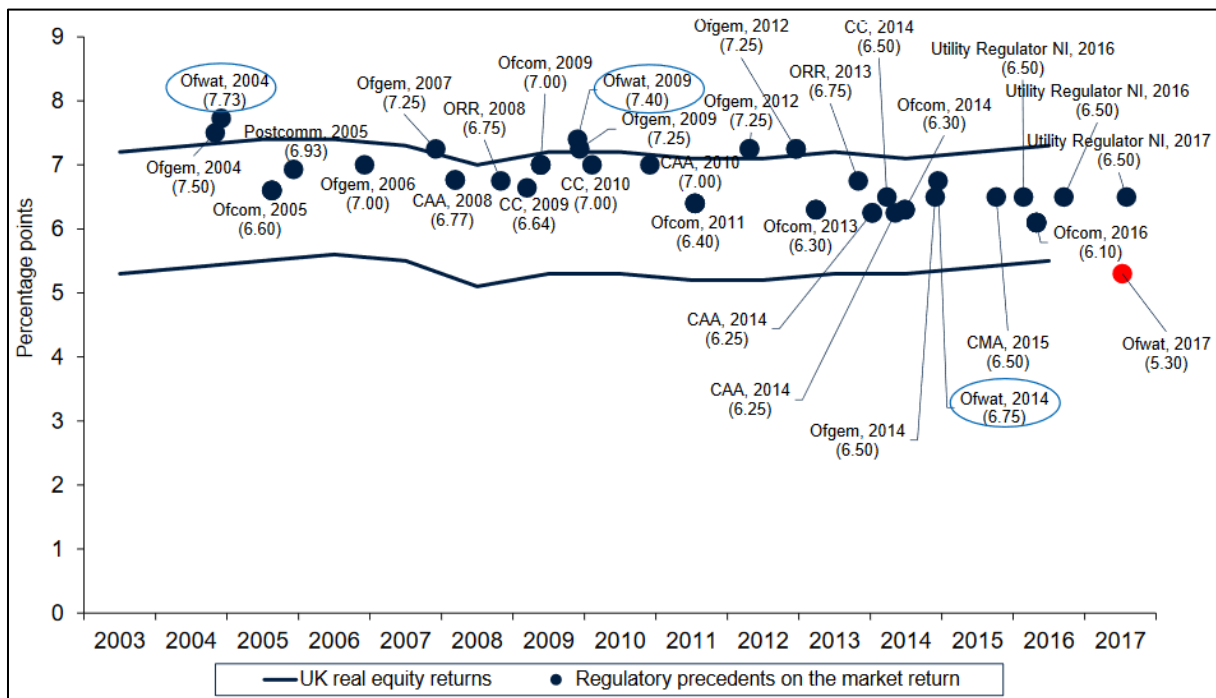


Figure D2 Arithmetic and geometric means of the historical real UK returns on equity by DMS vs. the determinations of the real return on equity by UK Regulatory Authorities
 Source: directly taken from Oxera (2017): "Developments in the allowed cost of capital"

Historical averages of interest rates

In the German Electricity Grid Charges Ordinance (Stromnetzentgeltverordnung), 10-year averaging has been required by law since 2005 (in § 7, para. 4); in the telecommunications sector, such an average has been used since 2010. This was mainly justified by stability considerations. CEER (2019, p. 115) notes: “most Member States use historical averages, but in relation to the years of historical analysis there is no uniform usage. The majority of NRAs apply 1, 5 or 10 years of historical analysis independent of electricity or gas sector and TSO or DSO regulation”. Stehle (2016, p. 13) also points out the large differences that exist within and between countries.

Averages are also common in the telecommunications sector, cf. Brattle (2016, pp. 41-43), SWD (2019, inter alia pp. 17-18 and 28-35) or BEREC (2021). The EU Notice (point 27) recommends averaging over the past five years.

Stehle (2016, p. 65) improves on the rationale of Stehle (2010), this is still representative for us today:

- *"This approach currently gives an upwardly biased estimate of the interest rate in the regulatory period. This was also the case when it was introduced in 2010. However, when it was introduced in 2010, it has helped to cushion the enormous interest rate cuts of the previous years. It should therefore be maintained at least until interest rates have risen noticeably again.*

- *It is a clear rule that is easy for all parties to understand and is also well suited for calculating the allowed interest rate in the debt capital area. Here, it would not make economic sense to use the expected interest rates on specific dates in the regulatory period as a basis, because most of the debt capital outstanding in the regulatory period was borrowed in previous years and must be serviced at the interest rates at that time”.*

Table D1 illustrates the effects of averaging the risk-free rate, which enters into the WACC calculation, by means of a numerical example. It is assumed that already 10 years before year 1 the risk-free rate was 3 %, as it was in the good old days. In year 11, the risk-free rate falls to 1 % and remains at this level for three years. Then the interest rate rises again to 3 %. A 5-year average cushions the fall, but a 10-year average cushions it more. Moreover, the minimum risk-free rate is higher, the average varies less and in the end the average interest rate is the same over the 24 years considered.

Table D1 The effect of averaging on the risk-free rate

Source: own presentation

	Risk-free	5-year	10-year
Year	Interest rate	average	average
1	3	3	3
2	3	3	3
9	3	3	3
10	3	3	3
11	1	3	3
12	1	2,6	2,8
13	1	2,2	2,6
14	3	1,8	2,4
15	3	1,8	2,4
16	3	1,8	2,4
17	3	2,2	2,4
18	3	2,6	2,4
19	3	3	2,4
20	3	3	2,4
21	3	3	2,4
22	3	3	2,6
23	3	3	2,8
24	3	3	3
Average interest rate	2,75	2,75	2,75

The BNetzA smoothing mechanism ‘Exponential Smoothing’ in the telecom area

The enormous difference, from an economic and regulatory point of view, between the fixed network WACC estimates in 2007 and 2009 (8.07 % and 5.51 %, i.e. the drop was 2.56 percentage points or 32 %) prompted BNetzA to carry out an exponential smoothing of the estimated values in the telecommunications sector, starting with 2009. The ‘Applicable WACC’ is the sum of the current WACC estimate, weighted by 0.3, and the applicable WACC of the last notification, weighted by 0.7 (cf. Stehle (2010), p. 72 et seq.).

Since 2009, the Applicable WACC has decreased more slowly than the respective current WACC estimate. However, if interest rates rise again (or if the risk premium or the beta increases), the Applicable WACC will rise more slowly than the respective current WACC estimate.

Exponential smoothing of the WACC estimates or the Applicable WACC has been used since 2009 in the German telecommunication rate regulation. Since then, BNetzA has used the WACC calculated according to Stehle (2010) without any modification as the initial value for exponential smoothing mechanism. In combination with the use of the 10-year average for the

risk-free rate, the procedure has contributed to an almost constant reduction of the allowed real WACC for the fixed legacy network from 8.07 % in 2007 to 3.87 % in 2020.⁵¹

The Swiss threshold value concept

In Switzerland, the electricity network allowed WACC is determined based on Art. 13 para. 3 let. b of the Electricity Supply Ordinance. For several years, it has been 3.83 %.⁵²

There are thresholds for the individual components. In the WACC determination for 2021, for example, it is stated:

- *“For the [asset] beta factor to be applied in the WACC calculation, the four thresholds 0.25, 0.35, 0.45 and 0.55 and the corresponding threshold ranges come into play. The value derived by the consulting firm IFBC AG is 0.43. Since this value lies in the relevant range between the threshold values 0.35 and 0.45, the specified value of 0.4 is to be assumed as the unlevered beta for the WACC calculation.”*
- *“The risk-free rate for equity is determined as the monthly average yield of the past year (2019) of Swiss Federal Bonds with a remaining term of 10 years (zero-bond yield) with defined threshold values. The resulting value of - 0.49 % requires the application of a value of 2.5 % in the calculation of the WACC for a threshold of less than 3 %.”*
- *“The risk-free rate for debt is calculated as the arithmetic monthly average of the past year (2019) of Swiss Federal Bonds with a remaining term of 5 years (zero-bond yield) with defined threshold values. For the calculated value of - 0.81 %, the lower threshold value of 0.5 % is to be applied in accordance with the concept.”*
- *“The cost of debt of 1.75 % results from the addition of the risk-free rate of 0.5 % and the risk premium including issuing and procurement costs of 1.25 %”.*
- *“The WACC results from the addition of the 40 % weighted cost of equity of 6.96 % and the 60 % weighted cost of debt of 1.75 %. This results in a WACC (total cost of capital) of 3.83 % rounded to two decimal places.”*

Most of these values have been constant for years. This leads to the unusual stability compared to other countries. *“This clearly shows that the calculation method has a stabilising effect on the course of the WACC.”*

The Swiss approach is discussed in detail in IBFC (2015).

⁵¹ Cf. Table 2 in Stehle (2016 b, p. 8) and the BNetzA decision currently in consultation BK3c-20/013.

⁵² Cf. <https://www.bfe.admin.ch/bfe/de/home/versorgung/stromversorgung/stromversorgungsgesetz-stromvg/wacc.html>.

Surcharges to the cost of equity or WACC

Occasionally, national regulators allow surcharges to the cost of equity or the WACC, mostly for new investments. Plausible reasons are usually given for these. Occasionally, however, smoothing could also play a role. A positive aspect of their use is transparency. ECA (2018, section 13.3, p. 96 et seq.) provides a detailed overview of such surcharges in European electricity and gas network regulation.

Annex E: The Credit Default Swap (CDS) premium and the CDS spread

A Credit Default Swap (CDS) is a financial instrument or credit derivative with which an investor can protect himself against the default of a debtor. Credit Default Swaps are individually contracted and traded over the counter between two parties, the protection seller and the protection buyer. “*The corresponding contracts are based on the standards of the International Swaps and Derivatives Association (ISDA)*”. (Cf. Deutsche Bundesbank (2010), p. 47).

In its Master Agreements, ISDA defines the events that lead to an insurance payment. In addition to the default of a payment, the events that trigger an insured event include, for example, the postponement of a payment, the so-called moratorium.⁵³

The Credit Default Swap (CDS) premium is the annual (insurance) payment that the protection buyer or purchaser of a Credit Default Swap has to make such that his holdings of a certain bond are insured (through the seller of the CDS, the protection seller) against the default or restructuring of the bond for a certain period of time (usually ten years for government bonds). The CDS spread is calculated from the CDS premium defined above, by dividing it by the volume to be insured. The CDS spread is thus the premium payment as a percentage of the volume to be insured, which must be made annually by the buyer of the CDS.⁵⁴

CDS spreads are expressed in basis points of the nominal value of the volume of a bond to be insured. For a better understanding, the following example is provided: In July 2020, the spread of Bunds with a 10-year residual maturity was 0.2 % or 20 basis points (see Damodaran (2021, p. 113). At the time, the annual cost of hedging an investment of, say, Euro 10 million, in these Bunds against default or restructuring was Euro 20,000 per year (0.2 % times Euro 10 million) or Euro 5,000 per quarter, as CDS premiums are usually paid quarterly.

In practice, CDS spreads and the risk premium of a debtor's bonds, are closely related, but not in an easily describable way. CDS spreads are essentially determined by the default risk of the debtor, but the so-called counterparty risk also plays a role, since potentially the seller of the CDS can also default. In addition to the default risk, the risk premium of bonds also includes the interest rate risk as well as the liquidity risk of the bond.⁵⁵

⁵³ Cf. <https://www.isda.org/a/ur4TE/Guidelines-for-Smart-Contracts-CDS.pdf> .

⁵⁴ It should be noted here that in the literature (including Deutsche Bundesbank (2010)) and in newspaper articles, the term CDS premium and CDS spread are often used as synonyms in the sense in which we define CDS spreads. However, we would like to point out the difference between premium and spread by using the exact definition.

⁵⁵ Andres/Betzer/Doumet (2021) describes the advantages of Credit Default Swaps in comparison to bonds when measuring default risk.

The default probabilities of bonds can be derived from Credit Default Swap spreads by applying more or less complex models (such as the Constant Hazard Model by Duffie (1999)). However, the calculation of default probabilities in the context of government bonds is associated with great difficulties, which the Bundesbank points out in detail in its Monthly Report of December 2010 on page 49. For example, one must make an assumption regarding the recovery rate of the defaulting loan. Usually, a recovery rate of 40 % is assumed here. However, an empirical study by the International Monetary Fund IMF (2005) shows, that this recovery rate can fluctuate very strongly in the context of sovereign insolvencies, which in turn has a considerable effect on the default probability to be calculated.

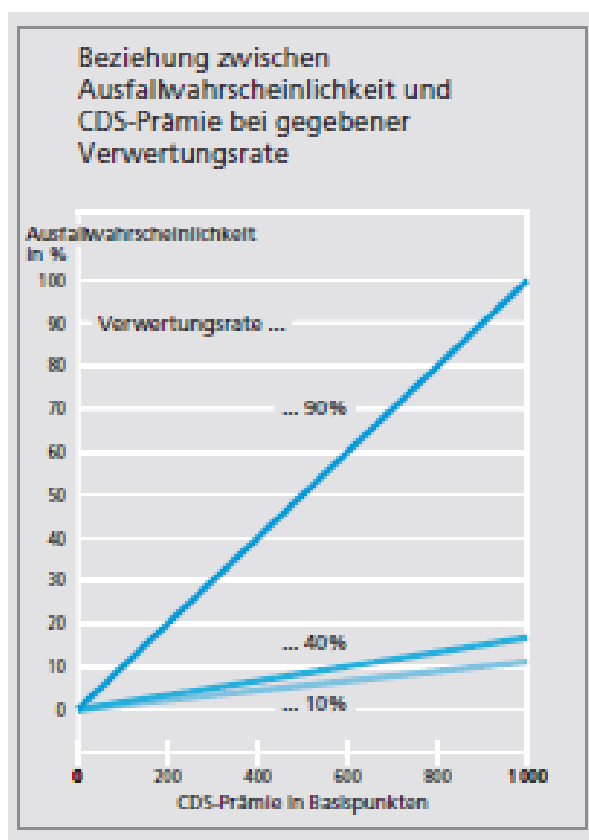


Figure E1 Relationship between default risk and CDS-Spreads for different recovery rates

Source: directly from Deutsche Bundesbank (2010), p. 49

Figure E1 from the December Monthly Report of the Deutsche Bundesbank (2010) impressively illustrates the influence of the assumption about the recovery rate on the default probability. The recovery rate is the percentage of the defaulted credit volume that is repaid to the creditors despite default.

The European Central Bank (ECB) publishes in its Statistical Data Warehouse the CDS spreads of a sample of Credit Default Swaps involving the government bonds of 13 EU countries in a freely accessible way. The swaps are for contracts for five years. The ECB website also contains a graph that starts in 2007 and is continuously updated, see our figure E2 below. At the end of Q2, 2021, of the 13 countries in the sample, Italy and Greece have the highest CDS spreads;

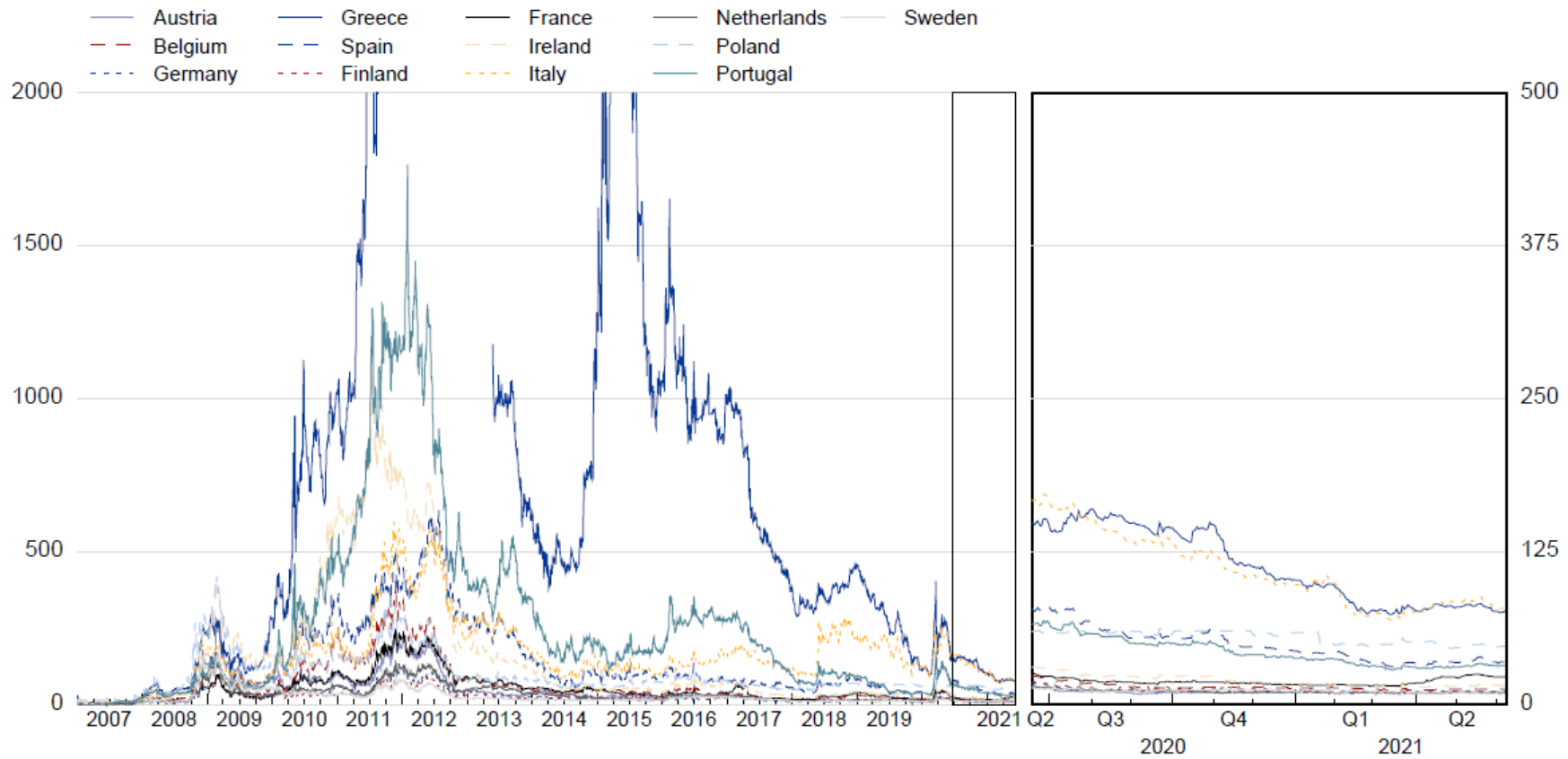
however, both are less than 100 basis points. The two countries are followed by Poland, Spain, Portugal and France. The other countries in the sample are all so close to each other or close to zero that in the chart the differences cannot be recognised.

Figure E2 also shows that the Greece spread was at times higher than 2000 basis points in 2011 and 2015. For Italy⁵⁶ and Portugal it was higher than 500 in 2011.

⁵⁶ Italy's high default risk around the year 2011 is discussed by Anelli et al. (2021).

2.8 CDS premia on sovereign debt

(Sample of EU countries; basis points; five-year maturities; last observation: 8 Jun. 2021)



Sources: Refinitiv and CMA.

Notes: Greek sovereign CDS were not traded between 9 March 2012 and 11 April 2012 following the decision by the ISDA that a credit event had occurred. Due to the lack of contributors, data were also not available between 1 March and 21 May 2013. For presentational reasons, this chart has been truncated.

Figure E2 5-year Credit Default Spreads, 2007 to 8/2021 for several European countries

Source: directly from ECB, Statistical Data Warehouse, Figure 2.8 <https://sdw.ecb.europa.eu/reports.do?node=1000003315> (retrieved on 10.08.2021)

Damodaran (2021), among others, publishes the exact amounts of CDS spreads on government bonds of individual European Union countries, as of July 2020 and with a 10-year instead of a 5-year maturity, see the following Figure E3. Note that the countries included in Figures E2 and E3 are not identical.

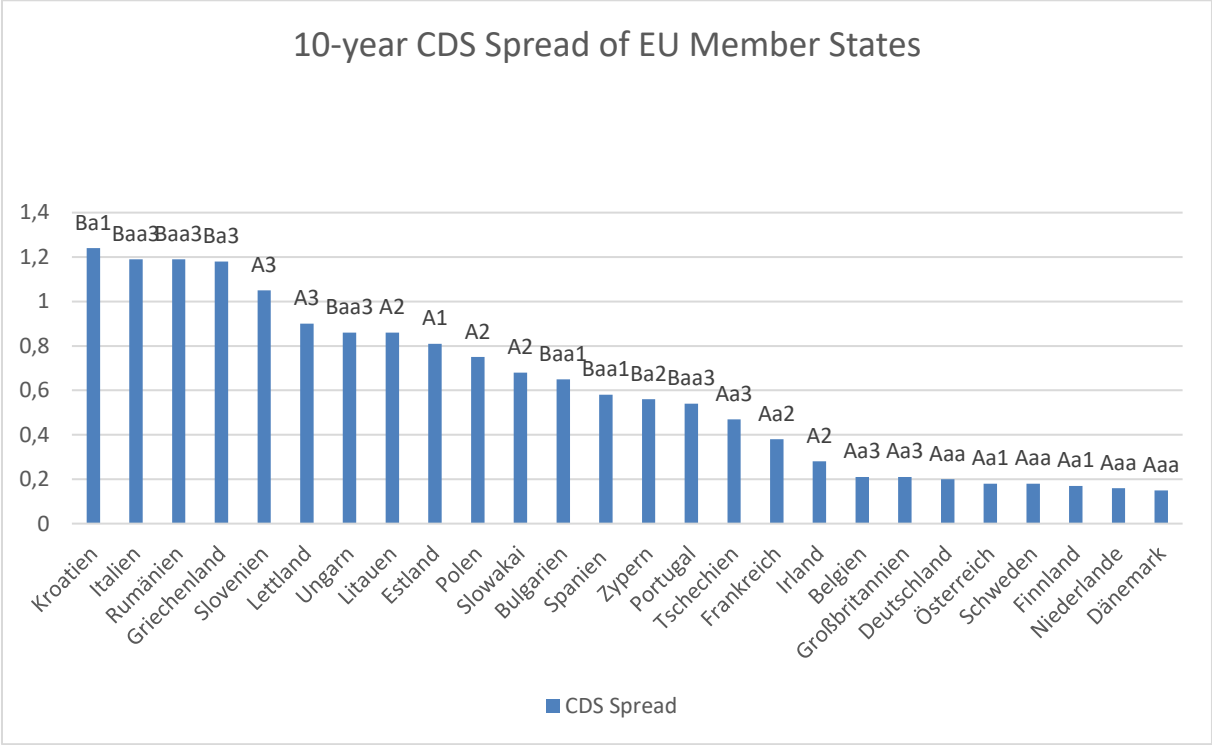


Figure E3 10 year Credit Default Swaps for selected EU Member States and their ratings in July 2020

Source: own presentation for the countries mentioned in BEREC (2021), Spread-data and ratings from Damodaran (2021, pp. 111-117).

In July 2020, Croatia had the highest 10-year CDS spread of all countries in the European Union at 1.24 %, closely followed by Italy and Romania at 1.19 % each, Greece at 1.18 % and Slovenia at 1.05 %. All other EU countries had a spread below 1 % in mid-2020, with the lowest spread in Denmark (AAA, 0.15 %), followed by the Netherlands (AAA, 0.16 %), Finland (Aa1, 0.17 %), Sweden (AAA, 0.18 %) and Austria (Aa1, 0.18 %). Germany had a CDS spread of 0.20 % on its 10-year government bonds at that time.

Figure E3 and Column 4 of our Table 1 illustrate that an average of the yields of the triple A rated Eurozone countries (currently Germany, the Netherlands and Luxembourg) may provide a better estimate of the risk-free rate of return than looking at Bunds alone. In their report for the Austrian Regulator E-Control, Randl/Zechner use the average of Austrian, Dutch and Finnish government bonds as an estimate based on a similar assumption and further considerations (cf. our section III.2.3), but do not include Germany (cf. (Randl/Zechner (2019, p. 12)).

Theoretically, the purchase of e. g. Italian government bonds and the matching Credit Default Swaps should result in a risk-free investment whose yield matches the yields of triple A bonds. However, since the annual coupon payments of the bond differ from the CDS premia in amount and also in timing, and because of other details, there should be small differences in practice in this regard.

Annex F: Euro exchange rates of selected EU currencies

Danish krone (DKK)

13 August 2021

EUR 1 = DKK 7.437 -0.0001(-0.0%)

Change from 4 January 1999 to 13 August 2021

Min (25 April 2003)	Max (18 March 2020)	Average
7.4234	7.4732	7.4486

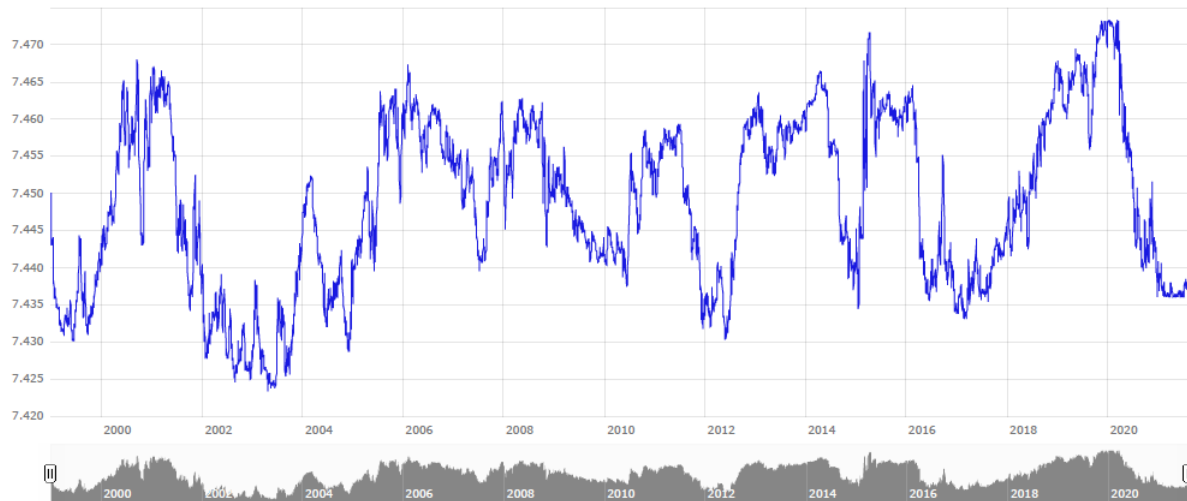


Figure F1 Exchange rate Danish Krone (DKK) and Euro between 1999 and 2021

Source: directly taken from ECB, https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/eurofxref-graph-dkk.en.html

Bulgarian lev (BGN)

13 August 2021

EUR 1 = BGN 1.9558 0.0000(0.0%)

Change from 19 July 2000 to 13 August 2021

Min (4 April 2005)	Max (24 May 2005)	Average
1.9441	1.9620	1.9545

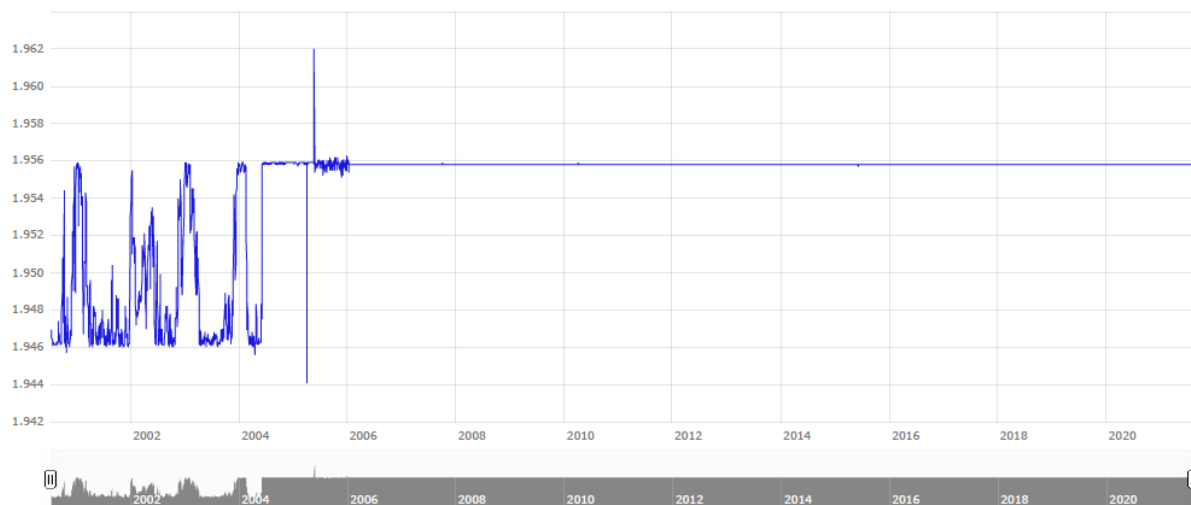


Figure F2 Exchange rate Bulgarian Lev (BGN) and Euro from 1999 to 2021

Source: directly extracted from ECB, https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/eurofxref-graph-bgn.en.html

Swedish krona (SEK)

13 August 2021

EUR 1 = SEK 10.1993 0.0110(0.1%)

Change from 4 January 1999 to 13 August 2021

Min (3 May 2000)	Max (6 March 2009)	Average
8.0550	11.7135	9.4179

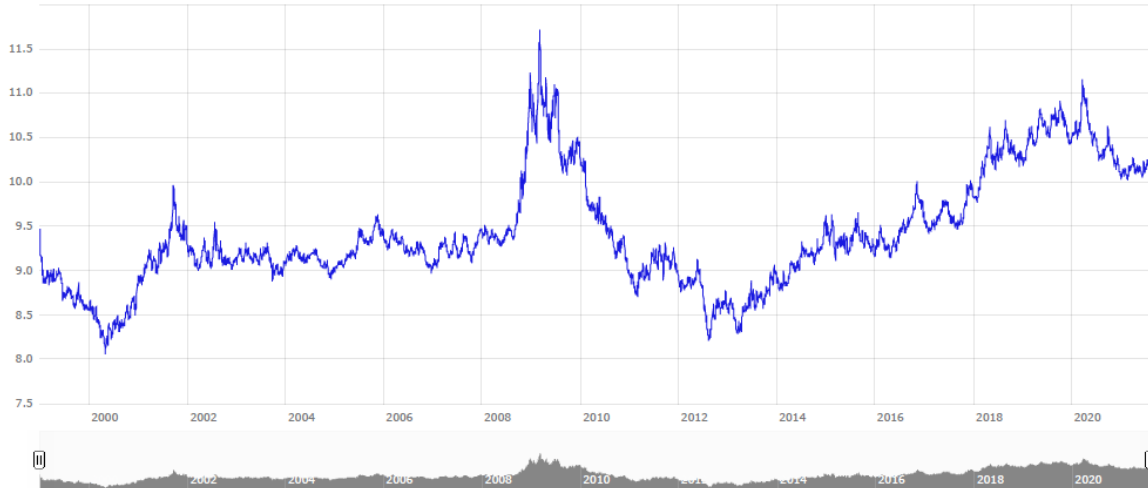


Figure F3 Exchange rate Swedish Krona (SEK) and Euro from 1999 to 2021

Source: directly taken from ECB, https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/eurofxref-graph-sek.en.html

Hungarian forint (HUF)

13 August 2021

EUR 1 = HUF 353.03 -0.22(-0.1%)

Change from 4 January 1999 to 13 August 2021

Min (18 July 2008)	Max (1 April 2020)	Average
228.16	369.36	283.38



Figure F4 Exchange rate Hungarian Forint (HUF) and Euro from 1999 to 2021

Source: directly taken from ECB, https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/eurofxref-graph-huf.en.html

Croatian kuna (HRK)

13 August 2021

EUR 1 = HRK 7.4983 -0.0005(-0.0%)

Change from 1 April 2005 to 13 August 2021

Min (26 September 2008)	Max (19 February 2015)	Average
7.1047	7.7253	7.4449



Figure F5 Exchange rate Croatian Kuna (HRK) and Euro from 1999 to 2021

Source: directly from ECB, https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/eurofxref-graph-hrk.en.html

Norwegian krone (NOK)

13 August 2021

EUR 1 = NOK 10.3753 -0.0002(-0.0%)

Change from 4 January 1999 to 13 August 2021

Min (8 January 2003)	Max (19 March 2020)	Average
7.2225	12.3165	8.5273



Figure F6 Exchange rate Norwegian Krone (NOK) and Euro from 1999 to 2021

Source: directly from ECB, https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/eurofxref-graph-nok.en.html

Annex G: Deutsche Telekom AG (DTAG) interest load**Table G1 DTAG interest load resulting from Euro denominated bonds**

Source: <https://www.telekom.com/de/investor-relations/fremdkapital/anleihen-und-debt-issuance-programme/>, retrieved on 20th July 2021, Columns 'Issue Date', 'current time to maturity' and 'original time to maturity' own research on www.ariva.de or own calculation.

ISIN	Volume	Issue Date	Coupon	maturity	current time to maturity	Original time to maturity
XS0441740817	350,000,000.00 €	27.07.2009	5,375%	27. Jul 21	0	12
XS1557095459	610,371,000.00 €	30.01.2017	0,375%	30. Okt 21	0	4
XS0480543239	100,000,000.00 €		4,628%	25. Jan 22	1	
XS0525787874	1,250,000,000.00 €	13.07.2010	4,250%	13. Jul 22	1	12
XS1828032513	500,000,000.00 €	01.06.2018	0,625%	01. Dez 22	1	4,5
XS1828028677	400,000,000.00 €	01.06.2018	0,000%	01. Dez 22		4
XS0351489579	200,000,000.00 €	17.03.2008	5,851%	17. Mrz 23	2	15
XS1382792197	1,750,000,000.00 €	23.03.2016	0,625%	03. Apr 23	2	7
XS1557096267	1,250,000,000.00 €	30.01.2017	0,875%	30. Jan 24	3	7
XS0847580353	650,000,000.00 €	24.10.2012	2,750%	24. Okt 24	3	12
XS1732232340	750,000,000.00 €	13.12.2017	0,625%	13. Dez 24	3	7
XS0503603267	500,000,000.00 €	22.04.2010	4,875%	22. Apr 25	4	15
XS1828032786	1,000,000,000.00 €	01.06.2018	1,400%	01. Dez 25	4	7,5
DE000A2TSDD4	500,000,000.00 €	25.03.2019	0,875%	25. Mrz 26	5	7
XS1617898363	750,000,000.00 €	22.05.2017	1,125%	22. Mai 26	5	9
XS0732998967	80,000,000.00 €		4,300%	20. Jan 27	6	
XS1557095616	1,250,000,000.00 €	30.01.2017	1,375%	30. Jan 27	6	10
XS2024715794	1,250,000,000.00 €	05.07.2019	0,500%	05. Jul 27	6	8

XS0875797515	750,000,000.00 €	17.01.2013	3,250%	17. Jan 28	7	15
XS1382791975	1,500,000,000.00 €	23.03.2016	1,50%	3. Apr 2028	7	12
XS1828033834	1,000,000,000.00 €	01.06.2018	2,000%	01. Dez 29	8	11,5
XS0553728709	300,000,000.00 €	28.10.2010	4,500%	28. Okt 30	9	20
DE000A2TSDE2	1,000,000,000.00 €	25.03.2019	1,750%	25. Mrz 31	10	12
XS0868517177	100,000,000.00 €		3,000%	21. Dez 32	11,5	
XS0877572346	50,000,000.00 €		3,550%	17. Jan 33	11,5	
XS0161488498	500,000,000.00 €	24.01.2003	7,500%	24. Jan 33	11,5	30
XS0888813119	50,000,000.00 €	11.02.2013	3,550%	11. Feb 33	11,5	20
XS0952926581	80,000,000.00 €		3,500%	15. Jul 33	12	
XS1858856740	250,000,000.00 €	25.07.2018	2,200%	25. Jul 33	12	15
XS2024716099	850,000,000.00 €	05.07.2019	1,375%	05. Jul 34	13	15
DE000A2LQRS3	300,000,000.00 €	29.03.2019	2,250%	29. Mrz 39	18	20
XS2089226026	715,000,000.00 €	09.12.2019	1,750%	09. Dez 49	28	30

Outstanding total volume of Euro-bonds: 20,585,371,000.00 €
 Unweighted average coupon payment: 2.57 %
 Volume weighted average coupon payment: 1.93 %