Dublin Airport Cost of Capital for 2022 Interim Review

Final Report

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Summary

Due to a collapse in passenger numbers at Dublin Airport following the outbreak and spread of the Covid-19 pandemic, the Commission for Aviation Regulation (CAR) has carried out an Interim Review (2022 Interim Review) of all regulatory building blocks underlying its 2019 Determination of the maximum allowed level of Airport Charges at Dublin Airport.

In July 2022, CAR published its Draft Decision on the 2022 Interim Review (Draft Decision), including an estimate on the efficient level of Dublin Airport's real pre-tax Weighted Average Cost of Capital (WACC) for the 2023-26 period of 4.22 percent. This estimate is based on our 2022 Draft Report on Dublin Airport's cost of capital (Draft Report), which was published alongside the Draft Decision. A public consultation on the Draft Decision ended in September 2022.

The responses submitted by stakeholders concern a range of aspects in our methodology with a general emphasis on risk and inflation. For example, Dublin Airport express a concern that our methodology to determine the Asset Beta does not capture the full extent of risk that it is exposed to in the light of CAR's strict regulatory regime and evidence of its vulnerability to events such as pandemics. Airlines, on the other hand, were more concerned that the rising inflation may have not been properly reflected in our estimates of real interest rates.

Based on an extensive review of the stakeholder responses, we decided to make the following amendments to our Draft Report methodology:

- **Risk-free rate:** Use of a 6-months-averaging period instead of the previous 1-year, 2-year and 5-year averages to estimate current levels of Irish and German government bond yields.
- **Asset Beta:**
  - Removal of Sydney Airport (SYD) from the comparator sample due to the stock's delisting in February 2022.
  - Removal of Aeroporti di Roma (AdR) and London Gatwick Airport (LGW) from the comparator sample due to concerns of the underlying regulatory decisions becoming outdated.
  - Removal of London Heathrow Airport (HAL) and TAV Airports Holding (TAV) from the comparator sample due to concerns of double counting stock price movements of certain related airport operators.
  - Use of 1-year, 2-year, and 5-year periods to estimate empirical Betas, consistent with the 2019 Final Report methodology. However, we continue to exclude pandemic data (i.e. the year 2020) from the analysis.

- **Cost of debt:**
  - Inclusion of an issuance cost uptick on the cost of debt, reflecting actual expenses incurred by daa that are not already accounted for in other cost allowances.
  - Use of a 6-months-averaging period for the determination of the cost of new debt analogous to the estimation of the risk-free rate.

CAR has instructed us to prepare our final view on Dublin Airport's efficient level of the cost of capital over the 2023-26 period using updated market data and the methodological amendments described above. Our results are summarised in (**Table 1**).

Table 1: SE Advice on the Level of the Real Pre-Tax WACC for the 2023-26 Regulatory Period

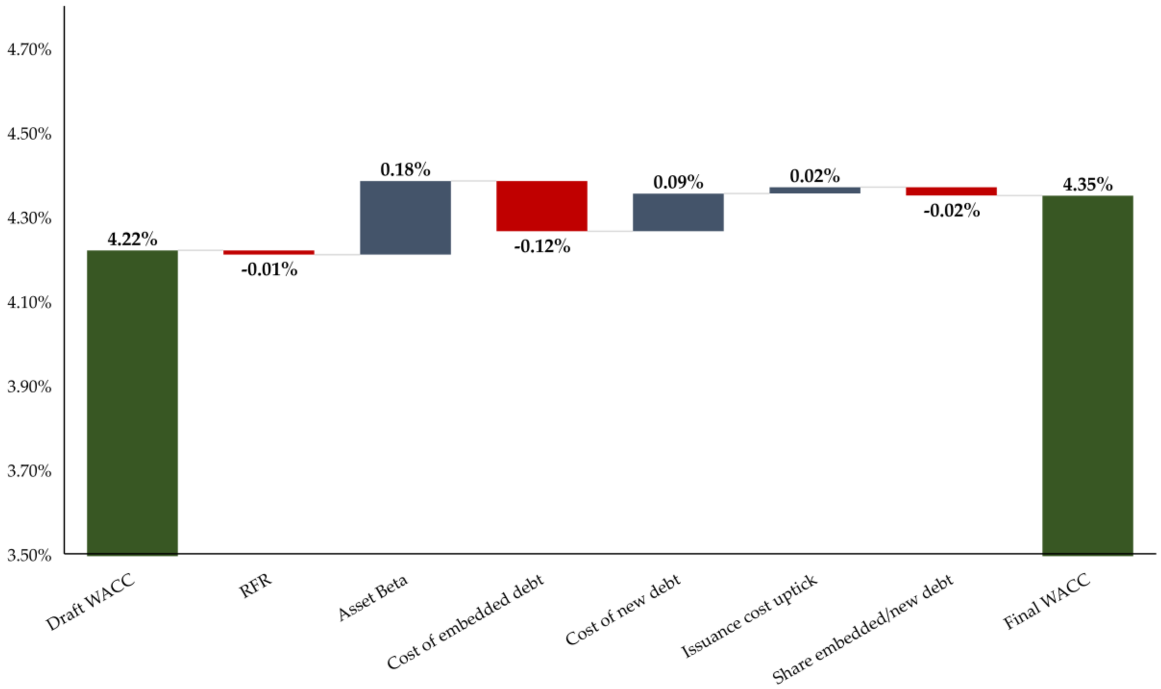
	2022 Final Report	2022 Draft Report	Difference
Gearing	50.00%	50.00%	*unchanged*
Tax rate	12.50%	12.50%	*unchanged*
RFR	-0.45%	-1.07%	↖ 61 bps
TMR	6.25%	6.25%	*unchanged*
ERP	6.71%	7.32%	↙ 61 bps
Asset Beta	0.60	0.56	↖ 0.04
Equity Beta	1.13	1.05	↖ 0.08
Cost of equity (post-tax)	**7.13%**	**6.60%**	↖ **53 bps**
Cost of embedded debt	-1.16%	-0.37%	↙ 79 bps
Cost of new debt	1.29%	0.35%	↖ 95 bps
Issuance cost uptick	0.05%	0.00%	↖ 5 bps
Share embedded/new debt	73%	62%	↖ 11 bps
Cost of debt (pre-tax)	**-0.45%**	**-0.10%**	↙ **35 bps**
Aiming up	0.50%	0.50%	*unchanged*
Advice on regulatory pre-tax WACC	**4.35%**	**4.22%**	↖ **13 bps**

Notes: Assuming a notional BBB+ credit rating for Dublin Airport.

Source: Swiss Economics.

Figure 1 illustrates the effects of the individual changes to the various components on the resulting overall WACC keeping everything else constant.

Figure 1: Approximate Ceteris Paribus Effects of Changes in WACC Components



Notes: The figure depicts ceteris paribus effects (i.e. keeping everything else constant on the proposed levels in the Draft Report) of the changes to the various WACC components on the final WACC. Only components which differ from their Draft Report values are displayed. The effects of component changes on the WACC are scaled down such that their sum equals the difference between the Draft and the Final WACC. Actual effects of component changes on the WACC are slightly higher. Although the RFR increases by 61 basis points relative to the Draft Report (see Table 1 above), its impact on the final WACC is slightly negative due to the Draft Report Equity Beta being greater than 1 (the marginal effect of changes to RFR on the cost of equity is [1 - Equity Beta]).

Source: Swiss Economics

The key changes can be summarized as follows:

- **Cost of equity**: We estimate an increase in the cost of equity from 6.60 percent to 7.13 percent. Underlying this change is an increase of the Asset Beta from 0.56 to 0.60, which is primarily driven by the exclusion of regulatory Betas from the comparator sample.
- **Cost of debt**: The increase in the cost of equity is partly offset by a decrease in the cost of debt from -0.10 percent to -0.45 percent. The decrease in the cost of debt is primarily driven by two (opposing) factors:
  - Increasing inflation expectations over the past months have reduced the level of real interest rates on Dublin Airport's embedded debt.
  - The increase in nominal corporate bond yields has exceeded the rise in inflation expectations, leading to an overall increase in Dublin Airport's real interest rates on new debt.

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1 Introduction

1.1 Background

1 On 22 July 2022, the Commission for Aviation Regulation (CAR) published its Draft Decision on an Interim Review (2022 Interim Review) of the 2019 Determination of the maximum level of Airport Charges at Dublin Airport for the period from 2023 to 2026 (Draft Decision). The 2022 Interim Review was initiated in response to an extreme downside passenger traffic scenario, following the outbreak and spread of the Covid-19 pandemic. The 2022 Interim Review consists of a reopening of all regulatory building blocks, including the cost of capital.

2 CAR's Draft Decision point estimate of Dublin Airport's efficient real pre-tax Weighted Average Cost of Capital (WACC) coincidentally remained unchanged at 4.22 percent compared to the 2019 Determination, with various changes in the individual components offsetting each other. The underlying range became slightly narrower with a lower boundary at 3.85 percent and an upper boundary at 4.49 percent.[1]

3 CAR's Draft Decision on the WACC was supported by a Swiss Economics SE AG (Swiss Economics) report (Draft Report) that updated our work in relation to the 2019 Determination in the light of the pandemic and other recent financial market developments.[2]

4 Over the past months, CAR has run a public consultation on the Draft Decision, which resulted in a range of stakeholder responses. CAR has asked us to review the feedback concerning the WACC and update our methodology if indicated.

5 In the light of quickly changing financial markets developments, CAR has instructed us to update our analysis using more recent data until the end of October 2022.

6 The results of this Final Report on Dublin Airport's Cost of Capital for the 2023 to 2026 period (Final Report) aim to inform CAR's Final Decision on the maximum level of Airport Charges at Dublin Airport from 2023 to 2026 (Final Decision), which is expected to be published in December 2022.

1.2 Overview of Stakeholder Responses

7 We have received responses from a range of stakeholders, including Dublin Airport, airport users, industry associations, and interested individuals. During the preparation of this Final Report, we have considered the following stakeholder responses:

- ACI Europe (2022), ACI Europe response to Commission Paper 3/2022 from 16 September 2022, in particular section 3.

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[1] Based on a notional BBB+ Credit Rating

[2] Swiss Economics (2022). Dublin Airport Cost of Capital for 2022 Determination. Final Version: https://www.aviationreg.ie/_fileupload/2023%20Interim%20Review/Cost%20of%20Capital%202022%20Final%20Version%20Redacted.pdf [24.11.2022].

- Aer Lingus (2022), Aer Lingus letter Re: Draft Decision on Interim Review of the 2019 Determination in relation to 2023 to 2026 from 16 September 2022, in particular section 4.
- Dublin Airport (2022), Dublin Airport's response to the Commission's Draft Decision 2022 from September 2022, in particular section 7, and Appendix 2: NERA (2022), Cost of Capital for Dublin Airport for 2023-2026 Regulatory Period from 14 September 2022.
- IATA (2022), IATA response to CAR's Draft Determination (undated), in particular the section on the Cost of Capital.
- NERA (2022), Dublin Airport Cost of Capital: 2023-26, Workshop Slides from 1 November 2022 (unpublished).
- Ryanair (2022), Ryanair submission on Draft Decision on an Interim Review of the 2019 Determination from 16 September 2022, in particular Appendix 1, section IV.

8 We have not addressed stakeholder responses from Joseph Ryan, the Car Rental Council of Ireland, Emerald Airlines, the Galway Chamber, Irish Air Line Pilots Association, the Irish Congress of Trade Unions, the Limerick Chamber, and Shannon Airport, as these did not contain specific comments on the cost of capital estimated by us.

1.3 Methodology

9 We continue to use the WACC-CAPM framework that we used in our 2019 Final Report[3] and our Draft Report for the 2022 Interim Review. Our WACC estimate builds on various components, including the gearing, the risk-free rate (RFR), the equity risk premium (ERP), the Beta, the cost of debt, and an aiming up component. For each of these components, we examined whether and how they should be updated.

10 First, we considered whether the methodology adopted in the Draft Report required amendment following the review of the stakeholder submissions. Each point of criticism underwent careful analysis based on concept-led thinking supported by empirical evidence from financial markets or sensitivity analyses if possible. If indicated, we updated our methodology accordingly.

11 Second, we changed the cut-off date of the time series data underlying our various analyses from 31 December 2021 to 31 October 2022, adding ten months of recent market observations to the dataset. This data update allowed us to move averaging periods and spot rate dates for estimates of various WACC elements based on historical data closer to the start of the regulatory period in 2023 and ensures that recent developments, such as the impact of the Ukraine conflict, are included in the analysis.

12 Third, when recent data indicated that financial markets underwent sustained changes (e.g. in the form of increased inflationary pressure or changed risk perceptions by market

[3] Jaag, C. et al. (2019). Dublin Airport Cost of Capital for 2019 Determination. Final Report. A report by Swiss Economics for the Commission for Aviation Regulation.

participants), we further adjusted our methodology such that these new realities are adequately reflected in our estimation of Dublin Airport's efficient cost of capital.

2 Gearing

2.1 Assessment of Stakeholder Responses

2.1.1 Marginal vs Average Capital Costs

13 Aer Lingus note that the notional gearing assumption of 50 percent is significantly higher than the (actual) gearing of the most listed airports. Thus, according to Aer Lingus, our methodology implicitly assumes that marginal investments for Dublin Airport are almost entirely funded by debt.

14 We note that actual gearing levels may differ from notional gearing levels (see section 2.1.2 below for the rationale for using notional gearing levels).

15 The WACC feeds into the price cap formula as a multiplicative term with the total regulated asset base (RAB). It must thus reflect average capital costs rather than marginal capital costs. A WACC above marginal capital costs is desirable as this ensures that incentives to invest are maintained.

2.1.2 Actual vs Notional Gearing

16 Ryanair argue that the actual gearing of Dublin Airport is higher than 50 percent, as evidenced by significant levels of debt raised in the past without corresponding equity injections from the shareholder. Ryanair also argue that, given the trend for the cost of debt was lower in recent times, more debt financing should be enabled and, hence, the gearing assumption should be higher than 50 percent.

17 Our approach with regards to the gearing rate is a notional approach. Rather than to reflect Dublin Airport's actual gearing, the notional capital structure underlying the regulatory WACC reflects a hypothetical gearing rate that an efficient airport operator would choose to minimise the cost of capital. The notional capital structure optimises the trade-off arising from increasing debt levels between greater tax benefits (as cost of debt is tax-deductible) and increased risk (for which equity holders must be reimbursed).

18 We also note that, while it is true that the real cost of debt has been decreasing recently, this is likely to change in the future given that the observed higher rates of inflation likely require further increases in interest rates. Given that the WACC should take a forward-looking point of view, it is incorrect to adjust notional gearing rates based on past developments.

19 Other regulators take a similar approach. The UK Civil Aviation Authority (CAA) proposes a higher gearing rate than 50 percent for the upcoming Heathrow Airport (HAL) regulatory period H7 (CAA, 2021), but the proposed range of 61 to 62 percent is very close to the previous gearing levels of 60 percent that were used in older decisions (including decisions in which debt rates were higher).

20 Some regulators also assume lower values. The Spanish regulator Comision Nacional de los Mercados y la Competencia (CNMC), for example, determined a gearing rate of 33 percent for Aeropuertos Españoles y Navegación Aérea (AENA) in 2021 (CNMC, 2021).

21 CAR used a gearing ratio of 50 percent in past decisions, mimicking a balanced capital structure that takes into account the trade-off between tax benefits and risk. There is merit in maintaining the current gearing ratio for the next regulatory period in the absence of a compelling reason to deviate since regulatory consistency is likely to increase investor and creditor confidence.

22 Finally, the effect of changes in the gearing level on the WACC is relatively small (see **Table 2**). Typically, the effect from a decrease of the weight of the cost of equity is offset by an increase of the level of the cost of equity driven by an increase of the Equity Beta.

23 The results of **Table 2** are broadly in line with the Miller-Modigliani theorem (1958, 1961), which predicts that the capital structure – in a simplified model without taxes, insolvency costs, asymmetric distribution of information and with complete capital markets – has no influence on the cost of capital. However, if taxes are considered in the model, the WACC decreases with increasing leverage (Modigliani & Miller, 1963).

Table 2: Sensitivity Analysis of the WACC Regarding Gearing Rates

	Gearing of 30%	Gearing of 40%	Gearing of 50%	Gearing of 60%	Gearing of 70%
WACC	4.45%	4.40%	4.35%	4.30%	4.25%

Source: Swiss Economics

2.2 Amended Methodology

24 In the interest of regulatory consistency, we recommend keeping the notional gearing rate of 50 percent that was used in the past decisions including the 2019 decision.

2.3 Updated Results

25 **Table 3** summarises our advice.

Table 3: Summary Gearing Rate

	Range (in %)	Point estimate (in %)
2022 Final Report	45 – 55	50
2022 Draft Report	45 – 55	50

Source: Swiss Economics

3 The Risk-Free Rate

3.1 Assessment of Stakeholder Responses

3.1.1 Expected Inflation

26 IATA state that inflation is currently higher than the long-term inflation expectations used in the Draft Report analysis.

27 Aer Lingus welcome CAR's Draft Decision. However, Aer Lingus are concerned that the current elevated inflation environment warrants particular attention. They express the opinion that uplifts from inflation indexation are materially higher than the inflation assumptions used to deflate nominal estimates of returns. According to Aer Lingus, this creates windfall gains for Dublin Airport.

28 The WACC is determined for the upcoming regulatory period from 2023 to 2026 and its components are determined from a forward-looking perspective whenever possible. It is possible (and likely) that *current* values of WACC components differ from the *forward-looking* values of the same components to some degree.

29 We use long-run inflation expectations over the next 10 years to convert nominal to real yields, consistent with the remaining time to maturity of the nominal bond yields. This long-term view reflects an investment horizon of 10 years that is adopted for the cost of equity.[4] We observe that in the short term, inflation expectations are higher an more consistent with recent inflation than in the long term towards the end of the 10-years-period.

3.1.2 Risk-Free Rate

30 Aer Lingus do not agree with the use of forward curves and argue that their predictive power is low.

31 Even if forward rates have a low predictive power, the predictive power of spot rates is very likely to be even lower. This is especially true for longer periods since spot rates reflect the current market situation without taking future market expectations into account. Given our forward-looking approach, it is still preferable to also consider data with low predictive power than only focussing on spot rates.

32 Aer Lingus cites a report by the UK's Competition and Markets Authority (CMA) published in early 2021 that argues against the use of forward rates (CMA, 2021). However, the CMA's argument against the use of forward rates is specific to the context of falling interest rates. The CMA states that "the use of a typically upwards sloping forward curve has led to unnecessary upward adjustments throughout what is now *decades of generally falling rates*" (CMA, 2021, p. 789). Since the publication of the CMA report, interest rates and inflation

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[4] For the cost of debt (in particular the cost of new debt), we use inflation expectations over the next 15 years. The reason for this is the long notional investment horizon of Dublin Airport, which is found to be roughly 15 years, as outlined in our Draft Report.

have dramatically changed. Hence, the CMA's view regarding forward rates is likely not valid anymore.

33 The CMA also cites a variety of papers that question the predictive power of forward rates. However, we find that the literature on the predictive power of forward-rates is mixed and not conclusive. The use of different approaches and methodologies (e.g based on exchange rates or bond yields) as well as the economic climate might influence findings. Hence, there are doubts on the external validity of the results in general (i.e. the applicability of the results outside the investigated area).

34 Dublin Airport suggest it is more appropriate to place weight on Irish bond yields. From their point of view a country risk premium should be added for German bond yields to estimate a true Irish risk-free rate.

35 We agree with Dublin Airport's assessment that, in general, bonds from the member state in which the airport is located should be used. As we already stated in our 2019 Report, this is generally in line with the Thessaloniki Forum of Airport Charges Regulators (Thessaloniki Forum) recommendations. However, as we argued in our 2019 Report "[a]lthough it is not explicitly mentioned by the Thessaloniki Forum, we consider that for airports in the Euro area, bonds from other Euro countries are relevant as well. This is illustrated by the fact that Dublin Airport Authority (daa) is not limited to raise funds in Ireland. For example, most of its existing debt was raised through the European Investment Bank. This is of relevance because bonds from other countries in the Euro area are perceived to be lower risk than Irish government bonds. […]." This still holds true as of October 2022 for an appropriate RFR estimation. German government bonds are often considered as the least risky assets in the Euro area (van Riet, 2017).

36 Dublin Airport also argue that Irish forward rates should be applied to the RFR to reflect the country specific risk premium.

37 It needs to be noted that our methodology for the forward rate adjustment is in line with Irish regulatory precedent,[5] whereas the use of an Ireland-specific forward rate would be unusual in the current regulatory context. The forward rate adjustments for the RFR should include a broader view (i.e. including German AAA-rated government bonds consistent to the approach to determine the current risk-free rate), as capital mobility in the overall Euro area is well established.

38 In addition, as we already noted in the 2019 Report, using an Irish forward rate would pose several problems primarily due to reasons of data availability. Namely we noted that "[t]he calculation of reliable forward rates requires a wide range of maturities, which is not readily available for Ireland and only to a limited extent for Germany" which is still the case as of October 2022.

5 See, for example, CRU's 2020 decision on ESBN/EIR Grid or CRU's 2019 decision on Irish Water Revenue Control.

3.2 Amended Methodology

39 As we already stated in our Draft Report, the situation in 2021 was exceptional in the sense that nominal yields did not immediately follow increased inflation expectations, which resulted in a decrease of real yields. This was observed both for government bonds as well as for corporate bonds. Nominal bond yields only started to increase, when the European Central Bank (ECB) increased interest rates in July 2022.[6]

40 There is a trade-off in the length of the averaging period. Using a long averaging period, outdated information might be included that does no longer reflect relevant market conditions. On the other hand, using a short averaging period may put too much emphasis on recent market developments and lead to the inclusion of noise and a reduction of predictive power.

41 From summer 2021 to spring 2022, inflation expectations started to increase, leading to a significant decrease in real interest rates. Only following the ECB's change in monetary policy, nominal bond yields have started to rise and offset the effect of increased inflation expectations.[7]

42 Given these developments, the predictive power of long-run historical averages becomes questionable. Thus, we opt to use a 6-months averaging period instead 5-year, 2-year, and 1-year averages used in the Draft Report.

43 We keep the methodology for estimating expected inflation, which is used to express the RFR in real terms. Expected inflation is approximated by survey data maintained by the ECB and yield data on inflation-linked German government bonds, which directly incorporate the market's inflation expectations.[8] Then nominal rates are converted to real rates using the Fisher equation (Fisher, 1930).

3.3 Updated Results

3.3.1 Nominal Government Bond Yields

44 The nominal yields of Irish and German government bonds depicted in **Figure 2** show the market increase in nominal yields since December 2021. The series is composed of an average of nominal yields with remaining time to maturity between 8 to 12 years. The series indicate the range of the RFR in nominal terms based on current market data.

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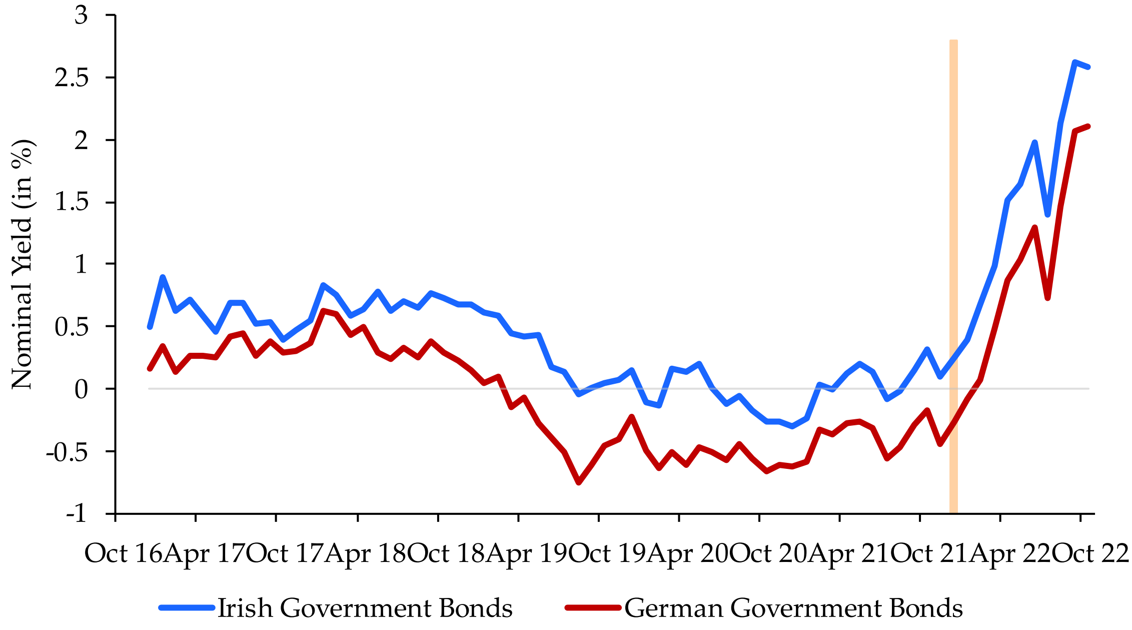
[6] https://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html [24.11.2022].

[7] See, for example, https://www.imf.org/en/Blogs/Articles/2022/10/23/europe-must-address-a-toxic-mix-of-high-inflation-and-flagging-growth [07.12.2022]

[8] Inflation expectations inherent in the yields of inflation-linked bonds were extracted by comparing them with nominal yields of German government bonds with comparable remaining time to maturity.

Figure 2: Average Nominal Yields of Irish and German Government Bonds



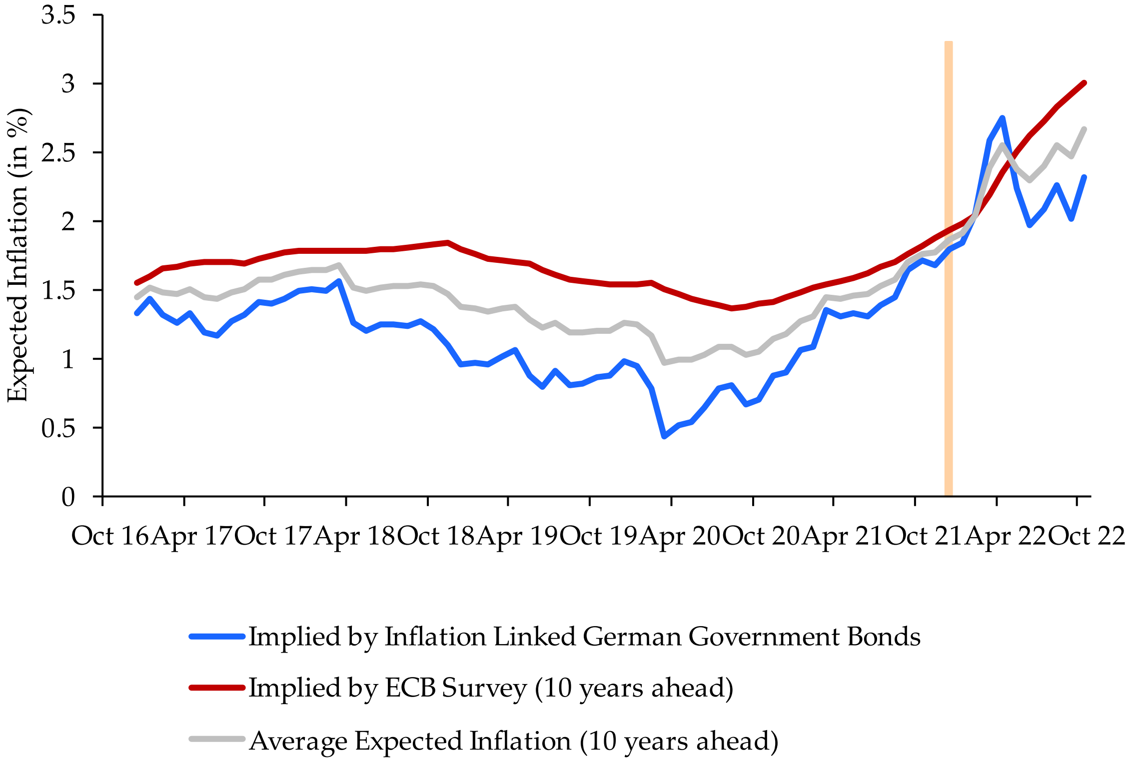
Note: The vertical line marks 31 December 2021. Since then, Irish nominal yields increased 234 basis points and German nominal yields rose 237 basis points.

Source: Swiss Economics based on Refinitiv Eikon data

3.3.2 Real Government Bond Yields

45 **Figure 3** shows how expected inflation according to an ECB survey and inflation-linked real government yields developed over the last 6 years. Since the beginning of the pandemic, we find a continuous increase in inflation expectations both from market data as well as implied in the ECB surveys. The inflation expectations rose continuously during 2022, leading to an expected inflation of 2.67 percent for the next 10 years as of October 2022.

Figure 3: Expected Inflation over the Next 10 Years

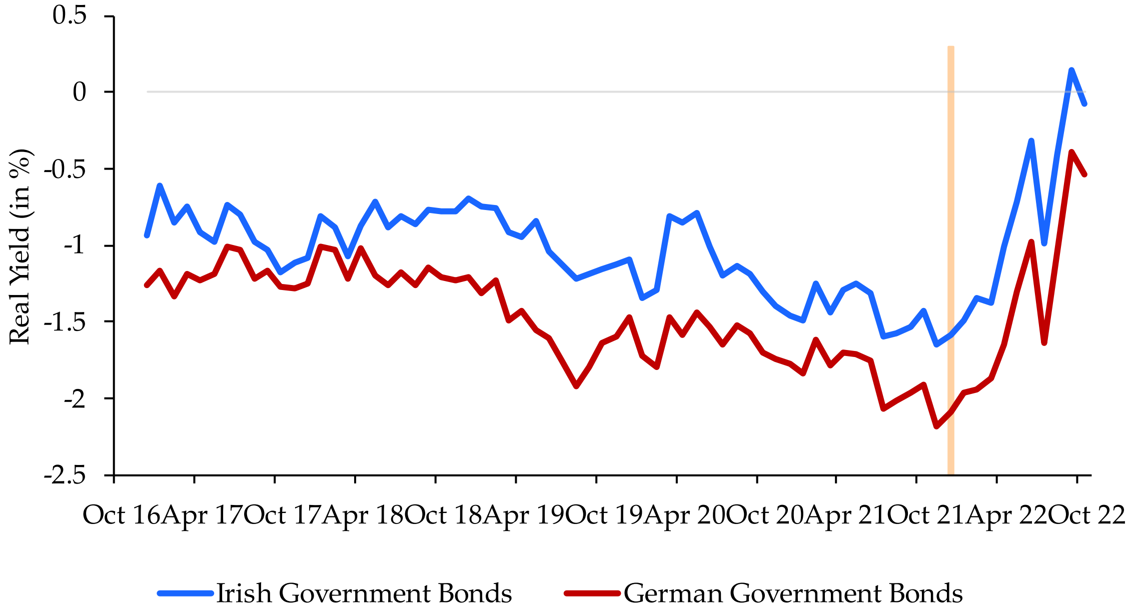


Note: The vertical line marks 31 December 2021. Since then, average expected inflation implied in 10 years increased from 1.87 percent to 2.67 percent.

Source: Swiss Economics based on Refinitiv Eikon data and ECB Surveys

46 Using the Fisher equation (Fisher, 1930) nominal rates are converted to real rates. **Figure 4** displays the development of Irish and German government bond yields with a remaining time to maturity between 8 and 12 years. The increase of real yields since December 2021 is significant, however, lower than the increase of nominal yields. The reason for this is the increase in inflation expectations which simultaneously increased by 80 basis points.

Figure 4: Real Government Bond Yields of Irish and German Government Bonds



Note: The vertical line marks the 31 December 2021. Since then, the real yields increased by 151 basis points and 155 basis points for Irish and German government bonds respectively.

Source: Swiss Economics based on Refinitiv Eikon data

47 **Table 4** compares the rates using the different averaging periods of the Draft Report to the Final Report using a 6-months-average. The 6-months averages are significantly higher than averages for the other averaging periods.

Table 4: Average Real Yields Comparison between the Draft and Final Report

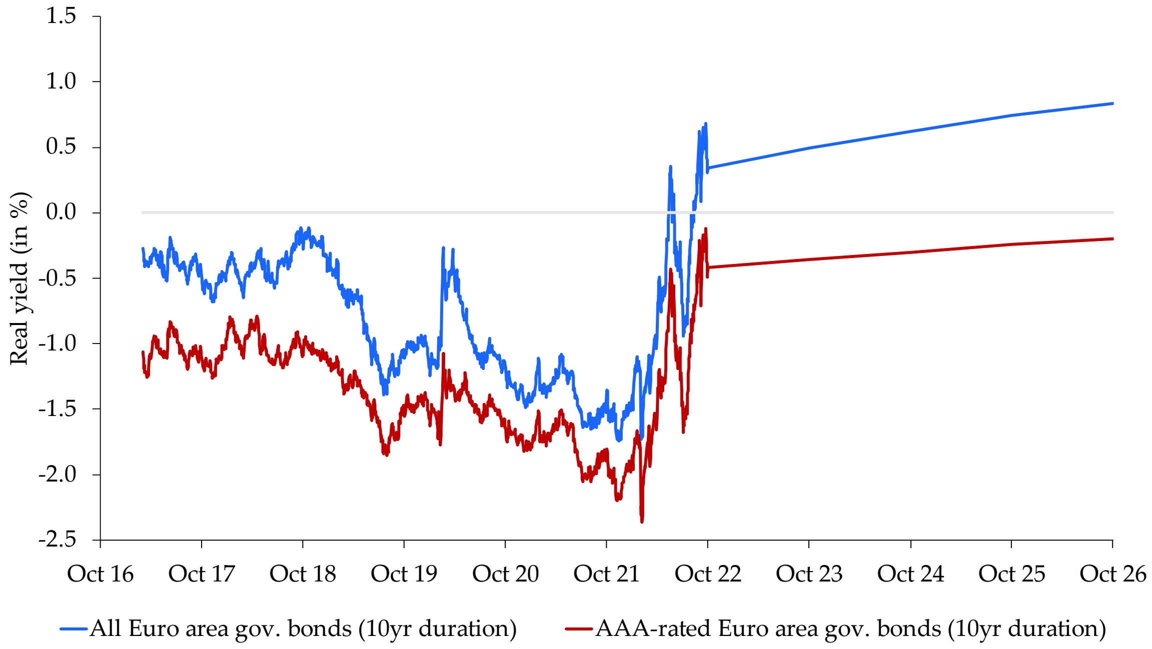
	6-months average	1-year average	2-year average	5-year average
Irish Government Bonds (October 2022)	-0.39	-0.90	-1.16	-1.05
Irish Government Bonds (Draft Report)	-	-1.45	-1.30	-1.03
Delta	-	↖ *0.55*	↖ *0.14*	↙ *-0.02*
German Government Bonds (October 2022)	-0.99	-1.47	-1.65	-1.51
German Government Bonds (Draft Report)	-	-1.89	-1.76	-1.49
Delta	-	↖ *0.42*	↖ *0.11*	↙ *-0.03*

Source: Swiss Economics based on Refinitiv Eikon data

3.3.3 Forward Rates

48 **Figure 5** displays forward rates based on 31 October 2022 spot rates over the 2023-26 period.

Figure 5: Forward Rates Implied by Government Bond Spot Rates



Note: Spot rates on 31 October 2022 were used as the basis for the calculation of forward rates.

Source: Swiss Economics based on ECB data

49 Compared to the Draft Report, the spot yield curves increased significantly and recently turned positive again for the Euro area government bond index. However, the implied increase in spot rates is less stark than in our previous analyses. Based on December 2021 data, we estiamted a forward rate adjustment between 0.49 percent and 0.29 percent. Using data up until the end of October 2022, our estimate decreases to between 0.33 percent and 0.14 percent (see **Table 5** for the calculation of the forward rate adjustment).

Table 5: Expected Real Future Yields from 2023 to 2026

Forward rate	All Euro area bonds	Delta to Oct 22	AAA-rated Euro area bonds	Delta to Oct 22
2023	0.50%	0.15%	-0.36%	0.06%
2024	0.62%	0.28%	-0.30%	0.12%
2025	0.75%	0.40%	-0.24%	0.18%
2026	0.84%	0.49%	-0.20%	0.22%
2023 - 2026 Average	**0.68%**	**0.33%**	**-0.28%**	**0.14%**

Source: Swiss Economics

3.3.4 Conclusion

50 We amend our methodology by using a shorter averaging period of 6 months to estimate the upper and lower bound of the RFR compared to the Draft Report where we took 1-year, 2-year and 5-year averages of Irish and German government bonds and used the lowest estimate as a lower bound and the highest estimate as an upper bound.

51 The recent increases in the real bond yields as well as our amended approach led to an overall increase in the RFR by 61 basis points. The calculation of the final RFR and its comparison to the Draft Report findings are reported in **Table 6**. Overall, the RFR is estimated to be at -0.45 percent.

Table 6: Evidence on the RFR and Comparison to the Draft Report Results

		Lower bound	Upper bound	Point estimate
	Evidence from current yields	-0.99%	-0.39%	
+	Evidence from forward rates and monetary policy	0.14%	0.33%	
=	**RFR**	**-0.85%**	**-0.06%**	**-0.45%**
	RFR (Draft Report)	-1.60%	-0.54%	-1.07%
	Delta between Final and Draft Report	↖ *75 bps*	↖ *48 bps*	↖ *61 bps*

Source: Swiss Economics.

4 The Equity Risk Premium

4.1 Assessment of Stakeholder Responses

4.1.1 ERP vs TMR Approach

52 IATA argue that the use of the total market return (TMR) approach, where the equity risk premium (ERP) is estimated by subtracting the RFR from the TMR, should be reconsidered, since it is not the approach applied in continental Europe where the ERP approach (i.e. separate calculation of the ERP) is more widely used.

53 Aer Lingus is also of the opinion that some weight should be given to an ERP approach.

54 We continue to believe that the TMR approach is the right approach to estimate the ERP. There is strong theoretical and empirical evidence showing that the ERP and the RFR systematically move in opposite directions, implying that the TMR is more stable over time than either of the individual components, making the TMR approach better suited to inform the appropriate level of the ERP (see the discussion in section 4.2 of our 2019 Report for more details).

55 One reason for why the ERP approach is more popular in continental Europe, is that the cost of capital is often determined in nominal terms. The TMR approach may lead to biases when not corrected for differences in inflation rates over time.

4.1.2 TMR Methodology

56 While NERA agree with using Blume's method (Blume, 1974), NERA state that, considering equity market evidence, holding periods of 1 to 5 years rather than 10 years should be used.

57 NERA also argue for the use of Irish and World TMR instead of Irish and European TMR on the grounds that the European TMR is more sensitive to outliers than the World TMR.

58 We disagree with NERA's suggestion regarding the holding period. A 10-year holding period allows for consistency across the cost of equity, as we use a similar investment horizon for estimating the RFR.

59 The choice of a 10-year investment horizon is also consistent with recent recommendations of the UK Regulators Network (UKRN, 2018). The UKRN recommends using a relatively long investment horizon, explicitly referring to 10 years as an example, because the notional investor would typically invest through a pension fund. The problem with using a short investment horizon is that this would introduce a clear disconnect between the horizon of the (notional) investor and the expected life of the assets employed (UKRN, 2018).

60 We also disagree with relying on a World TMR. We believe that a European equity portfolio is likely to better represent an Irish investors' investment universe than a world equity portfolio. A worldwide portfolio contains equity from countries with only negligible relevance to Irish investors.

4.1.3 Reliance on Forward-Looking Evidence

61 NERA argue against the use of a dividend discount model (DDM) due to concerns regarding the sensitivity of the results to the long-term dividend growth assumptions, for which there are no independent analyst forecasts. NERA also argue that our DDM represents an unrealistic single stage model and that a large cap index rather than broad-market stock index should be used.

62 A key issue of dividend discount modelling is the estimation of future dividends. In general, the ideal DDM would separately model each future period up to infinity. However, such a model needs perfect foresight in terms of future dividend payments. It is almost impossible to obtain high-quality dividend forecasts and they usually suffer from substantial noise. Hence, the benefits from more flexible multi-stage DDM can be overshadowed by additional errors in the inputs (Damodaran, 2002). There exists empirical evidence which finds that the Gordon growth model – assuming a constant dividend growth rate – performs nearly as well at explaining prices as more complex DDM models (e.g. Foerster & Sapp, 2005).

63 Using GDP forecasts rather than average historic dividend growth as a proxy for dividend growth has the advantage of adding stability to the estimation, since GDP forecasts are less volatile than dividend growth rates. Our forward-looking TMR estimate (see **Figure 6** in section 4.3.2) confirm its stability. The results shown below in section 4.3.2 also confirm the minor impact of using a DDM model compared with an approach focussing exclusively on historical data.

64 We use the STOXX Europe 50 price index for reasons of easier tractability compared with a broader index. Using an alternative index – e.g. the STOXX Europe 600 Index – increases the computational effort exponentially without rendering substantially different results since the two indices are highly correlated.

4.2 Amended Methodology

65 We see no compelling reasons to deviate from the methodology of the Draft Report and of the 2019 Report.

66 We continue to use a TMR approach and express the ERP as the difference between expected returns of the market portfolio (i.e. TMR) and the RFR. The level of the RFR is determined in section 3.3. We estimate the appropriate level of the TMR using a combination of backward- and forward-looking evidence:

- First, we employ a backward-looking method based on long-term historic averages.
- Second, we estimate the TMR using a DDM which is a forward-looking estimation.

4.3 Updated Results

4.3.1 Backward-Looking Estimate

67 We rely on the data provided by Dimson, Marsh, and Staunton (DMS, 2022) to estimate long-term averages of total market returns. The 2022 edition of the DMS-yearbook contains data on Irish and European real equity returns from 1900 to 2021.

68 **Table 7** reports mean equity returns for Ireland and Europe using arithmetic, geometric, and Blume's averaging methods (see Blume, 1974). Results have not changed compared to the Draft Report since no update to the latest 2022-edition of the DMS-yearbook has been published.

69 In line with the methodology of the Draft Report and the 2019 Determination we rely on the equity returns resulting from Blume's method. Blume's method accounts for the fact that the geometric and arithmetic means are both likely to be biased due to measurement errors.

Table 7: Average Equity Returns over the 1900-2021 Period (in Percent)

Equity returns	Arithmetic mean	Geometric mean	Blume's method
Irish equity returns	7.00	4.40	6.81
European equity returns	6.10	4.30	5.97

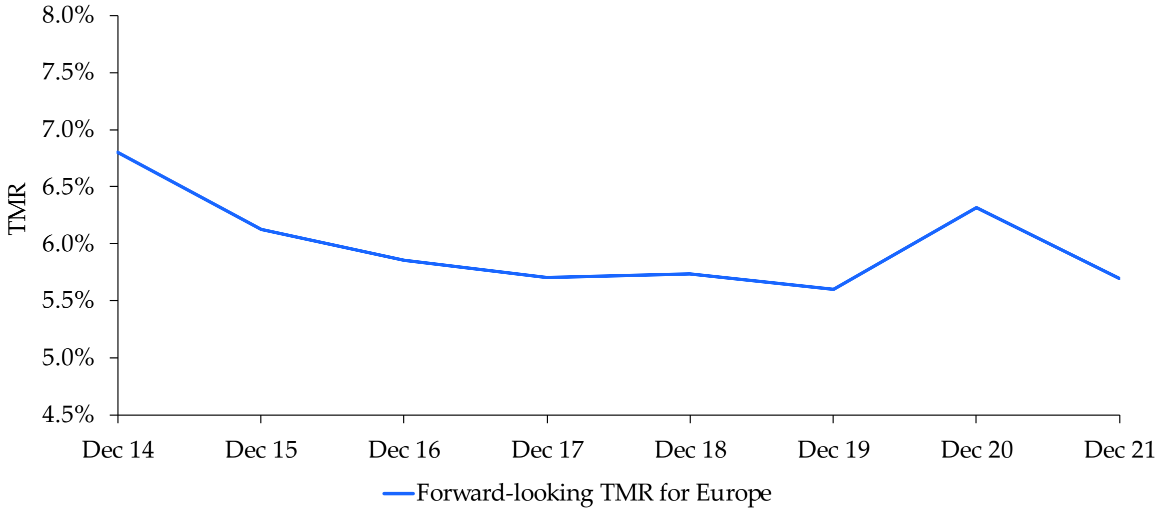
Note: Blume's method (BM) gives a weighted estimate of the arithmetic (AM) and geometric means (GM) based on the period over which the mean was calculated (N) and on the period over which returns are to be forecasted (T). The following formula is used: $BM=(T-1)/(N-1)\times GM+(N-T)/(N-1)\times AM$, with T = 10 years holding period and N = 121 observations of historic returns.

Source: Swiss Economics based on DMS (2022).

4.3.2 Forward-Looking Estimate

70 We use a forward-looking DDM as a second source of evidence for the level of the TMR. **Figure 6** shows the updated DDM calculated as explained in the 2019 Report. The DDM is identical to the Draft Report based on data until the end of 2021 for two reasons. First, there is no complete dataset regarding price and dividend data for 2022 available yet. Second, as explained in section 4.3.1, no update to the backward-looking estimate was possible since the latest DMS-yearbook (2022) contains data until the end of 2021. For reasons of consistency, we base the forward-looking DDM also on data until the end of 2021.

Figure 6: Forward-Looking TMR for Europe (Assuming Constant Dividend Growth)



Note: The analysis spans the period of 2014 to the end of 2021 (no complete dataset is available for 2022). Yearly price and dividend data were summed over all constituents of the STOXX Europe 50 price index. A constant dividend growth rate was assumed. The constant dividend growth rate was calculated by taking an arithmetic average of the yearly OECD real GDP forecast.

Source: Swiss Economics based on Bloomberg data.

71 The results of the DDM (**Table 8**) confirm the long-term stability of the TMR.

Table 8: Average Forward-Looking TMR Estimates over the Recent Past

	1-year average	2-year average	5-year average
TMR	5.70%	6.01%	5.81%

Source: Swiss Economics.

4.3.3 Conclusion

72 We estimate an updated range for the TMR between 5.70 percent and 6.81 percent with a point estimate at 6.25 percent. **Table 9** summarises our findings regarding the level of the TMR.

Table 9: Evidence on the TMR

		Lower bound	Upper bound
	Evidence from backward-looking evidence	5.97%	6.81%
	Evidence from forward-looking evidence	5.70%	6.01%
Min./Max.	TMR	5.70%	6.81%

Source: Swiss Economics

73 The range for the ERP was derived by subtracting our point estimate of the RFR of -0.45 percent from the TMR range. **Table 10** summarises our advice regarding the level of the ERP.

Table 10: ERP Summary

	Range (in %)	Point estimate (in %)
2022 Final Report	6.15 – 7.26	6.71
2022 Draft Decision	6.77 – 7.87	7.32

Source: Swiss Economics

74 The ERP point estimate increases relative to the Draft Report by 61 basis points. This is entirely due to the increase in the RFR from -1.07 percent to -0.45 percent.

5 Beta

5.1 Assessment of Stakeholder Responses

5.1.1 Risk Related to Covid-19 and Other Future Catastrophic Events

Overview of Stakeholder Responses

75 One element of our Beta estimation methodology that is criticised in a range of stakeholder responses, is the approach that we choose to deal with the impact of the outbreak of Covid-19 on stock price data.

76 Dublin Airport believe that the exclusion of 2020 comparator airport data, which contains most if not all Covid-19-related anomalies, leads to an underestimation of Dublin Airport's Beta risk over the 2023-26 period. Dublin Airport's point of view is that from the pandemic's impact on airport stocks it is evident enough that airports face greater systematic risk during catastrophic events than during normal times. This exposure to catastrophic events requires an upward adjustment of the Asset Beta according to Dublin Airport. ACI Europe shared this view.

77 Dublin Airport argue that the extensive support by CAR during the pandemic is not enough to deny the need for a Covid-uptick. Most peer airports would have also received government help during the pandemic, nevertheless their stock prices declined disproportionately, confirming the exposure of airports to catastrophic events despite likely government remedies.

78 IATA and Ryanair on the other hand believe that our approach did not go far enough and suggest to also exclude 2021 data from the analysis, as later Covid-19-waves also had an impact on the level of stock prices.

79 Finally, Aer Lingus broadly support our methodology to estimate the Asset Beta. For instance, Aer Lingus support excluding the peak of the pandemic from the calculation of comparator Betas.

Summary of Our View

80 We disagree with Dublin Airport on the need for an upward adjustment of the Beta reflecting the probability of extreme events for two reasons.

- First, we believe that markets' assessments of the impact of future catastrophic events (including but not limited to pandemics) on airports are likely to be much less negative than it has been for Covid-19. As shown below, the impact on airport profitability of a sudden and unprecedented demand shock turned out to be much less dramatic than markets initially expected. We expect that markets have updated their beliefs on factors such as the level of airport cost-fixity, and whether and how determined governments and regulators are ready to intervene to protect airports during a crisis based on recent events.

- Second, among a large range of remedial efforts by the relevant authorities, CAR's intervention has been among the most decisive, making observations for comparator airports less relevant. This further suggests that CAR would be similarly enabled to again amend the price control in the event of another similar incident over 2023-26, reducing Dublin Airport's relative exposure to such a shock.

81 In relation to the point raised by IATA and Ryanair, we acknowledge that there may be a risk of overestimating Dublin Airport's Asset Beta by keeping 2021 data in our empirical analysis. However, as we lay out below, financial markets' reactions to outbreaks of new Covid-19 variants (e.g. the Omicron outbreak in November/December 2021) were much more in line with the overall market and consistent with historically observed airport Beta risk compared to the first outbreak. As such, we believe it would be disproportionate to ignore more recent data that could contain valuable information on the development of markets' risk perception of airports that are not of a temporary nature.

82 We discuss our reasoning on these points in detail below.

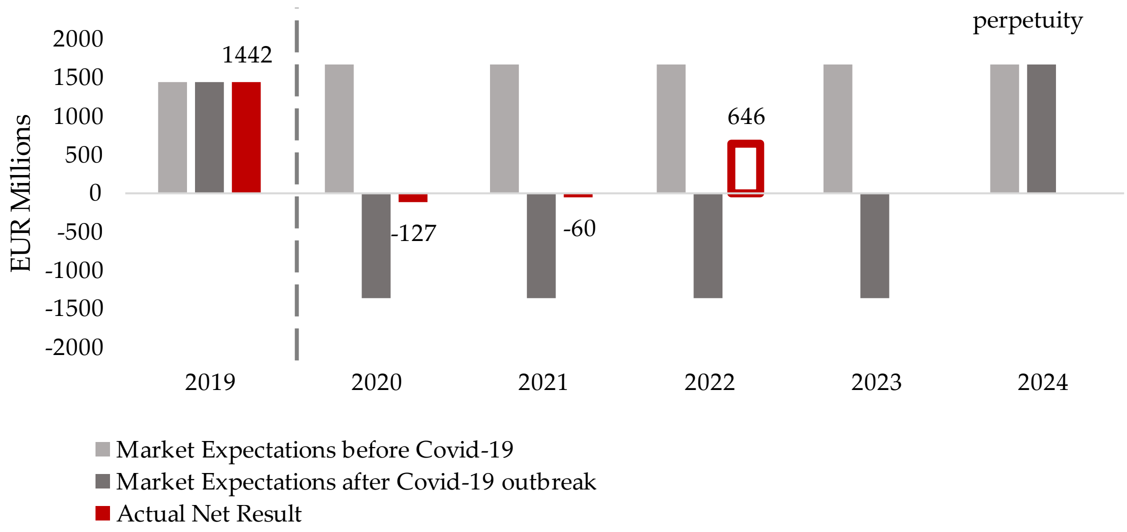
Updated Market Beliefs on the Impact of Catastrophic Events on Airports

83 Dublin Airport and ACI Europe make the argument that empirical Beta estimates based on data from business-as-usual time periods underestimate the systematic risk faced by airport operators because they do not include the effect of rare catastrophic events that will occur again in the future with certainty.

84 We are not convinced that there is a need for an explicit correction of business-as-usual Betas. We believe that markets expected the impact of Covid-19-related travel restrictions on airport profitability to be much more dramatic than it turned out to be in hindsight.

85 Based on a simple DDM, it is possible to approximate financial markets' expectations on the impact of Covid-19 at the beginning of the pandemic. **Figure 7** shows the results of our DDM analysis graphically. The methodology is described more formally in Appendix A.4

Figure 7: **Ex-Ante Market Expectations on AENA Net Results (based on DDM) before and after Covid-19 vs Actuals**



Note: Market expectations before Covid-19 are built on AENA's 31 December 2019 market capitalisation and market expectations after Covid-19 outbreak are formed on AENA's 31 March 2020 market capitalisation. We assume that investors discount net profits with a discount rate of 6.5 percent. Our DDM relies on the simplifying assumption that financial markets formed prices before the pandemic outbreak based on expected future net profits, which are assumed to be constant (i.e. no growth or developing path). At the outbreak of the pandemic early 2020, financial markets expected a constant decrease in net results over four pandemic years. Despite their simplifying nature, these assumptions are conservative in the sense that overly quick conclusions are prevented. This is mainly because a relatively long pandemic effect (four years) and no catch-up afterwards are assumed. The actual net result for 2022 was extrapolated from the net result in Q3 2022 and the shares of quarterly net results in 2019. The various calculation steps are set out in Appendix A.4

Source: AENA Annual Reports and Quarterly Reports 2019 to 2022 and Swiss Economics Analysis.

86 AENA's market capitalisation at the end of 2019 of EUR 25.6 bn suggests that the market expected future annual net profits close to EUR 1.5 bn. By the end of March 2020, market capitalisation decreased to EUR 14.9 bn, indicating that markets expected AENA would incur losses of approximately EUR 1.4 bn over the next couple of years during the pandemic.

87 Actual net results did in fact collapse during the pandemic compared to 2019. However, the impact turned out to be substantially less dramatic and more short-lived than expected. A trend reversal can already be seen in 2021, indicating that the negative effects of the pandemic may not only have been less severe but also lasting for a shorter time than markets expected. While markets expected a cumulated impact of EUR 9.3 bn over the first three years of the pandemic, the actual cumulated impact was closer to EUR 4.5 bn – less than 50 percent of what markets anticipated at the time of the outbreak.

88 Similar market overreactions can be observed for the most listed airport stocks. **Table 11** shows an overview of the results of the same analysis for Aéroports de Paris (ADP), Flughafen Zürich (FHZN), and Fraport AG Frankfurt Airport Services Worldwide (FRA). The actual impact of Covid-19 remained significantly below the level that markets expected based on observed decreases in market capitalisation.

Table 11: Decrease in Market Capitalisation for Selected Airport Operators due to Covid-19 Outbreak

	Change in market capitalisation due to the Covid outbreak[1]	Implied expected annual Covid impact (EURbn) [2]	Actual average annual Covid impact until 2022 (EURbn) [3]
AENA	-42%	-3.1	-1.5
ADP	-50%	-2.6	-1.8*
FHZH	-38%	-0.6	-0.3
FRA	-51%	-1.1	-0.6
STOXX Europe 600	**-26%**		

Note: [1] Based on data of actual market capitalisations for the listed airports and the total return index of STOXX Europe 600.

[2] Implied average annual Covid impacts are estimated based on the difference between expected annual profits implied in December 2019 market capitalisation and expected annual profits implied in March 2020 market capitalisation.

[3] Actual average annual Covid impacts are estimated based on the difference between expected annual profits implied in December 2019 market capitalisation and the average of actual annual net results from 2020 to 2022. FY 2022 net results were extrapolated based on actual Q1 to Q3 results.

* Average Covid impact for ADP is based on 2020 and 2021 actuals only due to missing quarterly publications.

Source: Swiss Economics based on Bloomberg data and airports' annual reports.

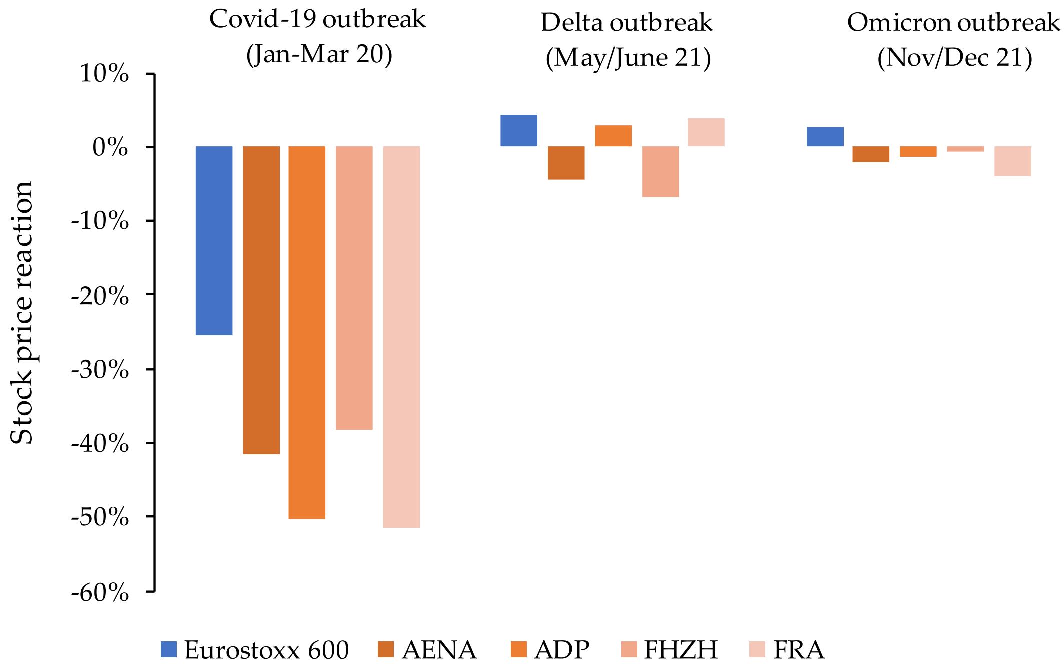
89 In hindsight, it seems as if airport stock price adjustments closer to the overall stock market (STOXX Europe 600 Index decreased by 26 percent over the same time period) would have been more in line with the impact on profits that followed. Catastrophic outturns for airports could largely be avoided. We are not aware of any major airport that was forced out of business due to the pandemic.

90 The reasons for the markets' overreaction to the pandemic impact on airports can be manifold. It is likely that the degree and determination with which airport authorities and governments in general stepped in and supported airports were simply not anticipated properly. For example, large scale job retention schemes in the form of temporary wage subsidies were rolled out across Europe already during the spring of 2020.

91 We believe that markets have learnt from the Covid-19 turmoil and airport stocks will be affected less when the next catastrophic event unfolds. It is likely that airport stocks will decrease much more in line with the overall market.

92 Consistent with this view, airport stocks did not nearly react as extremely to later Covid-19 waves than during the first wave in spring 2020. **Figure 8** shows that airport stocks reacted much less to the outbreaks of Covid-19 variants Delta and Omicron in 2021 than to the original outbreak. The figure also shows that later outbreaks rather decreased than increased the systematic risk component (i.e. amplified reactions compared to the market portfolio) in airport stocks.

Figure 8: Change in Airport Stock Prices due to Various Covid Outbreaks



Note: Based on Total Market Index values of the relevant stocks and indices on 31 October 2021 and 31 December 2021.

Source: Swiss Economics based on Bloomberg data.

CAR's intervention compared to other airport authorities' interventions

93 Dublin Airport argue that the fact that they had received government support during the pandemic is not a reason to exclude pandemic data from the empirical estimation. Dublin Airport also state that most other airport operators received help, keeping the situation comparable to Dublin Airport.

94 **Table 12** lists the main elements of aid to Dublin Airport to cushion the impact of travel restrictions due to the pandemic.

Table 12: Overview of Aid to Dublin Airport after the Covid-19 Outbreak

Intervention detail	CAR/Dublin Airport
Date of first intervention	June 2020 (First interim Review commenced, completed in late 2020)
Within regulatory period financial aid	Removal of Capex non-delivery and service quality penalties for 2020 and 2021
Within period RAB adjustment (2023-2026)	Delay of Capex plans and full suspension of clawback of unspent Capex for each year from 2020 to 2022
Within regulatory period tariff adjustments	▪ Waiver of global price cap compliance in 2020 only, allowing for an increase of approx. 40% in tariffs per passenger compared to the originally planned price cap for 2020 ▪ Current interim review of price caps, which implies a full risk reset for the final years of the 2019 Determination's regulatory period
Government aid	▪ EUR 59m (2020), EUR 73m (2021), and EUR 10m (2022) in the form of wage subsidies and rates waivers ▪ EUR 108m traffic recovery scheme paid to Irish Airports (of which EUR 97m were allocated to Dublin Airport) in December 2021 by the Department of Transport. However, we note that Dublin Airport was required to use this funding to provide traffic recovery incentives to airport users, ie this was a package to stimulate recovery of the industry more broadly.

Source: Swiss Economics

95 In October 2021, CAR forecast the total value of all interventions for Dublin Airport at between EUR 200m and EUR 220m over the period 2020-2022.[9] In its Draft Determination, CAR state that, given that passenger numbers in 2022 appear likely to be higher than at the time of its estimation in October 2021, the value of government interventions to Dublin Airport are likely to be even higher as well.

96 Based on our own research, we could not identify any other airports that have benefitted from such timely and decisive interventions.

97 For example, the CAA will be introducing several Covid-19-related adjustments into H7 period (with a backdated start point in January 2022), such as an increase in the RAB, an adjustment to the Beta, and a traffic sharing mechanism. To our knowledge, the regulator has not taken measures during the first two years of the pandemic of similar nature to those taken by CAR. However, HAL and other UK airports are likely to have significantly benefitted from the UK government's furlough scheme (wage subsidies) and the introduction of the Airport and Ground Operators Support Scheme (AGOSS) that was specifically aimed to support airports with grants to deal with the damages caused by Covid-19.

98 ADP decided to suspend its Economic Contract, which implies a change from a 5-years regulation to an annual tariff review. However, there were no adjustments to airport tariffs or other direct revenue adjustments. Only more general governmental aid to help with increasing safety and security costs and partial unemployment schemes benefitted ADP.

[9] Draft Decision on the Second Interim Review of the 2019 Determination in relation to 2022. Commission Paper 2/2021, 22 October 2021. See https://www.aviationreg.ie/_fileupload/Draft%20Decision(2).pdf [5.12.2022].

99 AENA requested to modify the regulatory document of the period 2017-2021 in order to cover the losses due to Covid-19, but this request was denied by the Spanish Aviation Ministry (DGAC). However, the Spanish Parliament approved a specific legislation by which AENA was allowed to recover the full costs of the operational and sanitary measures required in all AENA's airports due to the pandemic. These costs are now taken into account in the annual adjustment of the tariffs and are supervised by CNMC.

100 For several airports, regulatory interventions during the pandemic translated into a decrease in airport charges in order to protect users first. For example, the Austrian government seems to have removed any risk-sharing from Vienna Airports (FLU)' price formula in light of the pandemic.[10] At FHZN airport charges were reduced in 2021 across all categories (except for noise and environmental emissions charges) by 10 percent in order to allow airlines a speedy recovery.[11]

101 In general, the removal of distorted time periods from the data to increase an empirical estimation's precision is conceptually valid. Research shows that the influence of outliers can result in misleading OLS-estimates of Betas and that Beta estimates can be improved by removing outliers from the sample period (e.g. Martin & Simin, 2003, as cited in Pratt & Grabowski, 2014). It is also used in practice. For example, Dublin Airport's advisors NERA have themselves proposed a similar measure in the course of the 2005 Determination on Airport Charges at Dublin Airport. For their estimation of one comparator Beta, they omitted the period from February 1999 to September 2001 (approximately 2.5 years) from their analysis because they observed a "de-coupling" of the comparator's equity price from the market index, resulting in a deviation from the relationship observed under "normal" market conditions (NERA, 2005).[12]

102 In analogy to removing distorted time periods from the estimation of Asset Betas we also adjust the estimation period for the risk-free rate (see section 3.2) and the cost of new debt (see section 6.2). All these adjustments are likely to improve the predictive power and relevance of the determined WACC for the period 2023-2026.

5.1.2 Selection and Weighting of Comparator Airports

Overview of Stakeholder Responses

103 In its response to the Draft Decision, Dublin Airport emphasise various aspects of our methodology to select and weight comparator airports to inform the level of Dublin Airport's Asset Beta. Their criticism can be divided into three broad categories:

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10 We are not aware of any public documentation of the Austrian government's interventions but rely on a description included in the CAA's Section 3 on Financial Issues of its Final Proposals for H7, page 33.

11 Meyer & Seferovic (2022). Rechtlicher Kontext der Gebühren am Flughafen Zürich unter besonderer Berücksichtigung des Lärmschutzes.

12 According to NERA, the event that ultimately started the de-coupling was an EU Commission announcement about intentions to pursue the abolition of duty free for intra-EU travel (NERA, 2005).

- The conceptual criteria that we use to capture comparability in terms of risk exposure with Dublin Airport are not prioritised correctly.
- The proxy variables that we use do not reflect the conceptual risk criteria well enough and thresholds within the proxy variables are arbitrary.
- Our translation of risk assessment results into a concrete sample composition (e.g. the specific weighting) is problematic.

104 Ryanair express concerns regarding the use of non-European airports – specifically Sydney (SYD) and Auckland (AIA) – as comparators. According to Ryanair, the calculation of Dublin Airport's Asset Beta should be based solely on European comparator airports.

105 No other stakeholders express any concerns on our risk assessment and our sample weighting and selection. Aer Lingus express their support for relying on a broad sample of comparator airports and accounting for the relative risk of comparators in estimating Asset Beta.

106 We break down Dublin Airport's and Ryanair's arguments in each of the three categories and present our views on them in the following.

Prioritization of Risk Criteria

107 Dublin Airport argue that the primary criterion in the risk assessment should be whether the peer airport is regulated under a multi-annual incentive-based regime. Other criteria, such as the composition of demand, are secondary. Thus, airports such as SYD, FLU, or FRA should not be considered comparable with Dublin Airport.

108 In our view, at the heart of any assessment of airports' Beta risk exposure should be the question of how fluctuations of demand translate into profits at individual airports.[13] One central element of the relation between demand and profits is an airport's ability to adapt its tariffs to changes in the former. Under price cap regulation, airports will be constrained to adopt their prices to meet demand shocks. The general assessment may be that airports under Cost+ or rate of return regulation are less exposed to demand shocks than airports under price cap regulation. Also, airports under price cap regulation with traffic risk sharing mechanisms implemented may be less exposed to demand shocks than airports without such a mechanism. Thus, a comparison of price cap regimes does make sense for the assessment of comparability.

109 Nevertheless, we disagree with Dublin Airport's view that price cap rigidity should be considered as the single dominant criterion for the risk assessment. As explained in our Draft Report, we disagree with the notion that regulatory models for airport charges can be perfectly compared as simplistically as suggested by Dublin Airport ("multi-year price cap"). In practice there are differences among these regulatory models which makes the choice of "perfect comparators" challenging. As the regulatory regime is relevant to the extent that it

[13] Uncertainty around demand is generally accepted to be the primary source of systematic risk for airports. Demand uncertainty is likely to be highly correlated to overall economic activity and therefore also to financial performance of a well-diversified portfolio to some degree.

is a proxy for exposure to demand and cost shocks in terms of effects on profits and losses, these differences are not "minor" as suggested by Dublin Airport.

110 Examples of such differences include the following:

- Dublin Airport faces only partial cost risk: It faces most Opex risk except for certain costs which are passed through to users (such as Local Authority rates). Its exposure to Capex risk is limited by the Stage Gate process, which allows for costs of projects to change as the project design is developed, and also by the CAR approach of grouping allowances for smaller projects.
- The regulatory framework for Dublin Airport has a relatively flexible interim review mechanism, with no specific limitation on what the regulator can include in the scope of an interim review. Volume risk has been shared between Dublin Airport and users in the current period through the interim reviews, including this one. In the event of a future pandemic-like event, this will enable CAR to intervene in a manner which would reduce the exposure of Dublin Airport to such an event compared to airports which do not have this flexibility.
- In France, there is a legislative overlay requiring "moderation" in year-over-year changes to the airport charges and ADP has not been permitted to increase charges by more than 5 percent in nominal terms for the duration of the pandemic (CAA, 2022). Thus, it is unlikely that Dublin Airport's current year-over-year price cap increase proposal for 2023 would be possible for ADP. There is no such overlay at Dublin Airport, which allows a full risk re-set at a determination or interim review.
- In Dublin, the till structure is an important part of the regulator's powers. CAR has chosen to use a single till. In Spain and France (and Switzerland, with FHZN being the third comparator airport in Dublin Airport's analysis), the till structure is set in legislation. AENA is dual till, meaning that commercial investments are fully at the risk of the airport operator. ADP and FHZN have hybrid till. Dublin Airport's commercial business – which is responsible for roughly 50 percent of Dublin Airport's revenues – is hence of lesser risk compared with airports under the dual and hybrid till regulation since lower than anticipated commercial returns will be absorbed by airport users in following determination re-sets. NERA previously recognized the importance of the single or dual till regulation as set out below (see paragraph 121).
- The regulatory regimes also differ in terms of how they treat inflation. Dublin Airport's price cap is mechanistically uplifted for inflation based on a CPI index within the period. This is not the case for ADP's regulatory regime. In the current economic environment, combined with the legislative principle of moderation on the development of aeronautical tariffs, this is a major additional risk exposure for ADP.
- AENA's regulation adjusts the price cap across an inflation index called "P Index". The P Index is a customized index that covers costs that are outside of AENA's control. This includes costs for wages, security, cleaning, or energy. The P Index does not include all AENA's costs and is not a CPI. The P index values for 2021, 2022, and 2023 airport charges are 0.72 percent, 0.38 percent, and 0.72 percent, respectively, and hence far below

Spanish inflation rates. Moreover, efficiency measures are applied to the value of the P Index. If the P Index value is higher than 1 percent, a Council of Ministers' approval upon report of the Government Commission for Economic Affairs is mandatory.

- Despite being originated from commercial contracts with users rather than being set by an independent regulator, the price caps at FHZN are widely regarded as rigid. The airport currently does not have any discretion to alter the arrangement, which makes it an appropriate comparator to airports without any traffic risk sharing mechanisms according to the CAA.[14]
- Finally, it is important to note that CAR currently determines a WACC for a four-year regulatory period. This stands in contrast to AENA's and ADP's regulatory period of five years. This implies that their respective Betas overstate the risks faced by Dublin Airport, particularly if this is the main source of Beta risk as argued by NERA.

111 Besides the design of economic regulation, there is also a range of factors related to the structure of demand and business risks that affect an airport's Beta risk. In particular the income elasticity of demand, i.e. the extent to which passenger numbers react to changes in overall economic activity, may play an important role in assessing airport Beta risk. The composition and number of airlines and passengers as well as the composition of revenues may be relevant factors that determine how sensitively demand reacts to changes in GDP.

112 For airport operators with a range of related or unrelated activities in addition to operating a main airport stock price movements (and therefore empirical estimates of Beta risk) may be driven to a significant degree by risks that are unrelated to Dublin Airport as a regulated entity. For example, Fraport group owns and operates 11 airports in Europe, Asia, and South America besides the main airport in Frankfurt. Most of these airports are too small to represent a serious bottleneck to the economies in their catchment areas and are not under economic regulation. The risk profile of these airports may not be comparable at all with the risk profile of the main airport in Frankfurt. In 2019, international business activities were responsible for almost half of the group result. Similarly, AENA, ADP, or FHZN are all entities that operate multiple airports in addition to their main airports and engage in a range of unregulated commercial activities. The share of non-regulated businesses in FHZN's total revenues increased from 39 percent in 2016 to 57 percent in 2021. Similarly, the share of commercial revenues at AENA raised from 19 percent in 2013 to 33 percent in 2021. The share of Retail and Services in ADP's total revenues however remained stable between 26 percent and 28 percent during the last decade.[15]

113 Thus, the relationship between demand shocks and profits is much more complex and multifaceted than simply being a function of price cap rigidity in practice. A simple analysis of passenger numbers and profits across airports with different regulatory regimes illustrates this point.

[14] CAA (2022) Economic regulation of Heathrow Airport Limited: H7 Final Proposals

[15] This analysis is based on airports' revenue data by measure, segment, and geography retrieved from Bloomberg.

114 **Table 13** shows the development of passenger numbers and Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) at Dublin Airport over the fourth regulatory period from 2015 to 2019. Over this period, tariffs were capped in line with CAR's 2014 Determination, implying maximum demand and Beta risk according to Dublin Airport. A simple regression analysis suggests that an additional (a decrease of a) passenger led to an increase (decrease) on average of EUR 10.3 in EBITDA.

Table 13: Relation between Passenger Numbers and Profits at Dublin Airport

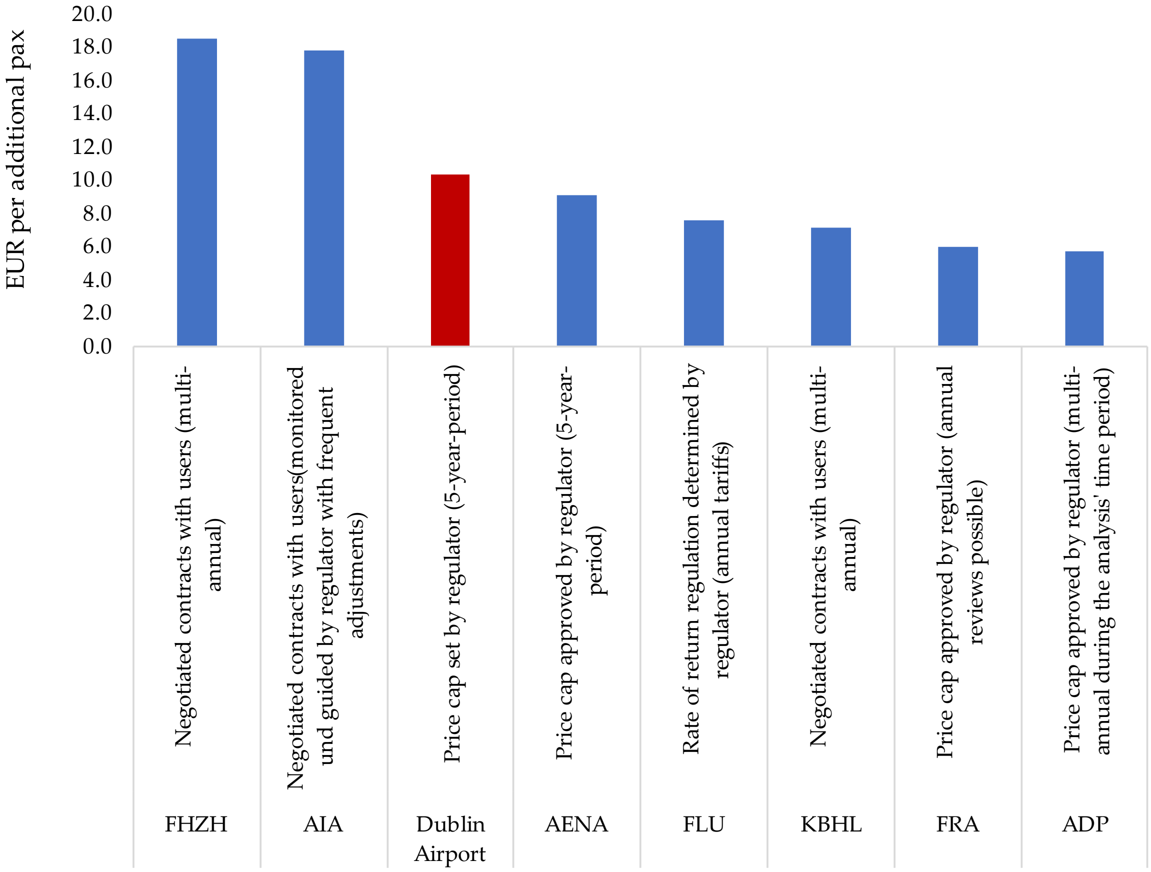
	2015	2016	2017	2018	2019
Dublin Airport – Price Cap Regulation (5-year-period)					
Passengers (m)	25.0	27.9	29.6	31.5	32.9
EBITDA (EUR m)	198.4	231.7	254.7	272.9	276.0
Estimated linear effect of an additional passenger on EBITDA (EUR)					**10.3**

Note: The estimated linear effect of an additional passenger on EBITDA is estimated using the Ordinary Least Squares Method.

Source: Swiss Economics based on airports' annual reports.

115 An overview of the results of similar analyses for peer airport operators is illustrated below in **Figure 9**.

Figure 9: Linear effect (in EUR) of an Additional Passenger on Peer Airport Operators' EBITDA



Note: The estimated linear effect of an additional passenger on EBITDA is estimated using the Ordinary Least Squares Method. As explanatory variable, we use the aggregate number of passengers across all airports from 2015 to 2019 in the portfolio of the airport operator as reported in the relevant annual reports. As explained variable, we use reported EBITDA in local currencies of the airport operators over the same period. AIA, FHZN and Copenhagen Airports (KBHL) were converted to EUR using the respective exchange rate as of 14 November 2022.

Source: Swiss Economics based on airport operators' annual reports.

116 **Figure 9** shows that the relation between variation in demand and profits is likely to be more distinct for Dublin Airport than for the most peer airport operators. However, with an impact of EUR 10.5 per additional passenger, it is well in the range of observed values with ADP at the lower end with EUR 5.7 per passenger and FHZN with EUR 18.5 at the upper end. Also, the estimate for Dublin Airport is in line with the average across peers of EUR 10.3 per passenger.

117 Overall, the results show that in contrast to Dublin Airport's view, the existence of multi-annually fixed caps is not the single dominant driver of airports' Beta risk.

118 For example, AIA is required to consult on the level of tariffs with its major users at least every five years.[16] However, in practice tariff resets are undertaken much more frequently. Following the Price Setting Event 3 from 2017 that fixed tariffs originally for the 2018-22

[16] See the Airport Authorities Act 1966

period, tariff revisions were already applied in February 2019 and again in August 2021. Despite the frequent tariff adjustments, AIA shows a significantly higher impact of demand variation on EBITDA than Dublin Airport.

119 Charles de Gaulle airport, the main airport of the ADP group, on the other hand was regulated under an economic contract from 2016 to 2020, which kept tariffs relatively fixed over this period.[17] Still, the effect of an additional passenger on the group's EBITDA was less pronounced than for any other peer airport operator, many of which operating their largest airports under less rigid tariffs.

120 Thus, we conclude that our multifaceted risk assessment, which takes into account a broad range of proxies for risk drivers in the areas of economic regulation, demand structure and business characteristics is likely to result in a more accurate and robust estimate of Dublin Airport's Asset Beta than an oversimplified approach focussing on a single risk dimension in the form of multi-annual price caps.

121 We also note that Dublin Airport's consultants NERA have been significantly inconsistent in their views regarding the choice of comparator airports and the sources of Beta risk in their past reports for Dublin Airport. NERA has provided advice to Dublin Airport for each Airport Charges Determination since 2005.[18] NERA's submissions on the risk assessment in past determinations show that their selection and weighting methodology has conceptually been similar to our approach.

- In their 2005 report, NERA argue for a wide range of comparator variables (NERA, 2005). Next to the regulatory regime – measured by the type of regulation (price and revenue cap or rate of return) and a single vs dual till regulation – NERA also consider the size and nature of an operation (number of passengers, number of airports, etc.), the revenue split between aeronautical and non-aeronautical revenue, the share of short-haul passengers, leisure passengers, and transfer passengers as well as the degree of the fixity of costs (ratio of capital costs to operating costs). Thus, in line with our approach, a variety of factors were considered. Also, based on these factors, NERA decided on a broad group of comparator airports that include the following: Manchester Airport Group, British Airports Authority (BAA), FLU, and Aeroporti di Roma (AdR).
- In their 2009 report, NERA exclude Macquarie Airports Group "as it is a multi-national multi-airport operator which means that its Beta estimates are unlikely to be indicative of Beta at any particular airport" (NERA, 2009, p. 27). This stands in contrast with NERA's current focus on AENA and ADP as key comparator airports for Dublin Airport. AENA operates 46 airports and two heliports in Spain and also has "a significant presence outside Spain, with direct interests in 23 international airports, including London Luton, which owns 51 percent equity, and a 100 percent of Northeastern Group of

[17] Aside from a modest traffic risk sharing mechanism implemented in the scheme and the exit clause that was triggered after the outbreak of Covid-19.

[18] These reports are all published on the CAR webpage for the relevant determination:https://www.aviation-reg.ie/economic-regulation/regulation-of-airport-charges-dublin-airport.117.html

airports (6) in Brazil."[19] ADP fully owns or has interests in 125 airports in 50 countries.[20] Thus, applying NERA's 2009 approach would lead to the exclusion of AENA and ADP entirely from the comparator set. In its 2009 report, NERA also consider a variety of variables to determine valid comparator airports for Dublin Airport.

- Similarly, in their response to CAR's Issues Paper 2018, NERA cite airport demand (passengers and movements), revenue risks (aeronautical/commercial revenue splits, passenger mix, etc.), and regulatory framework all as key Beta risks to be considered.[21]
- In their 2019 response to the 2019 Draft Determination, NERA recognized the importance of non-regulatory variables such as airport size, share of business flights, low-cost flights, and transfer flights in assessing a comparator airport's relative risks (NERA, 2019). NERA also considered the till structure in its analysis. Dublin Airport itself state in its response to the Commission's Issues Paper CP7/2018 that "key risk factors which affect systematic (Beta) risk of companies operating in the airport industry" must be considered when determining the suitability of individual comparator companies for Dublin Airport (Dublin Airport, 2018, p. 55). Dublin Airport also present a list of variables of key Beta risk factors that need to be considered: airport demand, revenue risk, and the regulatory framework in place.

Proxy Variables and Value Thresholds – Number of Flights and Passengers

122 Dublin Airport argue that the choice of the number of flights and passengers to estimate demand volume risks is arbitrary. According to Dublin Airport, a better predictor of its volatility would have been the mix of flag vs low-cost carriers, or the mix of business vs leisure passengers.

123 Dublin Airport further argue that some of the thresholds used to assess the dimensions of systematic risk are arbitrary. As an example, Dublin Airport mention the use of a 60 percent aeronautical revenue share for an airport to qualify as comparable with Dublin Airport.

124 We rely on the number of passengers and the number of flights because they are proxy variables for airport size. Airports of different sizes are likely to have different risk profiles. This is demonstrated by the small firm stock premium, which has been consistently observed in empirical studies (e.g. Fama & French, 2012).

125 Another reason for why we rely on the number of flights and passengers is data availability. These variables are publicly available in reliable quality for all comparator airports. More granular data, such as the mix of flag vs low-cost carriers, or the mix of business vs leisure passengers are not reported by all airports.

126 Also, the comparability of such data reported by different airports is likely low, since, for instance, the classification mechanism into business and leisure passengers varies

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[19] See https://www.aena.es/en/shareholders-and-investors/general-information/fact-sheet.html [31.10.2022].

[20] See https://www.parisaeroport.fr/homepage-groupe [31.12.2022].

[21] Dublin Airport Response to Issues Paper CP7/2018, p. 55. https://www.aviationreg.ie/_fileupload/2019%20Determination/Dublin%20Airport%20(Non-Confidential).pdf [31.10.2022].

substantially between airports. There is no comparable ambiguity for data such as the number of flights and passengers.

127 Dublin Airport's consultants NERA argued identically in their 2009 report on the cost of capital for Dublin Airport (NERA, 2009). To identify airports which most closely match Dublin Airport, NERA consider a list of airport characteristics. A proxy for airport size, NERA also rely on passenger numbers and aircraft movements. However, the following caveat is stated (NERA, 2009, p. 42): "We note that other characteristics might also be relevant to an evaluation of systematic risk. However, availability of evidence limits a comparison in some cases e.g. leisure versus business travel."

128 Regarding Dublin Airport's critique on the chosen thresholds, it must be stated that these are not randomly selected but are based on the distributions of the underlying variables across airports. This approach allows us to define thresholds that rely on data and do not require extensive conceptual judgement.

129 It is unclear what Dublin Airport's critique on the use of a 60 percent threshold for aeronautical revenues exactly entails. As explained in our 2019 Report, we consider all airports with a share between 44 percent (the lowest observed share in the sample) and 60 percent aeronautical revenues comparable to Dublin Airport (with a share of 51 percent). We continue to believe that this is a reasonable threshold.

130 The use of some judgment is inevitable in weighting comparator airports and choosing thresholds. By defining these thresholds, we decided for a transparent approach. We are not suggesting our specific weighting scheme is the only possible and reasonable specification of such a scheme. We have considered any specific comments or alternative proposals in relation to the scheme, however, no suggestions were made by Dublin Airport for alternative thresholds.

Proxy Variables and Value Thresholds – Comparability of AENA and ADP

131 Dublin Airport argue that the main reasons for not relying exclusively on AENA and ADP as comparator airports are primarily their greater size and organisation as a portfolio of airports. Dublin Airport further argue that their greater size is likely to be decreasing their Betas and that the smaller airports included in the portfolios besides the main airports only make a small fraction in revenues.

132 First, the reason for not focusing more on AENA and ADP is not limited to their size and portfolio structure, but also a range of other important features reducing their comparability with Dublin Airport as set out above (see paragraph 110). Consistent with our overall approach, we remain agnostic as to whether these differences imply greater or lower risk compared to Dublin Airport, but only make a judgement to comparability.

133 Second, regarding the comparability of AENA and ADP to Dublin Airport in terms of size, Dublin Airport also states that 80 percent of revenues for ADP and 90 percent of revenues for AENA are generated from their principal domestic hub (Paris Charles de Gaulle and Madrid-Barajas). Dublin Airport hence concludes that smaller airports have minimal

weighting in the composite group Betas of AENA and ADP and that these are therefore highly comparable to Dublin Airport.

134 However, the passenger numbers at both Madrid-Barajas and Paris Charles de Gaulle account for only 20 percent of AENA's and ADP's respective total number of passengers.[22] The high revenue shares of AENA and ADP stated by Dublin Airport hence do not refer to Madrid-Barajas and Paris Charles de Gaulle. Instead, they reflect the revenue shares of the *entire* domestic networks of AENA and ADP. NERA confirm this in its report for daa although it is worded ambiguously.[23] Thus, the majority of ADP's and AENA's risk is driven by smaller, more geographically diverse airports that bear little resemblance to Dublin Airport in terms of relevant demand and business characteristics.

135 This assessment is shared by the CAA who stated in their Final Proposals for H7 that "[…] we are conscious that the three airport comparators in the baseline comparator set [AENA, ADP, FRA] own portfolios of airports rather than representing "pure-play" single airport comparators. We acknowledge that, all else being equal, this reduces their reliability as comparators" (CAA, 2022, para 9.67).

Translation into Sample Composition and Weights

136 One final criticism from Dublin Airport related to our weighting scheme concerned the way we translated our risk assessment into specific sample weights. NERA argue that our approach to keeping all comparator airports in the sample and assign them weights reflecting their comparability with Dublin Airport should be replaced with an approach of focusing on a smaller sample (1 to 3 airports) that is best comparable to Dublin Airport.

137 Dublin Airport's critique is based on the following arguments:

- Dublin Airport's Beta risk is underestimated, as most airports that are less comparable (and given less but still some weight in the sample) have lower Beta risk than Dublin Airport, and
- using a large sample was inconsistent with regulatory precedent.

138 We disagree with both arguments. We have shown at the beginning of this section that demand risk at comparator airports is driven by a range of factors. The regulatory regime (including but not limited to the price cap rigidity) is an important, but not a dominant factor in this assessment. We have shown that other factors e.g. related to the scope of regulated revenues and demand structure can always impact the level of a comparator Beta and that the direction of the impact cannot always be predicted. For instance, we have

[22] September 2022, see https://www.aena.es/en/shareholders-and-investors/financial-and-economical-information/financial-and-operational-publications.html?anio=2022 (AENA) and https://www.parisaeroport.fr/docs/default-source/groupe-fichiers/finance/relations-investisseurs/trafic/2022/adp---september-2022-traffic-figures.pdf?sfvrsn=649bec2d_2 (ADP) [31.10.2022].

[23] NERA state that "[…] around 80 per cent and 90 per cent of revenues for ADP and AENA respectively are generated from their *domestic markets*" (NERA, 2022, p.5). Elsewhere in the report the following is claimed: "we calculate that around 80 per cent and 90 per cent of revenues for ADP and AENA respectively are generated from their *principal domestic hubs*" (NERA, 2022, p.iii).

shown that FRA, which operates under looser tariff regulation than Dublin Airport, exhibits higher demand risks than Dublin Airport.

139 This multifaceted and complex situation with regard to factors that explain Beta risk makes our approach preferential to NERA's. We refrain from making discrete assumptions on what airports are more or less exposed to Beta risk than Dublin Airport, but only assign more weight to closer comparators and less weight to weaker comparators.

140 In addition, our approach comes with a further important advantage. Underlying empirical estimates of Asset Betas is a relatively high degree of uncertainty, as is evidenced by significant changes over time. It is unlikely that these movements over time are due to fundamental changes in risk exposure.

141 **Table 14** shows the development of one-year-Asset Betas before the pandemic for the stock-listed comparator airports. Based on the estimated individual Asset Betas at different points in time, a standard deviation can be backed out for each airport. The standard deviation indicates the average deviation of the Asset Beta from the sample mean each year and is an established measure of uncertainty in statistics. For individual airports, the standard deviation ranges from 0.06 to 0.17. When averaging across airports, the standard deviation decreases to 0.06 implying reduced uncertainty around the average series.

142 Based on the standard deviation, one can infer confidence intervals (CI) for each airport's Asset Beta and an average across airports. Again, when using an average across all airports, the uncertainty reduces significantly compared to (at least some) individual comparator airport Betas. The analysis suggests that one can be rather confident that the average airport Asset Beta ranges between 0.40 and 0.51. For some individual airports on the other hand confidence ranges are much larger. For example, for FHZN, with the same level of confidence, we can only limit the Asset Beta range from 0.32 to 0.80.

Table 14: Development of Asset Betas for Comparator Airports over Time

Airport	2019	2018	2017	2016	2015	SD	Lower (90% CI)	Upper (90% CI)
AENA	0.57	0.57	0.66	0.61	0.43	0.09	0.43	0.62
ADP	0.47	0.44	0.59	0.43	0.45	0.06	0.37	0.50
AIA	0.84	0.98	1.03	1.20	1.05	0.13	0.81	1.09
KBHL	0.11	0.10	0.47	0.34	0.34	0.16	0.01	0.54
FRA	0.42	0.35	0.40	0.33	0.27	0.06	0.26	0.38
FLU	0.09	0.48	0.26	0.21	0.12	0.16	-0.02	0.50
FHZN	0.57	0.79	0.73	0.51	0.37	0.17	0.32	0.80
Average	0.44	0.53	0.59	0.52	0.43	0.07	0.39	0.54

Note: Reported are 90 percent CI.

Source: Swiss Economics

143 Thus, we believe that the Asset Beta estimate we can derive from our weighted sample

- is unbiased, i.e. there is no systematic over- or underestimation of Dublin Airport's systematic risks; and
- minimises estimation errors due to random noise, i.e. the uncertainty around Dublin Airport's Asset Beta is kept to a minimum.

144 NERA's approach on the other hand demands for fundamental and unpredictable changes at every determination, as it is illustrated by their past submissions. Their proposed comparator sample has changed significantly over the last decades, as has their view on the sources of Beta risk (see **Table 15**).

Table 15: Dublin Airport (NERA's) View on Sources of Beta Risk and Suitable Comparator Sample

Period	Most relevant sources of Beta risk	Resulting comparator sample
2022 Interim Review	▪ Multi-annual price caps	AENA and to a lesser degree ADP and FHZN
2019 Determination	▪ Regulatory regime (with a focus on multi-annul price caps) ▪ Demand and supply profile	ADP, AENA and to a lesser degree AIA
2014 Determination	*No NERA analysis on Dublin Airport's Asset Beta provided*	*n/a*
2009 Determination	▪ Airport size (passenger numbers and aircraft movements) ▪ Revenue characteristics (e.g. non-aeronautical revenue split, composition of non-aeronautical revenues, dependence on major airlines, passenger mix) ▪ Regulatory framework ▪ Degree of public ownership ▪ Cost structure	FLU
2005 Determination	▪ Nature of activities and demand (size and nature of market of operation, non-aeronautical income share, level of demand) ▪ Regulatory risk (regime type, single/dual till) ▪ Cost risks ▪ Capital structure and equity ownership	Manchester Airport Group, BAA (HAL), FLU, AdR

Source: Swiss Economics analysis of past Dublin Airport submissions to CAR.

145 Our approach of using a relatively broad sample to estimate Dublin Airport's Asset Beta is not inconsistent with regulatory precedent. There is no such thing as established regulatory practice for the sample selection of comparator Betas. We believe that using a (weighted) average of a relatively large sample is a central factor that allows for regulatory consistency over time. Larger samples help ironing out random noise and idiosyncratic errors irrelevant to Dublin Airport and ensure that the sample selection process does not have to be repeated from scratch at every determination. If there are changes from one period to the next making certain airports more or less comparable to Dublin Airport, this can be reflected through adjustments to the weightings.

146 Using a larger sample to estimate the Asset Beta is not only consistent with CAR's 2019 Determination but also with the approach taken by other regulators. Regulatory precedent for using a larger sample to estimate the Asset Beta includes the following.

- By ordinance, the regulatory WACC for FHZN must base on an Asset Beta that was estimated using at least 10 comparator airports.[24]
- The New Zealand Commerce Commission has used samples of 24 comparator airports, including a significant share that was located in developing countries, to estimate AIA's Asset Beta in the past.[25]
- Despite using a smaller set of comparators for the Asset Beta determination in H7, also the CAA acknowledges that its approach is prone to estimation errors and would prefer to use a broader peer group.[26]
- Indian Institute of Management Bangalore considers 12 comparable airports for the determination of the cost of capital of Cochin International Airport Limited (CIAL) and Hyderabad International Airport Limited (HIAL). However, only six airports were considered in the final comparison set for estimating Asset Beta based on availability of market price data and the experience of the regulatory authority in assessing airport Beta.[27]
- AENA proposes calculating the Asset Beta based on the Betas of four comparable European peers, namely AdP, Fraport AG, Flughafen Wien AG, Flughafen Zürich AG. Moreover, the Commission notes that the COVID-19 pandemic drove sharp increases in both AENA's and its peers' Asset Betas in 2020. Therefore, calculated Betas vary significantly depending on whether 2020 is included in the analysis or not.[28]
- Amsterdam Airport Schiphol determines the Asset Beta based on the selection of as many listed airports as possible (but at least four), which must be representative in the European Economic Area (EEA) and Switzerland and comparable to the airport activities (a so-called peer group). If there are less than four airports, listed airports in comparable economic systems outside of the EEA and Switzerland that are representative in terms of comparability need to be selected, such that a peer group of at least four listed airports is set up.[29]

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24 Annex 1 of the Swiss Ordinance on Airport Charges, downloaded from https://www.fedlex.admin.ch/eli/cc/2012/328/en [24.11.2022].

25 Wellington Airport & others v Commerce Commission [2013] NZHC 3289

26 Appendices to the CAA's Initial Proposals on H7, page 68.

27 Indian Institute of Management Bangalore: Study on the Determination of Cost of Capital of Hyderabad International Airport Limited (HIAL), December 2020 and Study on the Determination of Cost of Capital of Cochin International Airport Limited (CIAL), March 2021.

28 Comision Nacional de Los Mercados y la Competencia: Summary of the CNMC Assessment Report on Aena's Proposal for the Regulatory Framework of Airport Charges in Spain for the 2022-2026 Period.

29 Allocation system for aviation activities of Royal Schiphol Group at Amsterdam Airport Schiphol, June 2021.

- Aeroporti di Roma (AdR) calculates the Asset Beta using the average of weekly and monthly surveys carried out over periods of 3 and 5 years on the stock prices of a sample of four comparable airports, namely Frankfurt, Paris, Zurich, and Vienna.[30]

147 To sum up, we consider that there would be more merit in the approach proposed by NERA if it could be shown that AENA and ADP are singularly good comparator for Dublin Airport, and that the multi-annual price cap regulatory framework is the only or dominant source of Beta risk. We might then want to further consider whether this outweighs the other benefits of a larger sample which we have described. However, as we have shown above, the case of both suppositions is very weak.

Translation into Sample Composition and Weights – Non-European Airports

148 Ryanair express the view that some airport comparators used are not relevant for Dublin Airport – i.e. should be assigned a weight of zero. Ryanair specifically mention that the late opening of borders for international travel in Australia (July 2022) and New Zealand (August 2022) renders the inclusion of AIA and SYD airports as comparators unreliable. Ryanair advocate using only European airports as comparators.

149 We do not agree with excluding AIA as we deem it a fitting comparator for Dublin Airport based on our analysis of demand factors, business factors, and economic regulation similarity to Dublin Airport.

150 While it is true that Australian and New Zealand borders were closed more thoroughly to international travellers than other borders due to Covid-19, a major part of this period coincides with 2020, which we do not consider in our estimation of Asset Betas.

151 For unrelated reasons, SYD was dropped as a comparator for the Final Report nevertheless. Following an acquisition by a consortium of investment funds, SYD was delisted from the Australian Securities Exchange on 18 February 2022, rendering its 12-months and 22-months Beta estimates unreliable.

5.1.3 Methodology and Data Quality

Overview of Stakeholder Responses

152 Dublin Airport have raised two separate issues with regards to the data quality underlying our assessment of the Asset Beta.

153 With regards to Copenhagen Airports (KBHL) and AIA, Dublin Airport argue that the respective stock market data is unreliable. Dublin Airport give the following reasons for their assessment:

- Only one percent of KBHL's shares are listed,
- AIA trades on the poorly diversified NZX exchange of which AIA itself constitutes six percent of the total market value,

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[30] Aeroporti di Roma: Proposal of 2021 charges, August 2020.

- KBHL as well as AIA exhibit higher illiquidity than other listed comparators, their share prices demonstrating a bid-ask spread of one percent or more.

154 With regards to the regulatory precedent underlying the Asset Betas of London Gatwick Airport (LGW) and AdR, Dublin Airport make the following points:

- The decisions underlying the respective Asset Beta estimates date from before the pandemic, which ignores the effect of the pandemic itself and changed market perceptions since.
- In general, regulatory decisions should not be considered as these regulatory Beta decisions are not directly based on market evidence but instead rely themselves on a comparator set and reflect the regulators' view of the relative risk.

155 Lastly, with regards to the estimation methodology, Dublin Airport reiterate the argument from their 2019 submission that the Miller-formula is the more appropriate re-levering formula than the Hamada-formula that we have used to convert Equity Betas into Asset Betas and vice versa.

156 We give our views on all these issues in the following sections.

Reliability of AIA and KBHL Stock Market Data

157 In our view, the fraction of KBHL's shares that is listed does not impede the accuracy of the risk signals implied in their returns. Despite only reflecting a relatively limited share of total equity, the outstanding stocks will nevertheless accurately reflect markets' expectations of future earnings. To our knowledge, there is no reason to doubt that Copenhagen Stock Exchange, on which KBHL is listed, is a liquid and efficient marketplace.

158 With regards to Dublin Airport's point on the NZX exchange being poorly diversified with AIA itself constituting a large share of the total market value, we acknowledge that this could have an effect on the level of empirically estimated Betas. With increasing weights, market portfolio returns will pick up returns of individual stocks, inflating the resulting Beta coefficients. With six percent however, AIA's weight in NZX 50 is still far from being dominant and not warranting for an adjustment that would necessarily introduce additional uncertainty in the validity of the Beta estimate.

159 Also, it is likely that a lower degree of diversification is appropriate to assume for a notional NZ investor, given the limited size of their currency area.

160 Finally, we examine whether there is an issue with AIA and KBHL stock liquidity. In principle, empirical analysis of illiquid stocks may result in artificially depressed Beta values, as trades induced by changes in market portfolio returns are executed only with a delay and not captured in the regression coefficient.

161 In general, regressions based on daily stock market returns are more susceptible to problems due to illiquidity than regressions based on weekly stock market returns, given the shorter time period underlying the returns. However, a comparison of KBHL's and AIA's 12-months and 22-months Asset Betas underlying our methodology, which we estimated based on daily data, and their respective 48-months Asset Betas, which we estimated based

on weekly data, remains unsuspicious. KBHL's Betas based on daily data are both somewhat higher than the Beta based on weekly data (0.27 and 0.31 vs 0.17, see **Table 18**). Similarly, AIA's Betas based on daily data are in fact higher than the Beta based on weekly data (1.06 and 1.01 vs 0.87, see **Table 18**). This observation is not consistent with illiquidity being an issue in our Beta estimates. However, the observation does not allow for a coherent conclusion, as it could be driven by the fact that the underlying time periods between daily and weekly data vary.

162 To get a more conclusive answer on the potential impact of illiquidity for KBHL and AIA, we re-ran our Beta estimation, using the well-established Dimson adjustment (1979) for infrequent trading and compared to resulting adjusted Beta values to our own results below (see **Table 18**).

163 Dimson (1979) adjusts for asynchronous trading by including regression coefficients with respect to lagged market returns. Hence, the Equity Betas are estimated by running the following regression:

$$r_{i,t} = \alpha_i + \beta_{i,1} r_{m,t} + \beta_{i,2} r_{m,t-1} + \varepsilon_{i,t}, \tag{1}$$

$r_{i,t}$: *stock return of asset i at time t*

$r_{m,t}$ *and* $r_{m,t-1}$: *market return of asset i at time t and t* $-$ 1 *respectively*

$\alpha_i, \beta_{i,1}$ *and* $\beta_{i,2}$: *regression coefficients*

164 The Dimson-adjusted Beta is the sum of estimated regression coefficients, i.e.:

$$\beta_{i,adj} = \hat{\beta}_{i,1} + \hat{\beta}_{i,2} \tag{2}$$

165 As usual, we apply the Hamada-formula to convert Equity Betas into Asset Betas.

166 **Table 16** reports the estimated results of the Dimson adjusted Asset Betas for AIA and KBHL and their corresponding differences to the original results presented in **Table 18**.

Table 16: Dimson Adjusted Empirical Asset Betas for AIA and KBHL

	12-months	Delta	22-months	Delta	48-months	Delta
AIA	0.93	-0.13	0.92	-0.09	0.88	0.01
KBHL	0.26	-0.02	0.30	-0.01	0.42	0.25

Note: This table reports Dimson-adjusted Asset Betas and their respective differences to the original results.

Source: Swiss Economics

167 In general, the Dimson Betas do not deviate significantly from our simple estimates. With the exception of the 48-months weekly estimates, the adjusted values decrease compared to our simple estimates, which is not consistent with illiquidity depressing unadjusted Beta estimates.

168 Thus, we do not find any evidence for KBHL and AIA Asset Beta estimates suffering from illiquidity and do not see any reason to exclude the two comparators from our sample.

Use of Regulatory Precedent

169 We accept Dublin Airport's criticism that regulatory precedent for LGW and AdR increasingly becomes outdated and may not fully reflect the latest tendencies observed in recent market conditions after the pandemic anymore.

170 We also acknowledge that Asset Betas from regulatory decisions are typically based on empirical evidence of a subset or a partially overlapping sample of the peer airport operators that are included in our own sample. As such, the use of Asset Betas from regulatory precedent bears a risk of double counting or at least of placing excess weight on some peer airport operators.

171 To some degree however, this second criticism also holds for stock market evidence of peer airport operators that are intertwined in some form with each other. For example, the Beta risk of TAV Airports Holding (TAV) should already be reflected (at least in parts) in the stock price movements for ADP and FRA. ADP owns 46 percent of outstanding TAV shares, representing a significant share of its own market capitalisation. Antalya Airport, the largest airport in TAV's portfolio, is operated under an equal rights partnership with Fraport, with both companies owning 49 percent of equity. Thus, the Beta from TAV's main airport is already reflected (again in parts) in the FRA stock price movements.

172 We consider that our amended methodology should ensure consistency of selection criteria independent of the underlying data source. Thus, as outlined under section 5.2, our preferred approach to deal with the identified issues in data quality is to exclude regulatory precedent entirely from the comparator sample and consequently also exclude TAV, which exhibits the same risks of giving other peer airports excess weight in the estimation.

Re-Levering Formula

173 Dublin Airport reiterate the argument from their 2019 submission that the Miller-formula is the more appropriate re-levering procedure than the Hamada-formula, as it relies on a constant leverage ratio rather than constant debt.

174 The Miller formula suggested by Dublin Airport assumes a constant capital structure, i.e. a fixed ratio of debt to equity. In other words, companies are assumed to rebalance their capital structures in order to keep the ratio of debt to equity constant. The Hamada formula is based on the assumption that the level of debt is fixed.

175 The assumptions underlying both formulas are unlikely to be met in practice. In the long-run, debt levels may change and there may be reasons to assume that the level of debt is not fixed. However, most firms do not constantly rebalance their debt to equity ratio.

176 For a sensitivity analysis of the two de- and re-levering formulas we refer to our 2019 Final Report. The sensitivity analysis shows that the difference in Equity Beta resulting from using one or the other formula is negligible – if a difference exists at all.

177 Given the minor impact of changing the de- and re-levering formula and the fact that the Thessaloniki Forum recommends using the Hamada formula, we continue using the Hamada formula.

5.2 Amended Methodology

178 In line with the outcomes of the discussion of the stakeholder responses above, we keep the overall methodology to estimate Dublin Airport's Equity Beta in line with the Draft Report.

179 With regards to the sample composition of comparator airports, we make the following adjustments:

- SYD is removed as a comparator from the sample, as its stock was de-listed from the Australian Securities Exchange in February 2022.
- We drop AdR and LGW as comparators. The publicly available regulatory decisions on their respective Asset Betas are becoming increasingly outdated and may risk that more recent tendencies in market perceptions of airport risk are not adequately reflected any-more.
- We also drop HAL as the remaining comparator based on regulatory precedent from the sample despite the availability of recent regulatory precedent in the form of the CAA's Final Proposals. HAL's pre-pandemic Asset Beta (i.e. the starting value underlying the CAA's Beta analysis) is based on the empirical analysis of stock price movements for FRA, ADP, and AENA – all airports that we already consider separately. Thus, including HAL's recent regulatory precedent would risk putting excess weight on these airports without contributing new evidence.
- For similar reasons, we exclude TAV from our sample. First, TAV is partially owned by Groupe ADP (a share of 46 percent) so that its Beta risk is already (although arguably with a limited weight) reflected in the ADP's empirical Asset Beta. Second, since the closure of Istanbul Atatürk airport in 2019, the only airport exceeding 15 million passengers per year (pre-Covid-19) is Antalia airport, whose ownership is shared with Fraport and therefore, to some extent, already reflected in our sample. The fact that its portfolio primarily consists of airports located in developing countries with questionable comparability to Dublin Airport contributed to our decision to exclude TAV from the sample.

180 Finally, we reviewed our comparability assessment of peer airports in our 2019 Report on Dublin Airport's cost of capital and concluded that the relative differences of our sample weights are still appropriate. To our knowledge, there was no significant change in underlying economic regulation, demand, or business structure for any of the peer airports that would make the existing weighting scheme inept.

181 However, because of the reduced number of peer airports in the sample, we had to adjust the individual weights, so that the sum of all weights added up to 100 percent. A discussion of our review and the resulting sample weights is included below in section 5.3

182 The updated sample composition of peer airports and their weightings is illustrated in **Table 17**.

Table 17: Sample Composition and Weights

	Economic Regulation	Demand	Business	Total	Resulting Sample Weight
AENA	★★★☆☆	☆☆	★☆	★★★★☆☆☆☆	15%
ADP	★☆☆☆☆	★☆	★☆	★★★☆☆☆☆☆	12%
AIA	★★☆☆☆	★★	★★	★★★★★★☆☆	23%
KBHL	☆☆☆☆☆	★☆	★★	★★★☆☆☆☆☆	12%
FRA	★☆☆☆☆	★☆	★☆	★★★☆☆☆☆☆	12%
FLU	★★☆☆☆	★☆	★☆	★★★★☆☆☆☆	15%
FHZN	★☆☆☆☆	★☆	★☆	★★★☆☆☆☆☆	12%

Note: Scores adopted from 2019 Final Report.

Source: Swiss Economics

183 We continue to estimate empirical Asset Betas of peer airports using non-pandemic data only. However, instead of using a combination of a post-pandemic 1-year Beta and pre-pandemic 1-year, 2-year, and 5-year Betas we change back to 1-year, 2-year, and 5-year Betas with the most recent available data consistent with our 2019 Final Report. Since our data series end on 31 October 2022, we omit data for November and December 2020 in our 2-year Beta estimates and all of 2020 from our 5-year Beta estimate, such that the 2-year Beta includes 22 months instead of 24 months of data and the 5-year Beta includes 48 months instead of 60 months of data.

184 Otherwise, we have not changed our empirical estimation methodology compared to the Draft Report. Specifically, we kept the following approach:

- Use of total return indices.
- Use of STOXX Europe 600 Index for European airport operators and NZX 50 Index for AIA.
- Unlevering using the Hamada-formula based on market values of equity, book values of net debt, and effective tax rates.

185 The resulting Asset Betas per comparator and the resulting weighted average that reflects Dublin Airport's Asset Beta are presented in **Table 18**.

Table 18: Empirical Asset Betas

	12-months / 1-year	22-months / 2-year non-pandemic	48-months / 5-year non-pandemic
AENA	0.72	0.70	0.71
ADP	0.58	0.52	0.68
AIA	1.06	1.01	0.87
KBHL	0.27	0.31	0.17
FRA	0.45	0.45	0.63
FLU	0.24	0.33	0.21
FHZN	0.64	0.62	0.70
Dublin Airport (weighted average)	**0.61**	**0.61**	**0.59**

Note: Dublin Airport row reflects column averages across comparators using the weights set out in Table 17. Non-pandemic refers to the fact that all data from 2020 was removed from the underlying data.

Source: Swiss Economics

186 As a cross check and responding to Dublin Airport's critique regarding the comparability of Heathrow's and Dublin Airport's Asset Betas, we put these estimates into context with recent regulatory precedent. Two decisions made by the CAA, that were published after the Covid-19 pandemic outbreak, are particularly relevant:

- **H7 Final Proposals**: In June 2022, the CAA published its Final Proposals on HAL's H7 regulatory period, including a section on the cost of capital (CAA, 2022). The CAA estimates a pre-Covid Asset Beta for HAL of 0.5 in line with its 2014 Q6 Determination. In light of changes of relative risk differences to other airports due to the pandemic (e.g. relaxed capacity constraints, a reduction of the share of long-haul traffic, or slower traffic growth than other airports), the CAA updates its baseline Asset Beta to a range between 0.5 and 0.6. Based on the results of a Flint report (Flint, 2021), the CAA further adds an uptick of between 0.02 to 0.11 units to reflect risk directly induced by catastrophic events over the H7 period. However, this adjustment is more than offset by a further adjustment of the CAA to reflect mitigated demand risks due to a new traffic risk sharing (TRS) mechanism that is introduced for H7. The H7 TRS allows for ex-post adjustments of the price cap if passenger numbers turn out lower or higher than expected, which the CAA believes could be of particular importance during the still uncertain path to recovery of the air travel industry after the pandemic. The CAA's final proposals for HAL's Asset Beta range from 0.44 to 0.62. While no explicit point estimate is reported, the midpoint is used for the calculation of the WACC point estimate.

  Thus, our Asset Beta estimates for Dublin Airport fall within the CAA's range for HAL, but at the top end. A quick comparison of some of the two airports' characteristics does not raise any doubts with regards to Dublin Airport's Beta or its relative difference to HAL's. In terms of regulatory environment, the two airports are comparable in principle. The introduction of the TRS for HAL may imply somewhat lower demand risks over the next regulatory period. However, CAR has demonstrated to review and adjust tariffs during difficult times with an effect comparable to a TRS (at least for large demand shocks). Additionally, Dublin Airport's upcoming regulatory period will last for four years, i.e. one year less than H7, decreasing the demand risk from its price cap. In relation to demand structure, HAL is possibly less capacity constrained over the coming years during economic recovery than before the pandemic. Overall, HAL's demand risks should be comparable to Dublin Airport's. An Asset Beta within but closer to the top of the range for HAL's Asset Beta seems reasonable given the two airports' risk profiles.

- **NR23 Initial Proposals**: In October 2022, the CAA released its Initial Proposals on the regulatory period from 2023 to 2027 for en-route air traffic control services above the UK and the North Atlantic, which are currently licensed to NATS (En Route) Plc (NERL). The CAA determines a range of NERL's pre-Covid Asset Beta from 0.52 to 0.62 and after consideration of pandemic risks (based on a weighted benchmark of a listed traffic controller and other airports) a range from 0.54 to 0.64. The difference compared to HAL's Asset Beta range is mostly due to the inclusion of the air traffic controller ENAV as a comparator in the empirical Beta estimation, which, according to the CAA, faces higher regulatory uncertainty than airports.

  Again, the proposed range of the Asset Beta for NERL includes our Asset Beta range for Dublin Airport und does not raise any concerns.

5.3 Updated Results

187 The empirically derived Asset Betas for Dublin Airport transformed into a range of Equity Betas using a re-levering factor of 1.88 with a gearing of 60 percent and a tax rate of 12.5 percent. **Table 19** shows the range and midpoint of Dublin Airport's Asset and Equity Betas.

Table 19: Range of Dublin Airport's Asset and Equity Betas

	Asset Beta	Equity Beta
Lower boundary	0.59	1.11
Upper boundary	0.61	1.15
Midpoint	0.60	1.13

Source: Swiss Economics

188 The updated Beta midpoints suggest a slight increase in Dublin Airport's exposure to systematic risk compared to previous assessments. Compared to the 2019 Determination, Dublin Airport's Asset Beta (Equity Beta) has increase by 0.10 units (0.19 units). Compared to the Draft Report, the increase in the Asset Beta (Equity Beta) is 0.04 units (0.08 units).

Table 20: Change in Asset and Equity Betas

	2022 Final Report	2022 Draft Report	Change	2019 Determination	Change
Asset Beta	0.60	0.56	↖ 0.04	0.50	↖ 0.10
Equity Beta	1.13	1.05	↖ 0.08	0.94	↖ 0.19

Source: Swiss Economics

6 Cost of Debt

6.1 Assessment of Stakeholder Responses

189 Dublin Airport state that we failed to include issuance cost for our determination of cost of new debt, since these are not included in any other building block, e.g. as part of Opex or the RAB.

190 For the Final Report, we use actual information on issuance costs for embedded debt to determine a cost uptick for the overall cost of debt.

191 In its response to the Draft Decision, Dublin Airport noted that the forward rate adjustment for the cost of new debt should be based on Irish government bonds.

192 In principle, we agree with Dublin Airport's point of view that an Irish forward rate adjustment would be more appropriate. However, we refrain to adapt the methodology based on Irish government bonds, as we have some concerns relating to data uncertainty and availability. However, Appendix A.2 reports the results of a sensitivity analysis using an Irish forward rate adjustment. The results show that the change to an Irish forward rate would likely have very little impact on the WACC.

193 Both IATA and Ryanair disagree with us using a longer time to maturity for the cost of new debt. For IATA, there was no evidence given as to why 10+ year maturities should be more efficient than 7-year to 10-year maturities. The change to a longer time horizon in the cost of new debt is due to continued evidence that daa's actual debt tenor at issuance is closer to 15 years than 10 years. We have no reason to believe that this is an inefficient practice and therefore changed our approach. Thus, the use of bond yields with remaining time to maturity closer to Dublin Airport's actual debt tenor serves as a more adequate proxy for the estimation of its cost of new debt.

194 IATA state that we underestimate the weight of embedded debt. For the Final Report, we use an updated split between new debt and embedded debt, reflecting the average expected share between existing debt and new debt over the 2023-26 period.

6.2 Amended Methodology

Issuance Costs

195 For the Final Report, daa has provided us with a list of issuance expenses that were incurred on embedded debt. The details of the issuance date, cost, and maturity date per bond are

summarized in **Table 21**. The yearly write-offs over the bond lifetime are calculated by dividing the total issuance cost by the period the bonds will be amortized.

Table 21: Overall Issuance Cost Details

[✂]

Note: [✂].

Source: Swiss Economics based on daa data

196 Table 22 depicts the embedded debt forecast over the regulatory period, assuming constant amortisation profile.

Table 22: Embedded Debt Forecast (EUR m)

[✂]

Note: [✂].

Source: Swiss Economics based on daa data.

197 [✂] this leads to an issuance cost uptick **to the cost of debt** of **5 basis points**.

Adjusted Investment Horizon

198 As in the Draft Report, we amended the methodology for estimating Dublin Airport's cost of new debt to better reflect actual time to maturities at issuance of Dublin Airport's debt. In the 2019 Final Report, we still used a notional investment horizon of 10 years for the cost of new debt in line with our assessment of the cost of equity. Given continued evidence that the average time to maturity at issuance of daa's debt is approximately 15 years, we solely focus on bond yields of an index for corporate bonds with a remaining maturity of more than 10 years as a benchmark. For the 2019 Determination, we also considered a similar index for bonds with a remaining time to maturity of between 7 to 10 years.

BBB+ Rated Non-Financials for Cost of New Debt

199 In previous reports, we estimated the cost of new debt using a notional BBB credit rating and presented results for a BBB+ credit rating only as a sensitivity. For this Final Report, the main result is now based on a BBB+ credit rating, following continued practice by CAR to use this credit rating in other building blocks.

Averaging Period

200 As already stated in section 3.2 and due to the circumstances in the bond market at the end of 2021 and at the beginning of 2022, we deem it reasonable to reduce the averaging period not only for the estimation of the RFR but also for the estimation of the cost of new debt to 6 months.

6.3 Cost of Embedded Debt

201 To estimate the level of embedded debt, we use daa information from October 2022 on current outstanding loans.

202 **Table 23** summarizes daa's current debt structure and the real interest rate paid on its debt. The total current amount of embedded debt decreased from EUR 1,686.8m to EUR 1,642.3m compared to the Draft Report. This is in part due to [✂].

203 The current real interest rate paid on the outstanding loans decreased by 90 basis points, due to a marked increase in inflation expectations.

Table 23: daa Debt Structure per October 2022

[✂]

Note: [✂].

Source: Swiss Economics based on daa data

204 The weighted average of real interest rates across embedded debt as of October 2022 is -1.13 percent, i.e. 80 basis points lower than in the Draft Report using December 2021 data.

205 **Table 24** reports annual forecasts of real interest rates for embedded debt which is determined by the expected amortisation schedule of embedded debt.

Table 24: Forecast of Real Interest Rates per Embedded Debt Class over 2023-26

Name	2023	2024	2025	2026	Average (2023-2026)
Weighted Average	-1.16%	-1.18%	-1.21%	-1.23%	**-1.19%**

Note: Reported are interest rates and loan amounts as of October 2022. Nominal interest rates are converted to real interest rates using a rate of 2.67 percent for expected inflation as of October 2022.

Source: Swiss Economics

206 **Table 25** summarizes the upper and lower bound estimates for the cost of embedded debt. The upper bound is based on current real interest rates (see **Table 23**) and the lower bound is based on expected average real interest rates over the next regulatory period (see **Table 24)**. The midpoint of -1.16 percent implies a decrease of cost of embedded debt by 79 basis points compared to the Draft Report.

Table 25: Summary on Cost of Embedded Debt

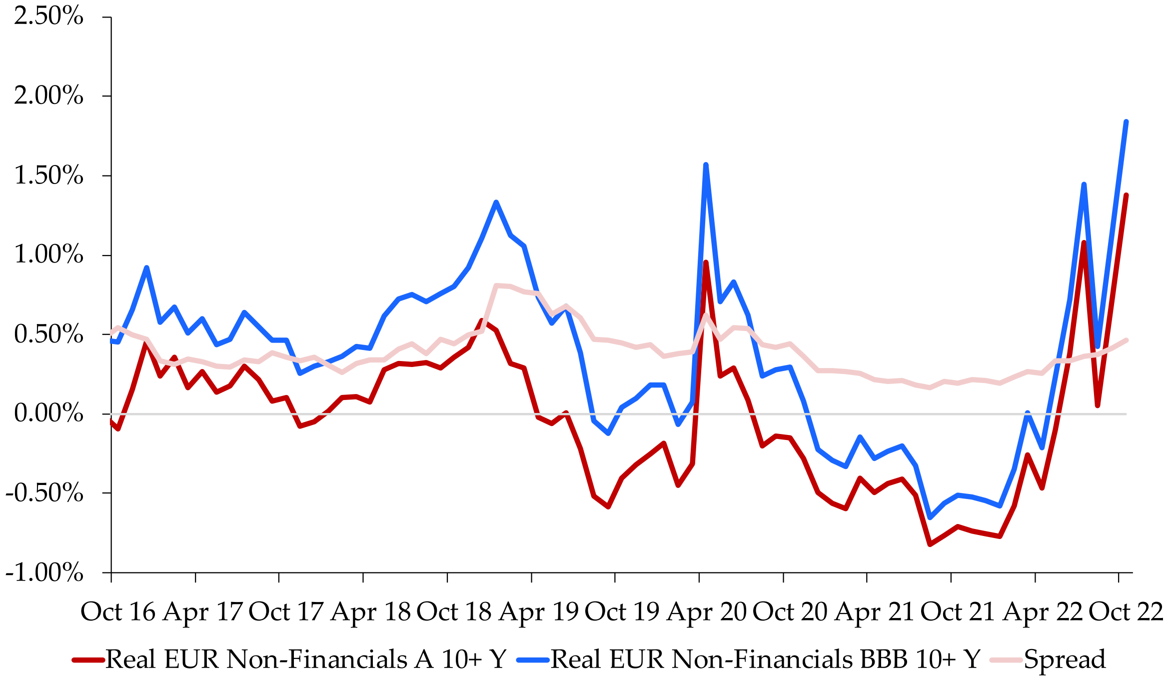
	Lower bound	Upper bound	Point estimate
Real cost of embedded debt	-1.19%	-1.13%	-1.16%

Source: Swiss Economics

6.4 Cost of New Debt

207 **Figure 10** shows real yields of the iBoxx EUR A and BBB Non-Financials over the last five years. We find an increase in real yields compared to the Draft Report, even if expected inflation has increased markedly. This is likely due to the ECB interest rate hikes' effects on nominal yields.

Figure 10: Real Yields of the iBoxx EUR A and BBB Non-Financials 10+ Years with Corresponding Yield Spread



Note: Real yields are calculated using the Fisher equation. Therefore, expected inflation 15 years ahead as of October 2022 was used, which corresponds 2.94 percent.

Source: Swiss Economics based on Refinitiv Eikon data.

208 **Table 26** reports the averages of both the A-rated and BBB-rated non-financials, as well as the calculation of the downward notch to convert the BBB to BBB+ non-financials. We find that the spread between A-rated and BBB-rated bonds for the 6-months average corresponds roughly to the 5-year average. This is still markedly lower than the spreads found in the 2019 Report. However, it confirms our point made in the Draft Report on the unusual bond market situation concerning, among other things, a reduced risk premium for BBB-rated bonds with respect to A-rated bonds in 2021.[31]

[31] The spread between A-rated and BBB-rated bonds in Figure 10 increased during 2022. The lowest spread in the present series is found in July 2021 at 0.17 percent which is markedly lower than the spread in October 2022 which is found at 0.5 percent.

Table 26: Real Yields based on iBoxx Indices and Calculated Adjustment

Index	6-months average	1-year average	2-year average	5-year average
iBoxx EUR Non-Financials A	0.79%	0.15%	-0.22%	-0.06%
iBoxx EUR Non-Financials BBB	1.19%	0.48%	0.06%	0.34%
Delta A to BBB	0.41%	0.33%	0.27%	0.40%
Delta BBB+ to BBB (1/3 x Delta A to BBB)	0.14%	0.11%	0.09%	0.13%

Source: Swiss Economics based on Refinitiv Eikon data.

209 **Table 27** adds a forward-looking adjustment to the cost of new debt. The cost of new debt at BBB credit rating ranges between 1.33 percent and 1.52 percent, depending on the adjustment leading to a point estimate of 1.43 percent.

Table 27: Calculation of the Cost of New Debt at BBB Rating

		Lower bound	Upper bound
	Current investment grade yields (6-months average)	1.19%	1.19%
+	Forward-looking adjustment of new debt	0.14%	0.33%
=	Cost of new debt at BBB credit rating	1.33%	1.52%

Source: Swiss Economics

210 To arrive at the cost of new debt at BBB+ credit rating a downward notch is calculated based on the results in **Table 26** and applied in **Table 28**. The resulting cost of new debt ranges from 1.20 percent and 1.39 percent with an average of 1.29 percent.

Table 28: Calculation of the Cost of New Debt at BBB+ Rating

Cost of new debt	Lower bound	Upper bound
Cost of new debt at BBB credit rating	1.33%	1.52%
Downward adjustment notch from BBB+ to BBB	0.14%	0.14%
Cost of new debt at BBB+ credit rating	1.20%	1.39%

Source: Swiss Economics

211 This is a significant increase in the cost of new debt compared to the Draft Report. One reason for this is the shorter averaging period, but also the long-expected increase in bond yields in recent months.

6.5 Conclusion

212 **Table 29** presents an overview of the cost of debt calculation. We use a share of 27 percent for cost of new debt and a share of 73 percent for embedded debt, reflecting updated information on the debt structure provided to us by CAR. This also aligns relatively closely with the weighting for new debt calculated by Dublin Airport (26 percent). Applying this new split, we find a pre-tax cost of debt of -0.43 percent for the upcoming regulatory period.

Table 29: Weighted Cost of Debt

	Lower bound	Upper bound	Point estimate	Split
Cost of embedded debt	-1.19%	-1.13%	-1.16%	73%
Cost of new debt	1.20%	1.39%	1.29%	27%
Weighted cost of debt	-0.55%	-0.45%	-0.50%	
Issuance Cost Uptick	0.05%	0.05%	0.05%	
Weighted cost of debt incl. issuance cost uptick	**-0.50%**	**-0.40%**	**-0.45%**	

Source: Swiss Economics.

213 **Table 30** summarises our findings for the range of the cost of debt and compares it to the range found in the Draft Report.

Table 30: Summary Cost of Debt

	Range	Point estimate
Final Report advice for cost of debt	-0.50% – -0.40%	-0.45%
Draft Decision advice for cost of debt	-0.26% – 0.14%	-0.06%

Source: Swiss Economics.

7 Aiming Up

7.1 Assessment of Stakeholder Responses

214 IATA, Aer Lingus, and Ryanair expressed a concern regarding the use of an aiming up allowance.

215 IATA argue that measurement errors can be positive or negative, and that it is not clear why the regulated company should be shielded from potential negative errors but be allowed to benefit from potential positive ones. Ryanair do not agree with the notion that the effects of underinvestments, relative to overinvestments, are asymmetric, and states that no cogent explanation is provided as to why this is so. Ryanair state that this is particularly the case where much of the proposed investment is premature and not required by users.

216 Aer Lingus finally state that a government-owned company does not require an aiming up allowance. Also, Aer Lingus are of the opinion that our methodology already overestimates individual components of the WACC.

217 We agree with IATA's concerns that measurement errors can be positive or negative. However, the reasoning behind the use of an aiming up is that the consequences of positive and negative measurement errors are asymmetric. An overestimation of the WACC can lead to excessive airport charges which harm consumers. An underestimation of the WACC may lead to underinvestment over the next regulatory period. Given the nature and scale of the investment programme, and the status of Dublin Airport within Ireland, we remain of the view that this would have longer lasting consequences for the Irish air travel industry and the Irish economy in general.

218 We agree that airlines would be negatively affected by an overestimation of the WACC and resulting higher airport charges. Passengers may also be negatively affected through reduced choice and value in relation to air travel. The timing of this effect will depend on CAR's approach to financeability and profiling of capital expenditure allowances. For example, if the aiming up allowance just reduces a given requirement for pre-funding to finance the allowed investment programme over 2023-2026, then the aiming up will not impact airport charges over 2023-2026, but in future periods.

219 Airlines also benefit from investments, particularly capacity investments for their own operations, but also those for other operators; for example, where capacity expansion facilitates an increase in passengers which creates downward pressure on the price cap per-passenger. CAR has assessed that a high level of capital investment, relative to historic levels, is in the interests of current and future airport users. An underinvestment over the next regulatory period is most likely not in the interest of airlines, as it will constrain their growth plans at the airport into the future, nor of passengers as it will lead to diminished service quality and/or reduced value and choice in relation to air travel.

220 We note that Aer Lingus and Ryanair are strongly supportive of the projects expected to be used by them to facilitate their plans at Dublin Airport. Indeed, Ryanair supports an even larger capacity expansion to Pier 1 (where Ryanair operates) than included in the Dublin

Airport Capital Investment Programme (CIP), stating that this should be added to the CIP now to 'ensure an acceptable level of contact service is provided in Terminal 1'. We note that this is not required to deliver an airport capacity of 40 million passengers per annum expected by 2030.

221 Aer Lingus further stress the importance of a timely delivery of Dublin Airport's CIP and specifically of the South Apron Hub. The proposed CIP – including a revised timescale foreseeing the completion of the South Apron Hub by 2030 instead of 2027 – will, according to Aer Lingus, delay economic benefits for Ireland, increase inefficiency, and constrain traffic growth:

- Delay of economic benefits: Aer Lingus argue that the delay to the development of the South Apron infrastructure will lead to Dublin Airport losing its competitive position relative to other transatlantic hubs and the economic benefits provided to Ireland will be delayed and reduced.
- Increased inefficiency: The airline states that a delayed South Apron hub infrastructure constrains the airport's operational efficiency.
- Constrained traffic growth: Aer Lingus analysis show that passenger and traffic volumes will exceed the capacity of Customs and Border Protection by 2023 and the East Stands by 2026. This will hold back growth at Dublin Airport and, by extension, the benefits of the Irish aviation to the wider economy.

222 Aer Lingus specifically acknowledge the dynamic economic effects of Dublin Airport for the Irish economy. A study it commissioned on the Economic impact of the development of Dublin airport as a hub found that this would generate roughly 40,000 jobs and additional GDP of more than EUR 18 bn (EY, 2018). Aer Lingus warn that the 'delay to the realisation of an efficient hub risks Ireland losing these considerable benefits should aircraft need to be deployed elsewhere in the event that operational stands and infrastructure are not available at Dublin Airport.'

223 Thus, when it comes to their own operations, we consider that the airlines reveal that they agree with us on the asymmetric impact of underinvestment during 2023-2026.

224 Furthermore, in contrast to the case of an airport under a strict price cap regime and under a WACC that is too low, an airline is able to pass on higher airport charges to consumers in the case of a high WACC. This again highlights the asymmetric effects of underestimation vs overestimation of the WACC.

225 Regarding Aer Lingus's comments on government-owned companies, we note that it may be true that the risk of underinvestment tends to be reduced for a public entity that also follows other goals than pure profit orientation. Still, since this is a hypothetical argument and we are not aware of any evidence to support this claim, allowing for an aiming up component is in line with a prudent approach to regulation.

226 We do not agree with Air Lingus' claim that our methodology involves an implicit overestimation of the WACC components. In contrast to other regulatory precedent, our methodology follows best practice regarding the estimation of all individual WACC components.

We also base the point estimates of all elements on the 50th percentile of their estimated ranges and do not include any implicit aiming up.

227 Other regulators which do not rely on an explicit aiming up component most often use upper boundaries of ranges instead. A recent example is the December 2020 decision by the Commission for Regulation of Utilities (CRU), which uses the 67th percentile of the component's ranges.[32] The CRU highlights two reasons for relying on the 67th percentile, both of which are also applicable for the use of an aiming up component: Alignment with regulatory precedent and alignment with investment ambitions of the regulated entity. If we were to decide on not allowing for an explicit aiming up, we would most likely use upper boundaries of estimates components' ranges instead.

228 In general, there is no substantive change in regulators' approaches to aiming up compared with the 2019 Determination. For a broader overview of Irish regulatory precedent, we refer to section 7.2 of the 2019 Report.

229 Finally, the argument for aiming up is particularly strong regarding new investments. The UKRN argues that the WACC on new investments should be set above the 90th percentile of the range depending on their importance. For sunk investments, the UKRN argues that the point estimate of the true WACC is enough (UKRN, 2018). Considering Dublin Airport's CIP that will enable growth in passenger numbers to 40mppa, we believe aiming up the WACC – based on point estimates – is still a prudent approach.

7.2 Amended Methodology

230 We see no reason to deviate from our advice on an aiming up component of the WACC by 50 basis points to mitigate the risks associated with measurement errors.

7.3 Updated Results

231 **Table 31** summarises our advice on aiming up.

Table 31: Summary Aiming Up

	Range	Point estimate
Final Report	n/a	50 bps
Draft Decision	n/a	50 bps

Source: Swiss Economics.

[32] See https://www.cru.ie/wp-content/uploads/2020/12/CRU20152-TSO-and-TAO-Transmission-Revenue-2021-20252.pdf [24.11.2022].

8 Conclusion

232 We estimate a final range of the efficient level of real cost of capital for Dublin Airport for the 2023-26 period of 4.35 percent. **Table 32** summarises our findings using the amended methodologies as well as updated data until 31 October 2022. To estimate the ERP for the upper and lower bounds we use the point estimate.

Table 32: Ranges and Point Estimates for all Individual WACC Components

	Lower bound	Upper bound	Point estimate
Gearing	45.00%	55.00%	50.00%
Tax rate	12.50%	12.50%	12.50%
RFR	-0.85%	-0.06%	-0.45%
TMR	5.70%	6.81%	6.25%
ERP	6.15%	7.26%	6.71%
Asset Beta	0.59	0.61	0.60
Equity Beta	1.11	1.15	1.13
Cost of equity (post-tax)	5.99%	8.29%	7.13%
Cost of embedded debt	-1.19%	-1.13%	-1.16%
Cost of new debt	1.20%	1.39%	1.29%
Issuance cost uptick	0.05%	0.05%	0.05%
Cost of debt (pre-tax)	-0.50%	-0.40%	-0.45%
True pre-tax WACC	3.54%	4.04%	3.85%
Aiming up	0.50%	0.50%	0.50%
Advice on regulatory pre-tax WACC	4.04%	4.54%	4.35%

Note: Assuming a notional BBB+ credit rating for Dublin Airport and applying a new embedded debt to new debt split.

Source: Swiss Economics

233 **Table 33** summarizes the point estimates of all WACC components and compares them with the Draft Decision values.

Table 33: Regulatory WACC Advice and Comparison with Draft Report

	2022 Final Report	2022 Draft Report	Difference
Gearing	50.00%	50.00%	*unchanged*
Tax rate	12.50%	12.50%	*unchanged*
RFR	-0.45%	-1.07%	↖ 61 bps
TMR	6.25%	6.25%	*unchanged*
ERP	6.71%	7.32%	↙ 61 bps
Asset Beta	0.60	0.56	↖ 0.04
Equity Beta	1.13	1.05	↖ 0.08
Cost of equity (post-tax)	7.13%	**6.60%**	↖ **53 bps**
Cost of embedded debt	-1.16%	-0.37%	↙ 79 bps
Cost of new debt	1.29%	0.35%	↖ 95 bps
Issuance cost uptick	0.05%	0.00%	↖ 5 bps
Share embedded/new debt	73%	62%	↖ 11 bps
Cost of debt (pre-tax)	**-0.45%**	**-0.10%**	↙ **35 bps**
Aiming up	0.50%	0.50%	*unchanged*
Advice on regulatory pre-tax WACC	**4.35%**	**4.22%**	↖ **13 bps**

Note: Assuming a notional BBB+ credit rating for Dublin Airport.

Source: Swiss Economics.

234 Our Final Report advice implies an increase in the regulatory WACC of 13 basis points compared to the Draft Decision. The increase is mainly due to an increase in Asset Beta and an increase in the cost of new debt, which are partly offset by a decrease in the cost of embedded debt.

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A Appendix

A.1 Irish and German government bonds data

Table 34 and **Table 35** list all Irish and German Government Bonds used for the main methodology in the present report.

Table 34: Irish Government Bonds

ISIN	Maturity	Coupon
IE00B6X95T99	18 Mar 2024	3.4
IE00B4TV0D44	13 Mar 2025	5.4
IE00BV8C9418	15 May 2026	1
IE00BKFVC568	15 May 2027	0.2
IE00B4S3JD47	20 Mar 2023	3.9
IE00BFZRQ242	18 Mar 2031	1.35
IE00BJ38CR43	15 May 2030	2.4
IE00BH3SQ895	15 May 2029	1.1
IE00BDHDPR44	15 May 2028	0.9
IE00BKFVC899	18 Oct 2030	0.2
IE00B7XWNN51	20 Jul 2027	5.72
IE00B8J2NN65	20 Jul 2027	5.72
IE00BMQ5JL65	18 Oct 2031	0
IE00BMD03L28	18 Oct 2032	0.35
IE00B7Z55X64	20 Mar 2032	5.82
IE00B8HCPH68	20 Mar 2032	5.82
IE00BFZRPZ02	15 May 2033	1.3
IE00BKFVC345	15 May 2035	0.4

Source: Refinitiv Eikon.

Table 35: German Government Bonds

ISIN	Maturity	Coupon	Inflation-linked
DE0001030542	15 Apr 2023	0.10	Yes
DE0001030559	15 Apr 2030	0.50	Yes
DE0001030567	15 Apr 2026	0.10	Yes
DE0001030583	15 Apr 2033	0.10	Yes
DE0001104834	10 Mar 2023	0.00	No
DE0001141778	14 Apr 2023	0.00	No
DE0001104842	16 Jun 2023	0.00	No
DE0001030740	15 Oct 2027	1.30	No
DE0001102309	15 Feb 2023	1.50	No
DE0001102317	15 May 2023	1.50	No

DE0001102325	15 Aug 2023	2.00	No
DE0001102333	15 Feb 2024	1.75	No
DE0001102358	15 May 2024	1.50	No
DE0001102366	15 Aug 2024	1.00	No
DE0001102374	15 Feb 2025	0.50	No
DE0001102382	15 Aug 2025	1.00	No
DE0001102390	15 Feb 2026	0.50	No
DE0001104859	15 Sep 2023	0.00	No
DE0001102416	15 Feb 2027	0.25	No
DE0001102424	15 Aug 2027	0.50	No
DE0001102440	15 Feb 2028	0.50	No
DE0001102457	15 Aug 2028	0.25	No
DE0001102465	15 Feb 2029	0.25	No
DE0001141786	13 Oct 2023	0.00	No
DE0001104867	15 Dec 2023	0.00	No
DE0001104875	15 Mar 2024	0.00	No
DE0001141794	5 Apr 2024	0.00	No
DE0001141802	18 Oct 2024	0.00	No
DE0001141810	11 Apr 2025	0.00	No
DE0001030716	10 Oct 2025	0.00	No
DE0001141828	10 Oct 2025	0.00	No
DE0001141836	10 Apr 2026	0.00	No
DE0001102606	15 Aug 2032	1.70	No
DE0001102408	15 Aug 2026	0.00	No
DE0001141844	9 Oct 2026	0.00	No
DE0001141851	16 Apr 2027	0.00	No
DE0001102523	15 Nov 2027	0.00	No
DE0001102556	15 Nov 2028	0.00	No
DE0001104883	14 Jun 2024	0.20	No
DE0001104891	13 Sep 2024	0.40	No
DE0001134922	4 Jan 2024	6.25	No
DE0001135044	4 Jul 2027	6.50	No
DE0001135069	4 Jan 2028	5.63	No
DE0001135085	4 Jul 2028	4.75	No
DE0001135143	4 Jan 2030	6.25	No
DE0001135176	4 Jan 2031	5.50	No
DE0001135226	4 Jul 2034	4.75	No
DE0001102473	15 Aug 2029	0.00	No
DE0001102499	15 Feb 2030	0.00	No

DE0001030708	15 Aug 2030	0.00	No
DE0001102507	15 Aug 2030	0.00	No
DE0001102531	15 Feb 2031	0.00	No
DE0001030732	15 Aug 2031	0.00	No
DE0001102564	15 Aug 2031	0.00	No
DE0001102580	15 Feb 2032	0.00	No
DE0001102515	15 May 2035	0.00	No

Source: Refinitiv Eikon.

A.2 Nominal Cost of Debt

235 **Table 36** reports our estimate for the level of cost of debt in nominal terms.

236 Both, the cost of embedded debt as well as the cost of new debt, were estimated using the methodology outlined in section 6.3 and 6.4 (i.e. based on Dublin Airport's actual payments for embedded debt over the 2023-26 period and a 6-months-average of a comparator bond yields index). However, we omitted the transformation from nominal to real yields based on the Fisher transformation and kept all rates in nominal terms.

Table 36: Cost of Debt in Nominal Terms

	Lower bound	Upper bound	Point estimate
Nominal cost of embedded debt	1.45%	1.51%	1.48%
Cost of new debt	3.89%	4.08%	3.99%
Nominal cost of debt (w/o issuance cost) (using a split of 73% for embedded debt and 27% for new debt)	2.11%	2.20%	2.16%
Issuance cost uptick	0.05%	0.05%	0.05%
Total nominal cost of debt	**2.16%**	**2.25%**	**2.21%**

Source: Swiss Economics based on daa data and Refinitv Eikon data.

A.3 Irish Forward Rate and Corresponding WACC

237 To calculate the forward yields with 10 years to maturity for the next four years, we need the spot rates for bonds with maturities ranging from 1 to 4 and from 11 to 14 years (see the forward rate formula in equation 1). Irish government bonds under consideration are those with remaining time to maturity between 4 months and 14 years and 6 months. For our framework the time to maturity had to be rounded to the next full year[33]. In some instances, there were multiple bonds having the same rounded time to maturity. In these cases, the bond having a remaining time to maturity closer to the rounded value was used for the forward rate calculation. In other instances, different bonds had the same remaining time

[33] That is, the time to maturity within a range of more or less than six months was rounded to the next whole year.

to maturity, but their spot rates were nearly identical. Thus, either of these has been included in the forward rate calculation.

$$i_{y^{t_x}}^{FOR} = \left[\frac{(1+i_x)^x}{\left(1\ +1_y\right)^y}\right]^{\frac{1}{x-y}} \quad (3)$$

$i_{y^{t_x}}^{FOR}: implicit\ foward\ rate\ for\ a\ bond\ from\ t_y\ to\ t_y$

$i_x: spot\ rate\ at\ time\ t_x$

$i_y: spot\ rate\ at\ time\ t_y\ (where\ t_y\ is\ closer\ to\ the\ present\ than\ t_x)$

238 We found bonds for almost all required maturities. However, within the outstanding government bonds, there is no bond with 12 years remaining time to maturity. The forward rate estimate for the year 2024 is thus lacking and has to be extrapolated using the forward rates of 2023 and 2025. The bonds used for the analysis are listed in **Table 37** including the calculated time to maturity as well as the rounded value for the time to maturity.

Table 37: Irish Government Bond Data for Remaining Time to Maturity between 0 and 15 Years

Bond Name	ISIN	Maturity Date	Issuance Date	Time to maturity	Rounded years to maturity
3.90 per cent Treasury Bond 2023	*IE00B4S3JD47*	*2023-03-20*	*2022-10-21*	*0 y, 4 m, 19 d*	-
3.40% Treasury Bond 2024	IE00B6X95T99	2024-03-18	2022-10-21	1 y, 4 m, 17 d	1
5.40 per cent Treasury Bond 2025	IE00B4TV0D44	2025-03-13	2022-10-21	2 y, 4 m, 12 d	2
1.00 per cent Treasury Bond 2026	IE00BV8C9418	2026-05-15	2022-10-21	3 y, 6 m, 14 d	3
0.20% Treasury Bond 2027	IE00BKFVC568	2027-05-15	2022-10-21	4 y, 6 m, 14 d	4
5.72 per cent Amortising Bond 20 July 2027	*IE00B7XWNN51*	*2027-07-20*	*2021-06-16*	*4 y, 8 m, 19 d*	-
5.72 per cent Amortising Bond 2027 (issued 2013)	IE00B8J2NN65	2027-07-20	2014-12-09	4 y, 8 m, 19 d	5
0.9% Treasury Bond 2028	IE00BDHDPR44	2028-05-15	2022-10-21	5 y, 6 m, 14 d	6
1.1% Treasury Bond 2029	IE00BH3SQ895	2029-05-15	2022-10-21	6 y, 6 m, 14 d	7
2.4 per cent Treasury Bond 2030	*IE00BJ38CR43*	*2030-05-15*	*2022-10-21*	*7 y, 6 m, 14 d*	-
0.20% Treasury Bond 2030	IE00BKFVC899	2030-10-18	2022-10-21	7 y, 11 m, 17 d	8
1.35% Treasury Bond 2031	*IE00BFZRQ242*	*2031-03-18*	*2022-10-21*	*8 y, 4 m, 17 d*	-
0% Treasury Bond 2031	*IE00BMQ5JL65*	*2031-10-18*	*2022-10-21*	*8 y, 11 m, 17 d*	-
5.82 per cent Amortising Bond 20 March 2032	*IE00B7Z55X64*	*2032-03-20*	*2017-01-27*	*9 y, 4 m, 19 d*	-
5.82 per cent Amortising Bond 2032 (issued 2013)	IE00B8HCPH68	2032-03-20	2015-05-20	9 y, 4 m, 19 d	9
0.35% Treasury Bond 2032	IE00BMD03L28	2032-10-18	2022-10-21	9 y, 11 m, 17 d	10
1.30% Treasury Bond 2033	IE00BFZRPZ02	2033-05-15	2022-10-21	10 y, 6 m, 14 d	11
0.4% Treasury Bond 2035	IE00BKFVC345	2035-05-15	2022-10-21	12 y, 6 m, 14 d	13
5.92 per cent Amortising Bond 20 January 2037	IE00B8JXZJ91	2037-01-20	2020-07-24	14 y, 2 m, 19 d	14
5.92 per cent Amortising Bond 2037 (issued 2013)	*IE00B8MZCR91*	*2037-01-20*	*2014-01-24*	*14 y, 2 m, 19 d*	-
1.7% Treasury Bond 2037	IE00BV8C9B83	2037-05-15	2022-10-21	14 y, 6 m, 14 d	15

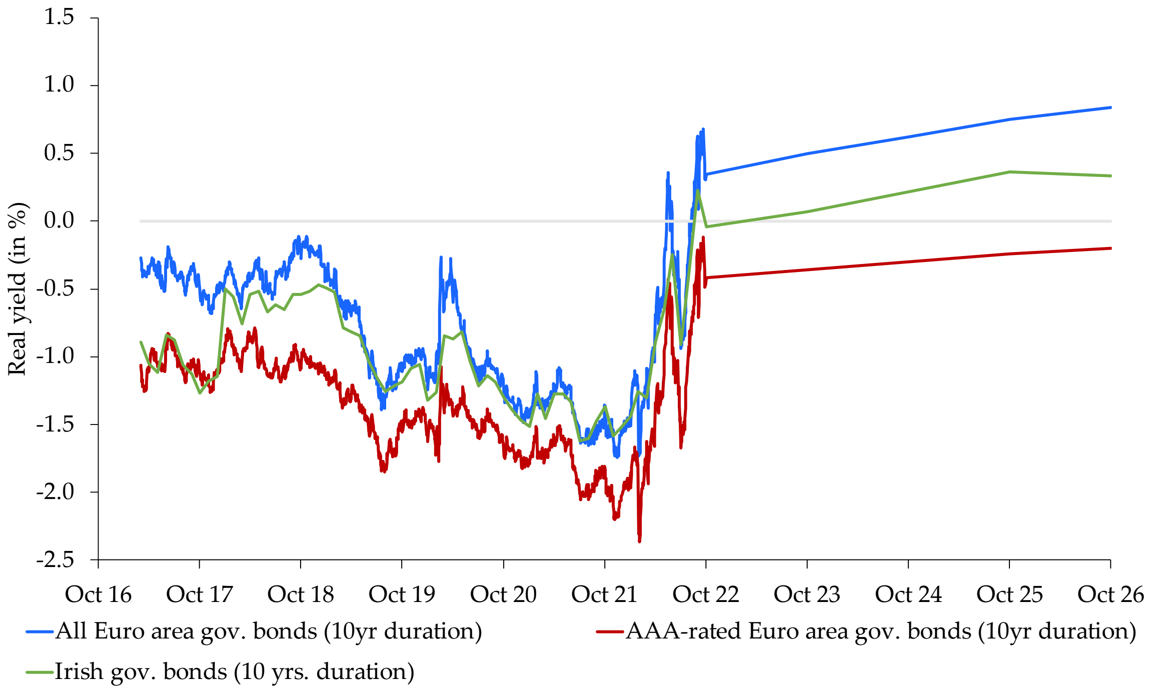
Note: Bonds in italic were not considered for the forward rate calculation, however, they were included in the spot rate series depicted in Figure 11.

Source: Swiss Economics based on Bloomberg.

239 **Figure 11** presents the results of the Irish government bond spot rates as well as the forward rates as of October 2022. For the observed period, the spot rates lie mostly between both

Euro area government bond indices used in our usual approach. However, Irish government spot rates are in general somewhat closer to the all Euro area government bonds spot rates. The forward rates are located between both Euro area bond indices.

Figure 11: Forward Rates Implied by Government Spot Rates including Irish Government Bond Data



Note: Irish real bond spot rates based on monthly data, spot rate 10 years to maturity based on average yields of bonds with 9.5 to 10.5 years to maturity, for certain months there was no data available.

Source: Swiss Economics based on Bloomberg data.

240 Table 38 displays the forward rates for the regulatory period as well as the difference between the respective forward rate and the spot rate as of October 2022 (at -0.04 percent). This leads on average for the years 2023 to 2026 to a forward rate adjustment of 0.29 percent.

Table 38: Irish Forward Rate Adjustment

Forward rate	Irish bonds	Delta to Oct 22
2023	0.07%	0.11%
2024	0.22%	0.26%
2025	0.36%	0.40%
2026	0.33%	0.38%
2023 - 2026 Average	0.25%	0.29%

Source: Swiss Economics based on Bloomberg data.

241 Based on the above Irish forward rate adjustment, we calculate the WACC analogously to our methodological recommendation, except adding the Irish forward rate adjustment to

the cost of new debt estimate instead of our standard forward rate adjustment. The results are summarised in Table 39. Overall, we find a higher WACC when an Irish forward adjustment is used. The regulatory pre-tax WACC increases by 1 basis point.[34]

Table 39: WACC Recommended Variation and with Irish Forward Rates

WACC Component	Recommended Variation	Irish forward rates	Delta
Gearing	50.00%	50.00%	0 bps
Tax rate	12.50%	12.50%	0 bps
RFR	-0.45%	-0.45%	0 bps
TMR	6.25%	6.25%	0 bps
ERP	6.71%	6.71%	0 bps
Asset Beta	0.60	0.60	0
Equity Beta	1.13	1.13	0
Cost of equity (post-tax)	**7.13%**	**7.13%**	**0 bps**
Cost of embedded debt	-1.16%	-1.16%	0 bps
Cost of new debt	1.29%	1.35%	↖ 5 bps
Issuance cost uptick	0.05%	0.05%	0 bps
Cost of debt (pre-tax)	**-0.45%**	**-0.43%**	↖ **1 bps**
True pre-tax WACC	3.85%	3.86%	↖ 1 bps
Aiming up	0.50%	0.50%	0 bps
Regulatory pre-tax WACC	**4.35%**	**4.36%**	↖ **1 bps**

Source: Swiss Economics.

242 The caveats for this analysis are, for instance, the rounding of the years to maturity but also the need to extrapolate the 2024 forward rate. As for the rounding one might apply a more flexible approach. However, for the lack of data points there is hardly any workaround, other than a simple extrapolation. In general, however, the analysis shows the validity of our approach. Irish government spot rates lie quite reliably between both Euro area government bond indices. Whereas the forward adjustment is more closely at the all Euro area government bond forward rate adjustment, which increases the regulatory pre-tax WACC by 1 basis point.

A.4 Ex-Ante Market Expectations on AENA Net Results (based on DDM) before and after Covid-19 versus Actual Net Results

243 We estimate financial markets expectations of the impact of Covid-19 on airports' profits using a simple dividend discount model.

[34] The difference is 0.7 basis points to be slightly more precise.

244 Starting point is the assumption that an airport's market capitalisation reflects the sum of discounted expected future company net profits (i.e., after tax and interest payments and therefore the return for equity holders) at any point in time.

$$\mathrm{M}_{i,0} = \sum_{t=1}^{\infty} \frac{E[\pi_{i,t}]}{(1 + r_e)^t} \qquad (4)$$

$t: time\ period, with\ 0\ being\ today$

$M_{i,0}: current\ (t = 0)\ market\ capitalization$ of airport i

$E[\pi_{i,t}]: market\ expectations\ of\ net\ profits\ at\ time\ t$

r_e: d$iscount\ rate$

245 An airports' market capitalisation can always be inferred from stock prices. The markets discount rate coincides with the nominal cost of equity and can be approximated reasonably well, in line with the considerations of this report. We use a value of 8.5 percent, composed of a real cost of equity for airports of around 6.5 percent and long-run inflation expectations of around 2 percent.

246 Assuming that markets expect future net profits to remain constant in normal times (i.e. $E[\pi_{i,t}] = E[\pi_{i,0}]$ for all future time periods t), only one $E[\pi_i]$ unknown remains and the formula can be expressed as a geometric series.

$$\mathrm{M}_{i,0} = \frac{E[\pi_i]}{r_e}\,;\ E[\pi_i] = \mathrm{r_e} \mathrm{M}_{i,0} \qquad (5)$$

247 This allows to back out market expectations shortly before the pandemic outbreak on the level of future annual profits using data on the market capitalisation as of 31 December 2019.

248 To quantify the impact of the Covid-19 pandemic on expectations of airport profits, we use data on airports' market capitalisation shortly after the outbreak on 31 March 2020. This assessment requires some additional assumptions on the form and length of the impact. Specifically, we assume that markets expected the pandemic to have an annual impact I_i on airport profits for four years. The impact remains constant each year before airport net profits return to normal levels in the fifth year after the outbreak.

249 Formally, we compare an amended version of formula [2] before and after the outbreak of Covid-19 to back out expectations on annual profit impacts.

$$\mathrm{M}_{i,Before} = \frac{E[\pi_i]}{(1+r_e)^1} + \frac{E[\pi_i]}{(1+r_e)^2} + \frac{E[\pi_i]}{(1+r_e)^3} + \frac{E[\pi_i]}{(1+r_e)^4} + \frac{E[\pi_i]}{(1+r_e)^4 \times r_e} \qquad (6)$$

$$\mathrm{M}_{i,After} = \frac{E[\pi_i]-E[I_i]}{(1+r_e)^1} + \frac{E[\pi_i]-E[I_i]}{(1+r_e)^2} + \frac{E[\pi_i]-E[I_i]}{(1+r_e)^3} + \frac{E[\pi_i]-E[I_i]}{(1+r_e)^4} + \frac{E[\pi_i]}{(1+r_e)^4 \times r_e} \qquad (7)$$

250 Using the two formulas, one can back out $E[I_i]$.

$$E[I_i] = \frac{(M_{i,After} - M_{i,Before})(1+r_e)^4}{2+r_e+(1+r_e)^2+(1+r_e)^3} \qquad (8)$$

251

252 Market expectations on annual future net profits before the pandemic outbreak are summarised below in

Table 40: Expected Annual Net Profits per Airport According to DDM

Airport	Expected annual net profit $E[\pi_i]$ (in EURm)	Expected annual Covid-Shock $E[I_i]$ (in EURm)	Expected net profit during pandemic (in EURm)
AENA	1662	-3108	-1446
ADP	1133	-2561	-1428
FRA	353	-607	-254
FHZN	455	-1051	-595

Source: Swiss Economics based on Bloomberg data.

253 The net results were gathered from AENA's annual reports. The exception is the 2022 net result, for which the net result for the third quarter is taken and extrapolated using the net result shares per quarter from 2019. Shares in passenger numbers between 2018 and 2019 did not differ greatly, also overall profits increased from 2018 to 2019, thus it is reasonable to assume that in 2019 Covid did not yet have an impact on these numbers.

Table 41: Actual Net Results

Airport	2019	2020	2021	2022*
ADP	588	-1169	-248	-
FHZN	309	-69	-10	120
FRA	421	-658	83	152
FLU	159	-73	4	96

Note: The net result for 2022 was extrapolated using annual and intermediate results from 2019.

Source: Swiss Economics based on airports annual reports.

A.5 Ex-Ante Market Expectations on AENA Net Results (based on DDM) before and after Covid-19 versus Actual Net Results

Table 42: Analyses on the Linear Effect of an Additional Passenger on Airport Operators' EBITDA

	2015	2016	2017	2018	2019
Dublin Airport – Price Cap Regulation (5-year-period)					
Passengers (m)	25.0	27.9	29.6	31.5	32.9
EBITDA (EUR m)	198.4	231.7	254.7	272.9	276.0
Estimated linear effect of an additional passenger on EBITDA (EUR)					**10.3**

FRA – Flexible Tariffs (annual reviews possible)					
Passengers (m)	208.6	215.8	209.6	238.8	248.9
EBITDA (EUR m)	848.8	1054.1	1003.2	1129	1180.3
Estimated linear effect of an additional passenger on EBITDA (EUR)					**6.0**
AENA – Price cap approved by regulator (5-year-period)					
Passengers (m)	207.4	244.8	265	280.3	293.2
EBITDA (EUR m)	2098.4	2293.6	2517.4	2735.3	2865.8
Estimated linear effect of an additional passenger on EBITDA (EUR)					**9.1**
ADP– Price cap approved by regulator (multi-annual during the analysis' time period)					
Passengers (m)	144.6	147	228.2	281.4	234.5
EBITDA (EUR m)	1184	1195	1567	1961	1772
Estimated linear effect of an additional passenger on EBITDA (EUR)					**5.7**
AIA – Negotiated contracts with users (monitored und guided by regulator with frequent adjustments)					
Passengers (m)	15.8	17.3	19.0	20.5	21.1
EBITDA (EUR m)	210.2	224.9	254.6	279.9	299.6
Estimated linear effect of an additional passenger on EBITDA (EUR)					**17.8**
FHZH– Negotiated contracts with users (multi-annual)					
Passengers (m)	26.3	27.7	29.4	31.1	31.5
EBITDA (EUR m)	539.2	517.9	596.2	601.1	588.1
Estimated linear effect of an additional passenger on EBITDA (EUR)					**18.5**
KBHL– Negotiated contracts with users (multi-annual)					
Passengers (m)	26.6	29.0	29.2	30.3	30.3
EBITDA (EUR m)	280.1	295.5	327.6	342.8	331.1
Estimated linear effect of an additional passenger on EBITDA (EUR)					**7.1**
FLU – Rate of return regulation determined by regulator (annual tariffs)					
Passengers (m)	27.8	28.9	30.9	34.3	39.6
EBITDA (EUR m)	275.2	329.8	326.5	350.4	384.8
Estimated linear effect of an additional passenger on EBITDA (EUR)					**7.6**

Note: The estimated linear effect of an additional passenger on EBITDA is estimated using the Ordinary Least Squares Method.

Source: Swiss Economics based on annual reports.

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