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Assessment of airport characteristics that capture differences in Beta risk

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Abstract:	We assess the factors that drive differences in airports' systematic risk exposure. We score airports under French airport charges regulation and comparator airports according to their risk exposure. We derive a weighting scheme that can be used to determine the Beta of French airports.

Disclaimer

Executive Summary

The Autorité de regulation des transports (ART) determines the appropriate level of remuneration for cost on equity, to which airports under its mandate are entitled for. The French transport law foresees that the Capital Asset Pricing Model (CAPM) is used to estimate airports' cost of equity. A key component of the CAPM is the Beta, which measures the airport's systematic risk (i.e. non-diversifiable risk).

We assess the factors that drive differences in airports' Beta risk using a framework that connects various degrees of systematic risk with microeconomic analysis of how demand shifts translate into profit variation. We find the following relevant factors:

- **Factors related to the regulatory regime under which an airport operates**: We find traffic risk resulting from price cap rigidity to play the major role for explaining differences in Beta risk.
- **Factors related to an airport's demand structure**: We find differences in traffic mix to influence airports' Beta risk. Specifically, we find airports' Beta risk to increase with the share of traffic from Low Cost Carriers. In addition, we find that under certain conditions, competition reduces airports' Beta risk.
- **Factors related to an airport's supply structure**: We find that capacity constraints reduce the systematic risk an airport is exposed to. Also, we find that airports with a higher degree of cost fixity are more exposed to systematic risk.

We score airports under French airport charges regulation and comparator airports according to their risk exposure and categorise them into three groups of similar risk exposure. Airports under ART's mandate are grouped into Groups 1 and 2, i.e. no French airport was assigned to Group 3:

- **Group 1** includes Bâle Mulhouse Airport, Bordeaux Mérignac Airport, Lyon Saint Exupéry Airport, Marseille Airport, Nantes Atlantique Airport, Nice Airport, and Toulouse Blagnac Airport;
- **Group 2** includes the Parisian Airports.

We determine weights to be attached to a sample of comparator airports for airports under ART's mandate depending on their group membership. The resulting weighting matrix is reported in **Table 1**.

Table 1: Weighting Matrix

	Group 1	Group 2
Aeroporti di Roma	0%	33%
Aéroports de Paris (Group)	0%	33%
Amsterdam Schiphol Airport	50%	0%
Copenhagen Airport	0%	33%
Fraport	50%	0%

Source: Swiss Economics

The Weighting Matrix allows to determine appropriate Beta values for all airports under ART's mandate when combined with estimates of Betas from the relevant comparator airports.

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Abbreviations

AdP	Aéroports de Paris
ART	Autorité de regulation des transports
ASI	Autorité de supervision indépendante
CAA	UK Civil Aviation Authority
CAPM	Capital Asset Pricing Model
CAR	Irish Commission for Aviation Regulation
EEA	European Economic Area
ERA	Economic Regulation Agreement
ERP	Equity Risk Premium
FSC	Full Service Carrier
GDP	Gross Domestic Product
LCC	Low Cost Carrier
pax	Passengers
RAB	Regulatory Asset Base

1 Introduction

1.1.1 Background

As per 1 October 2019, the Autorité de régulation des transports (ART) has become the supervising authority for airport tariffs levied to airlines and users by French airports with traffic above 5 million passengers (pax) over the last civil year, or airports part of an airport system with at least one airport with traffic above 5 million pax over the last civil year. In this capacity, ART approves the annual tariff schemes prepared and submitted by airports or gives a binding opinion on the Economic Regulation Agreement (ERA) the airports might enter into with the French Ministry in charge of transportation.

In accordance with Article L. 6325-1 of the French transport law, ART uses the Capital Asset Pricing Model (CAPM) to determine the cost of equity faced by airports under its regulatory mandate.[1] A key component of the CAPM is the Beta, which measures a company's systematic (i.e. non-diversifiable risk).

ART has commissioned Swiss Economics to identify and assess the factors responsible for differences in the level of Beta risk between airports under its mandate.

1.2 Approach

We use Microeconomic theory to identify and assess factors that affect the level of Beta risk airports are exposed to. We distinguish between factors related to the regulatory regime under which an airport operates, factors related to the structure of demand an airport faces, and factors related to the structure of supply.

In order to capture all relevant risks and find a robust methodology to assess them, we consulted with stakeholders twice. The first round of stakeholder consultation was done in the course of the data collection process. Secondly, stakeholders received the opportunity to comment on a draft version of this report.

1.3 Structure

The remainder of this report is structured as follows:

- Section 2 describes the framework that is used to analyse systematic risk and its underlying drivers;
- Section 3 identifies the main factors that are responsible for differences in Beta risk across airports;
- In Section 4, we score airports under ART's mandate and comparator airports along the dimensions we consider relevant to determine their level of systematic risk;
- In Section 5, we categorize airports into groups of comparable risk profiles;
- Section 6 presents the Weighting Matrix for comparator airport Betas and concludes.

[1] See ART (2019)

2 Framework

2.1 WACC, CAPM, and Beta risk

Regulators typically allow companies under their mandate to earn a return on capital that compensates the investors for the risk they assume.

The Weighted Average Cost of Capital (WACC) approach is generally accepted among regulators as a useful framework to determine the appropriate level of allowed capital returns. A firm's WACC is composed of the cost incurred on debt and the cost of equity, weighted relative to the company's gearing.

A firm's cost of equity cannot be derived from accounting or management figures, but it must be estimated using finance theory and data from financial markets. Article L. 6325-1 of the French transport law requires ART to determine airports' cost of equity based on the CAPM.

The CAPM was developed in the 1960s based on Markowitz' (1952) portfolio theory and is rooted in the idea that investors will require a premium for holding risky assets with undiversifiable fluctuations in return compared to a risk-free asset with no uncertainty around the level of returns. The Equity Risk Premium (ERP) is the difference between the level of returns on risk-free assets and the expected level of return on the market portfolio. The market portfolio is the hypothetical bundle of investments that includes every type of asset available in the investment universe, with each asset weighted in proportion to its total presence in the market. The premium that investors will require for holding a specific asset is determined by the extent its returns correlate with the yield of the market portfolio i.e. the systematic risk.

The systematic risk inherent to an asset is expressed through the CAPM's Beta parameter (or simply Beta). A Beta of 0 indicates that the returns of the asset do not correlate at all with the market portfolio. Investors can mitigate any risk in relation to the asset's returns by increasing the number of assets in their portfolio. As such, investors do not require a risk premium above the level of the risk-free rate. A Beta of 1 indicates that investors expect returns on a similar level as the returns of the market portfolio. In general, the level of the premium required by investors is defined by the product of the asset's Beta and the market portfolio ERP.

Variance in returns that is uncorrelated to the yield of the market portfolio does not require a premium according to the CAPM. This is because investors can diversify their portfolios to the extent that all random fluctuations in returns (i.e. idiosyncratic risk) of individual assets lose their relevance compared to the mass of assets in the portfolio.

However, idiosyncratic risk may still be considered in setting the regulated firms' allowed compensation. Its expected impact should not be covered by adjustments to the regulated Beta according to the CAPM, but **Appendix A1** lays out some of the options regulators can adopt to reflect it in the tariff nevertheless.

2.2 Translating business risk into Beta risk

A direct assessment of how Beta risk differs across airports may prove to be difficult in practice. The methods from academic Microeconomics and Industrial Organization, which are traditionally used to study firm behaviour and market structure, do not encompass firms' asset returns or market portfolio yields as variables of interest. There exists a large range of empirical finance literature that analyses the impact of firm characteristics on stock returns.[2] However, to

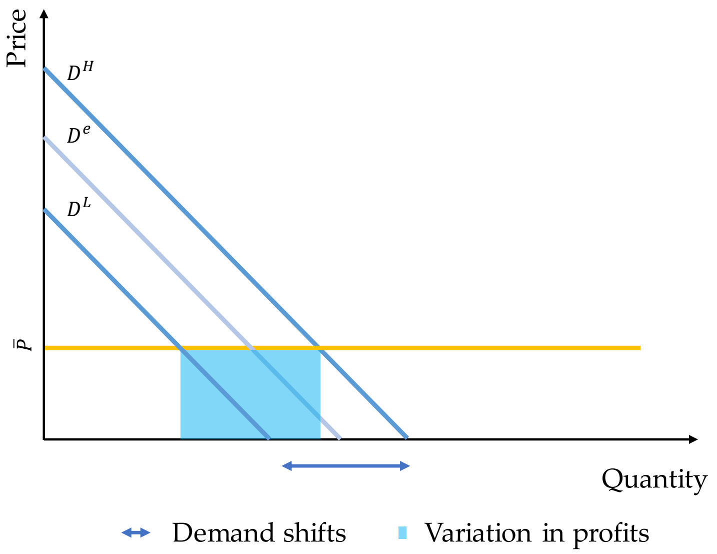
[2] E.g. Fama and French (2012).

the best of our knowledge, there exists no established theoretical framework that would link all relevant dimensions of firm and market characteristics to Beta risk.

We use an intuitive framework to translate differences in firm and market characteristics into differences in Beta risk across airports. Changes in the level of overall economic activity (which are highly correlated with returns to market portfolio) translate into shifts of the demand for air transport faced by airports. The degree to which shifts in demand (driven by changes overall economic activity) translate into changes in airport profits determines airports' Beta risk.

Figure 1 illustrates the basic microeconomic framework using shifts in a linear demand function for an airport under price cap regulation. The extent to which regulated profits differ between low demand outturns[3] (D^L) and high demand outturns (D^H) is illustrated by the blue rectangle. The size of the area of the rectangle may vary depending on how the airport is regulated, its demand structure, and its supply structure.

Figure 1: Basic microeconomic Framework



Note: Expected demand (D^e) is the basis for the calculation of the level of the price cap $\bar{P}$. Demand shifts (D^e to D^Lor D^e to D^H) are assumed to be due to changes in overall economic activity exclusively and are, as such, correlated to changes in the yield of market portfolio returns. To avoid unnecessary complexity, marginal costs are assumed to be 0 and fixed costs are assumed to equal expected revenues under the price cap if not indicated otherwise.

Source: Swiss Economics.

As tariffs are capped, the impact of demand shifts on the level of profits depends on the airport's regulation, its specific demand structure, and its supply structure.

The framework is based on the following assumptions:

- **Changes in the level of air transport demand correlate with changes in market portfolio returns:** We assume that market portfolio returns, the level of economic activity (i.e. GDP), and demand for air travel are all closely correlated.[4]

[3] Estimated for example through GDP

[4] Also, we do not distinguish between passenger demand and demand for cargo transport like one stakeholder suggested. We acknowledge that elasticities with respect to changes in overall GDP may not necessarily be identical between pax and cargo, but for the purpose of a high-level risk assessment it is reasonable to consider them jointly.

Indeed, academic literature and regulators tend to find a strong relationship between economic activity (e.g. measured as GDP growth) and passenger volume growth. For example, Profillifis & Botzoris (2015) show a distinct causal relationship between GDP and air passenger transport activity. Also, during the 2019 Determination of the Dublin Airport price cap, CAR estimated a passenger growth elasticity with respect to changes in GDP levels of very close to 1. According to CAR's (2019) analysis, a 1 percent growth in economic activity leads on average to a growth in passenger volumes of 1.05 percent. One airport stated during the stakeholder consultation that the passenger elasticity may be even higher. However, as long as the correlation is significant, the precise elasticity is not relevant for the framework of the analysis.

Also, the correlation between market portfolio returns and the development of economic activity is intuitive and has been demonstrated in the academic literature. For example, Fama (1990) found that growth rates of production explain variance in stock returns to a substantial extent.

- **Changes in airport profits correlate with changes in airport stock returns:** There is an intuitive relation between profit fluctuations and changes in stock returns. Changes to profits are likely to affect dividends and as such impact stock returns.

3 Identification of drivers of Beta risk

In the following, we identify risk categories for French airports based on economic theory, desk research of regulatory precedent, and submissions from airports operators and users we have received in response to a questionnaire we sent to the stakeholders of all ART regulated French airports.

We differentiate between factors related to the following dimensions:

- Factors related to regulation;
- Demand-side related factors; and
- Supply-side related factors.

We focus our analysis on the Beta risk related to the regulated entity only, i.e. an airport's activities under price regulation. In this report, unless stated otherwise, **Beta refers to the Beta of the regulated perimeter only**.

3.1 Factors related to regulation

Regulatory frameworks define the risk sharing mechanism between stakeholders, i.e. users, the French state and the airport operator. In that respect, the principal set of factors that may affect an airport's Beta is related to the regulatory regime under which it operates.

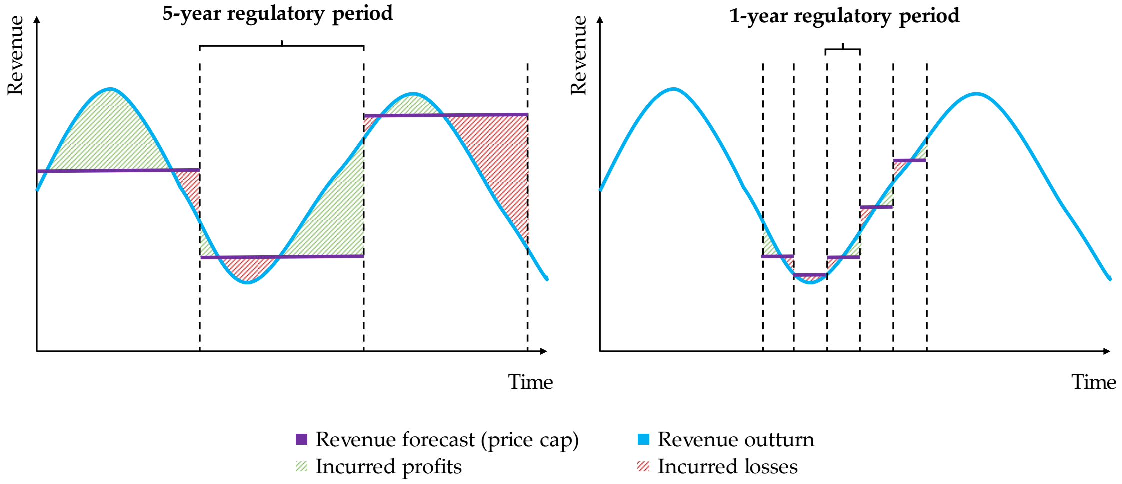
The relevant dimensions of regulation are grouped below into homogenous categories.

3.1.1 Price cap rigidity

Demand risk and related profits and losses are mitigated through a periodic reset of the regulatory parameters (e.g. forecasts of traffic, Opex, RAB, etc.). Whenever a new regulatory period begins, or when, within an ERA, the price cap is adjusted, expected revenues are brought in line with expected costs. The shorter the time period between resets (i.e. the length of the periods during which the airport operator **effectively** bears the risks) the smaller is the demand risk for the regulated entity. Thus, a key factor that determines the extent of demand risk is the length of the regulatory period and the frequency as well as impact of possible adjustments to the price cap during an ERA.[5][6]

Figure 2 illustrates the difference in potential profits and losses resulting from demand fluctuations for strict 5-year regulatory periods and strict 1-year regulatory periods.

Figure 2: Effects of varying regulatory periods on the variance in profits and losses



Note: In a stylised manner, deviations in revenue outturn from plan revenues are depicted as profits or losses.

Source: Swiss Economics.

Fluctuations in passenger numbers can be predicted to some extent via flight schedules, which are usually determined well in advance. Regulators can anticipate and react to changing traffic volumes when regulatory periods are short, e.g. annual review periods. Strict regulatory periods of 4 to 5 years, as in the case of Heathrow, create incentives to become more efficient over time, but they transfer significant (upside and downside) risks to airport operators.[7]

Besides the length of the regulatory period, a regulatory framework may enable implementation of mechanisms affecting the level of the price cap, which affect the rigidity of price cap as well.

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5 For airports under an ERA, realisations of traffic, Capex, etc. below or above certain thresholds may lead to a reset before the end of the ERA under specific circumstances (see ADP, CRE 3, article V.2).

6 One stakeholder found the concept of price cap rigidity misleading, as some price caps may be of rigid nature, but on a level that is so high that it does not constrain the airports in their pricing behaviour. We agree that an excessive price cap would reduce risk in theory. However, we have not seen any compelling evidence that the airports under ART's mandate or any comparator airports operate under an excessive price cap. In fact, we understand that French airports typically charge tariffs close to the respective caps. As such, we deem the argument to be of theoretical nature only.

7 Changes in passenger numbers typically evolve slowly over time and can be predicted to some extent via flight schedules, which are usually determined well in advance. Regulators can anticipate and react to changing traffic volumes when regulatory periods are short, e.g. annual review periods. Regulatory periods of up to 5 years, as in the case of possible French ERA, may create incentives to become more efficient over time, but they may transfer additional risks to airport operators. It is not only demand risk that is more distinct with longer regulatory periods. Other profit drivers whose outturn is uncertain at the point of the determination of the remuneration level are path dependent and will likely result in increased deviations from plan figures over time. Notably, capital costs, which represent a large share of total costs and are naturally linked to returns of the market portfolio, can be forecast with larger precision for the near future than for the more distant future. However, changes in the level of capital costs (e.g. changes over time of the risk-free rate or equity risk premium) affect all airports similarly, which is why they are less relevant to explain differences in Betas across airports.

These price cap adjustments may be another factor that drive differences in Beta risk across airports. Price cap adjustments mitigate, depending on their extent, demand risk and, as such, lower the degree of undiversifiable risk for an airport.

Price cap adjustments may be implemented in a regulatory framework in different ways:

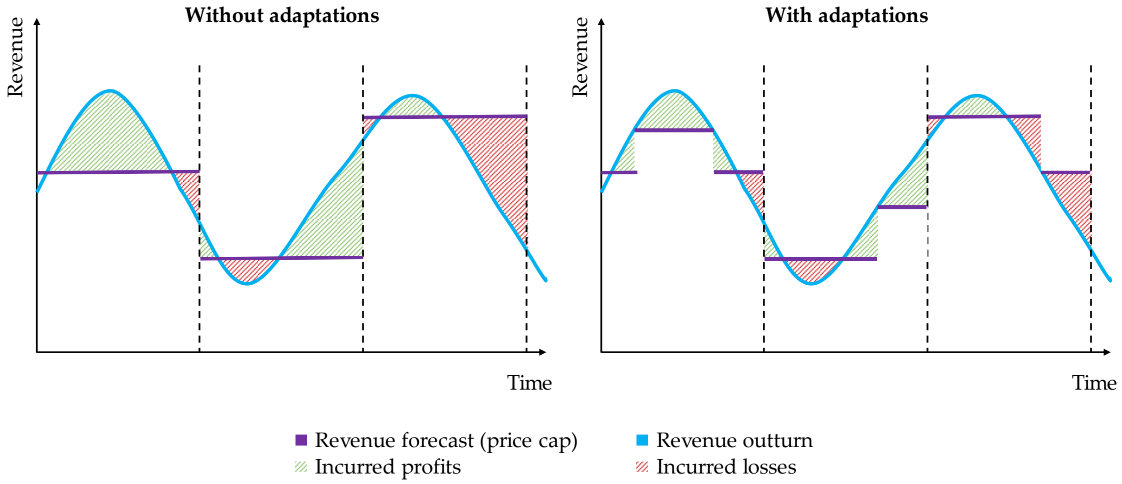
- **Ex-post adjustments** to the level of the price cap are defined ex-ante, but only come into play if demand outturn is above or below certain thresholds. As an illustration, the current ERA between the French Government and Aéroports de Paris (AdP) regarding the economic regulation of the Parisian Airports contains clauses to adjust the price cap depending on a given set of quantifiable factors. For instance, if traffic volumes exceed a certain amount during a given period, 50 % of the surplus is offset by a (negative) adjustment of fee rates in the period that follows.[8]
- **Within-period adaptations:** Regulators may have the discretion to intervene within regulatory periods and adjust price caps under certain conditions. For example, the Swiss Ordinance on Airport Charges enables the regulator to intervene and adjust the level of the price cap at any time if it starts to diverge from the principles set out in the law code.[9] In November 2019, the Swiss regulator reduced maximum charges for Zurich Airport based on the explanation that the airport's profits were allegedly not compliant anymore with the principle of cost recovery.
- **Retrocession mechanisms** compensate for extra profits or losses at the end of a regulatory period. The financial risk is either shifted to the government (in the case that government covers losses) or to users (in the case that losses are transferred as Opex allowance into the next regulatory period).

The various options for demand-related price cap adjustments result in comparable effects (despite with varying intensity) on Beta risk. The effect of regulatory interventions is depicted in **Figure 3**.

[8] See Economic Regulation Agreement between the Government and the Aéroport de Paris 2016-2020, Page 17.

[9] See Ordinance on Airport Charges (2012), Article 11, Paragraph 2, https://www.admin.ch/opc/en/classified-compilation/20110517/201206010000/748.131.3.pdf

Figure 3: Effect of price cap adaptations on profit variance



Note: In a stylised manner, deviations in revenue outturn from plan revenues are depicted as profits or losses.

Source: Swiss Economics.

Price cap adjustments are not limited to demand-related risks, but they may also be implemented for risks related to inflation, capital costs, or other factors, which may or may not be correlated to overall economic activity. Some regulators use ex-post adjustments to eliminate the risk of underinvestment. For example, the Irish Commission for Aviation Regulation has set Capex triggers in the past to eliminate the risk of underinvestment in the case of faster growth than expected. For the same purpose, it is possible for the Parisian Airports under the current ERA to request a fee adjustment, after stakeholder consultation and subject to Government approval, to provide for additional investment costs.[10] Also the CAA allows development Capex to vary in real-time over the course of the regulatory period, such that when Heathrow realises Capex, charges are adjusted to equal what they would have been, had the realised outcome been known at the start of the regulatory period.

3.1.2 Scope of the regulated perimeter

Under Dual Till regulation, only aeronautical activities are included in the regulatory perimeter. Commercial activities are managed by airport operators at their own risk without constraints regarding price levels.

Under Single Till regulation, revenues and costs from certain commercial activities (e.g. retail, property, car parking, and advertising) are reflected in the level of the price cap i.e. expected profits from these activities reduce the level of the cap.

Commercial revenues correlate closely with passenger numbers and overall economic activity.[11][12] This implies that commercial profits are high when aeronautical profits are high and they are low when aeronautical profits are low.

[10] See Economic Regulation Agreement between the Government and the Aéroport de Paris 2016-2020, Page 18

[11] For example, in the recent 2019 determination, the Irish Commission for Aviation Regulation (CAR) has undertaken analysis of the elasticity of several of Dublin Airport’s commercial revenues. For many revenue categories (including retail, car parking, and property), CAR estimated elasticities with respect to passenger numbers or Irish GDP of close to 1.

[12] See CAR (2019), Page 79.

However, the till system does not only determine which revenues are considered in the regulatory framework, but it also determines which assets are included in the RAB. Under Single Till regulation, assets, which are required to provide commercial services, are included in the RAB as well as assets, which are required to provide aeronautical services.

Expressed as a percentage of capital/RAB, it is unclear whether variations in profits are higher or lower under a Single Till regulation. If commercial services are provided using a less (more) capital-intense mix of inputs than aeronautical services, it seems likely that the Beta of the regulated entity decreases (increases). Whether and how the mix of inputs changes between aeronautical and commercial activities is airport-specific to the best of our knowledge. For example, the mix may vary depending on the extent and nature of commercial activities that an airport offers.

As such, the variance in profits, expressed as returns of the RAB (e.g. in the form of Return on Capital Employed, ROCE), is unlikely to be systematically driven by the regulatory perimeter.

Besides cost fixity, there may exist other ways of how the scope of the regulated perimeter affects airports' systematic risk. For example, regarding commercial activities within a Single Till, due to the compensation mechanism with the aeoronautical activities, the risk of write-offs in the case of bankruptcy may be reduced when activities are included in the regulatory perimeter. In the limited scope of this analysis, we have not explored every possibility for how the regulated perimeter may affect Beta risk.

Some stakeholders claimed that there are differences in elasticities to GDP between aeronautical and commercial revenues, which imply that the regulatory perimeter may influence the demand side related factors. However, we have received conflicting feedback in terms of direction of impact. One user representative argued that the elasticity for commercial revenues is higher than for aeronautical revenues, while an airport argued that commercial revenues, such as revenues from retail concessions, react less to changes in GDP than aeronautical revenues. We believe that elasticities are likely to differ to some degree. However, extent and direction of the difference is likely to depend on airport specifics and local conditions. In our view, it is reasonable to remain agnostic about the differences in elasticities within the high-level risk assessment of this report.[13]

3.1.3 Changes to the regulatory framework

The responses we received from airports and users named a range events that can be summarised under the title uncertainties in connection to changes to the regulatory framework.

The following events were identified:

- **Change in the regulatory perimeter** Some respondents named the possibility of a change in the regulatory perimeter as a risk to airports. Depending on the direction of the change and perspective of the respondent, a change in the regulatory perimeter was considered a potential upside or downside.[14]

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[13] There may exist other ways of how the scope of the regulated perimeter affects airports' systematic risk. In a Single Till for example, the risk of write-offs for commercial activities in the case of bankruptcy may be reduced due to the compensation mechanism with the aeronautical activities.

[14] See for example response of ACA or Bar France.

- **Restrictions on flight-times** Some airports consider a ban on night flights following pressure from the local population for stricter noise protection as a major risk over the coming years.[15]
- **Environmental regulation** Some airports consider that political pressure for environmental protection and measures against climate change could have a substantial impact on airports over the coming years.[16]
- **Additional taxes** One airport is concerned that the planned introduction of safety and security taxes will constitute a burden.[17]
- **Transition from Autorité de supervision indépendante (ASI) to ART** Some airports are concerned that the transition from ASI to ART increases uncertainty around the level of price caps.

We deem that the uncertainty around most of the above events is connected to the level of economic activity only to a marginal extent and are therefore uncorrelated to changes in the yield of the market portfolio. Thus, we do not consider differences in the exposure to changes in the regulatory framework to be a relevant factor driving Beta risk across airports.

During the stakeholder consultation, some airports reasserted that they perceive some of the above risks as key risks with a potentially substantial impact on them and that this should be reflected in the report. However, in our view these demands misconceive the methodology underlying the report and the logic of the CAPM. The CAPM predicts that these idiosyncratic risks will not affect airports' Beta coefficient. As such, even if we chose comparator airports with a similar exposure to these idiosyncratic risks, the resulting Beta coefficient for airports under ART's mandate would remain unaffected. The expected impact of idiosyncratic risks may be accounted for through alternative means as is outlined in Appendix A.1.

3.1.4 Conclusion on regulation-related factors

Based on the above assessment, we propose to focus on price cap rigidity as the main factor within regulatory dimensions that drives differences in airport Betas. Given the potentially large impact on profit variance from regulatory constraints, we consider that differences in risks related to regulation should be weighted substantially more than other risk dimensions.

Table 2 summarizes how we score airports according to their exposure to regulation-related factors driving Beta risk.

[15] See for example response of Toulouse Airport and Bâle Mulhouse.

[16] See for example response of AdP.

[17] See response of AdP.

Table 2: Summary of regulation-related variables driving differences in Beta risk between airports

Variable	Description	Weight
Price Cap Rigidity Score	We create a score that reflects the rigidity of the price cap under the relevant regulatory regime for an airport ranging from very flexible (annual reviews) to very strict (5-year-periods without the possibility of adjustments) in five steps. Airports are exposed to higher systematic risk with increasing score.	Very high. We consider that the rigidity of the price cap is a principal factor that determines differences in Beta risk across airports.
Scope of the regulated perimeter	We do not consider the regulatory perimeter / till system as a significant factor determining differences in regulated perimeter's Beta risk between regulated airports	None
Changes to the regulatory framework	We do not consider differences in the risk of change of regulatory framework to be systematically correlated to economic activity.	None

Source: Swiss Economics

3.2 Demand-side related factors

3.2.1 Traffic composition

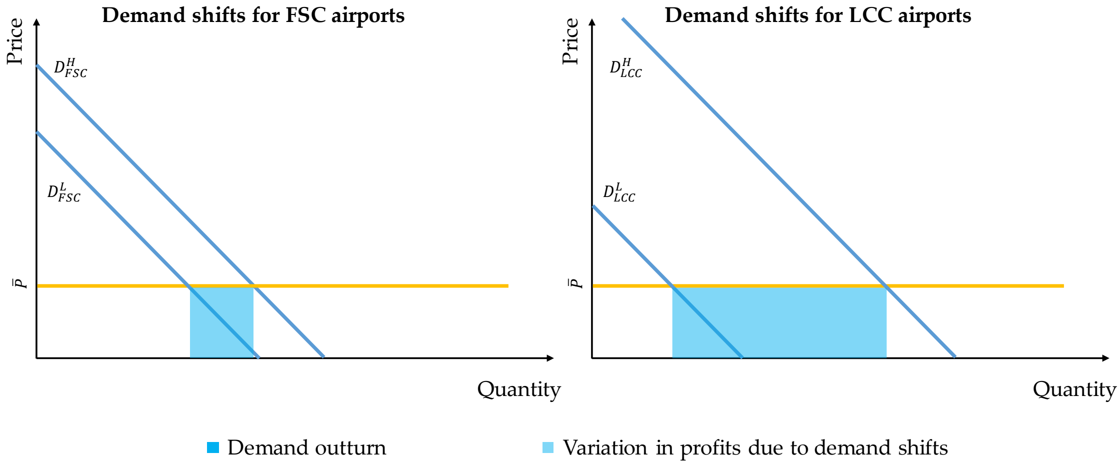
The extent to which demand correlates with overall economic activity may differ across airports depending on their user profile and traffic composition. A recent internal ART analysis suggests that traffic volumes travelling with Low Cost Carriers (LCC) react more sensitive to changes of GDP than traffic volumes travelling with Full-Service Carriers (FSC). To a lesser extent, international traffic is more sensitive to changes in GDP than national ones.

We adopt the preliminary results of ART's analysis and use the share of LCC traffic as a proxy for how traffic composition increases Beta risk.[18]

Figure 4 illustrates how larger differences between FSC and LCC traffic mixes for high and low demand outturns result in different profit variation. The profit variance, which is experienced by an airport with an LCC-heavy traffic mix, is substantially greater than the profit variance, which is experienced by an airport with a FSC-heavy traffic mix.

[18] More complex analyses could also include some form of geographical decomposition of the traffic.

Figure 4: Demand fluctuations for LCC and FSC airports



Note: D_{FSC}^{H} and D_{FSC}^{L} depict high and low demand (modelled as demand shifts) for airports with a high share of FSC in their traffic mix. D_{LCC}^{H} and D_{LCC}^{L} depict high and low demand (modelled as demand shifts) for airports with a high share of LCC in their traffic mix.

Source: Swiss Economics.

Some stakeholders argued that we should adopt a more nuanced view regarding the categorization of carriers into low cost and full service. Some argued that the business models of traditional LCC and FSC have largely aligned in the past years. Others argued that LCCs behaviour depends heavily on the airport and cannot be generalised. Yet others argued that we should also consider looking at traffic mix differences in terms of business and leisure pax or transfer pax and point to point pax, i.e. the other user side.

We acknowledge that there may exist more nuanced aspects and additional factors related to traffic mix, but we think in order to remain viable, the high-level risk assessment of this report must focus on a few key aspects.

3.2.2 Intensity of competition

For airports under economic regulation, it can be assumed that local competition for departing and arriving passengers is negligible.[19] Indeed, the existence of significant market power is typically the precondition under which economic regulation is put into place. Thus, competition between airports is mostly limited to connecting passengers, airlines (i.e. routes and aircraft), and commercial revenues:

- **Competition for transfer passengers**: Intercontinental traffic and to some extent intra-European traffic is often organized over hub and spoke systems. Services for distant city-pairs are connected through stopovers in hub airports. For many major European airports (e.g. London Heathrow, Frankfurt Fraport, or Amsterdam Schiphol) connecting passengers represent a large percentage of total passengers. Competition for transfer traffic is likely to be with a geographically distant airport within or outside Europe (Oxera, 2017).
- **Competition for airline routes and aircraft:** Naturally, the airlines' demand for offering routes to an airport is to a large degree derived from the potential passengers' demand for travelling to other destinations. However, an airline's demand for offering routes also

[19] Some airports argued that they compete for passengers with other airports in the same catchment area and alternative means of transport (e.g. train and ship). Within the scope of this analysis however, we believe it is appropriate to only consider the main dimensions of airport competition mentioned above.

depends on the costs in connection to operating the routes. Besides airport charges, fleet maintenance costs represent a major element in airlines' costs of operating routes. In order to create scale efficiencies, most airlines operate from bases, where they can concentrate aircraft and routes. Airports perceive airlines to have the possibility to move bases in the case of cost differences between airports. Low Cost Carriers in particular, operate multiple bases across European airports (Oxera, 2017).

- **Competition for commercial revenues:** Some airports stated that they face increased competition for commercial revenues.[20] In particular, neighbouring parking facilities or ride sharing apps put pressure on profits from car parking. Also, many airlines have increased their inflight duty-free sales, which is stated to have a negative impact on retail revenues. Broader economic trends, such as the growth of online shopping, further increase competitive pressure on retail.

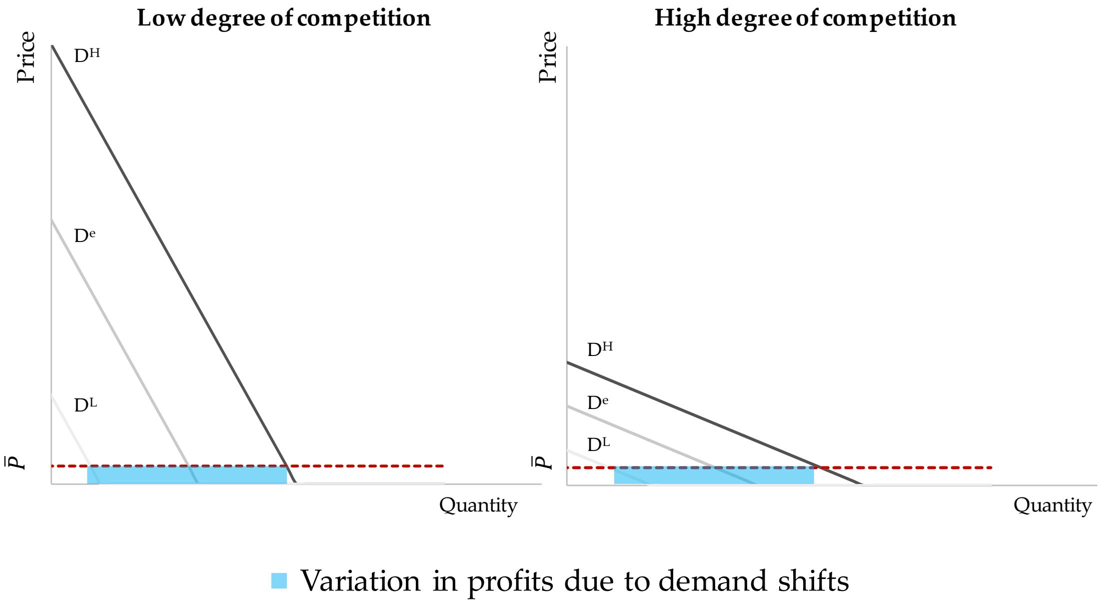
Under free market conditions the effect of increased competition on the variance in profits is well established and accepted in the economic literature. Competitive pressure constrains firms in their ability to charge prices above cost levels. As high prices will result in substantial volume loss, firms are likely to find it profitable to lower mark-ups and retain market shares following an increase in competition. In other words, competition translates into increased perceived price elasticity of demand for firms. The inverse relationship between profit-maximizing mark-ups and price elasticity of demand is demonstrated in the seminal Lerner-Index (Lerner, 1934).[21] Thus, with increased competition (and increased demand elasticity) prices converge to marginal costs. Competition erodes the potential for profit and as such also reduces the variance in profits (and systematic risk).

However, under regulation, mark-ups are constrained at a level that approximately allows airports to recover their fixed costs. As long as demand swings are limited and the profit-maximizing price remains above the price cap in the case of low demand outturns, firms will simply charge the price cap. In this case, shifts in demand are fully and symmetrically passed through to profits independent of whether the degree of competition is high or low. **Figure 5** illustrates the variance in profits when the profit-maximising price remains above the price cap during periods of low demand.

[20] See for example, response of Aéroport Marseille Provence.

[21] The Lerner-Index is defined as $\frac{P-c}{P} = -\frac{1}{\mu}$, where P is the firm's profit-maximising price, c is its marginal costs, and μ is the firm-specific price elasticity of demand.

Figure 5: Effect of competition when profit-maximising prices are above the price cap



Note: D^H and D^L depict demand swings around expected demand D^e. D^e is the basis for the calculation of the level of the price cap $\bar{P}$.

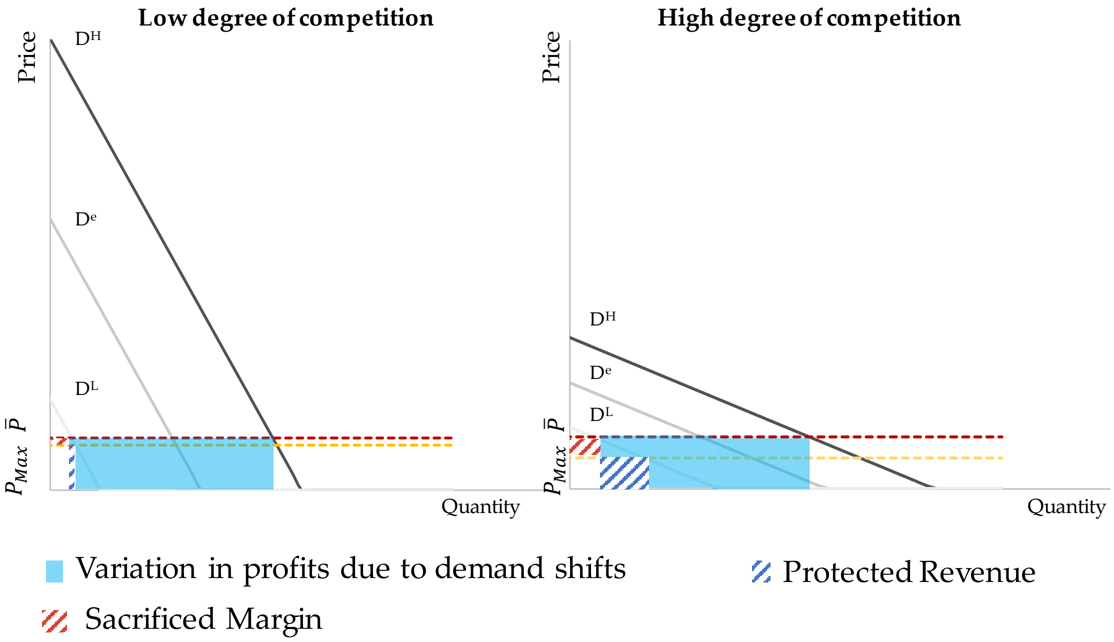
Source: Swiss Economics.

However, should profit-maximising prices fall below the price cap during times of low demand, airports will find it optimal to reduce charges. In this case, airports with more elastic demand (i.e. with more competition) may have an advantage compared to airports with less elastic demand (i.e. with less competition). They can protect their revenues more effectively by reducing charges below the cap, as their passenger volumes react more to price cuts than at airports with less elastic demand. For example, under linear demand and no marginal costs, the passenger volumes (and profits) that result in the optimal elasticity of 1 are always higher for the airport with increased competition.[22] The intuition behind this result is that an airport, which faces elastic demand, can protect more volume and revenues by reducing charges slightly than an airport that faces inelastic demand.

Thus, if the profit maximising price falls below the price cap, the variance in profits becomes asymmetric depending on the level of competition as **Figure 6** illustrates. Airports with less competition face higher Beta risk than airports with more competition (as indicated by the difference in the areas of the blue rectangles).

[22] The general finding holds under much less strict assumptions on demand and costs.

Figure 6: Effect of competition when profit-maximising prices are below the price cap



Note: D^H and D^L depict demand swings around expected demand D^e. D^e is the basis for the calculation of the level of the price cap $\bar{P}$. $P_{Max}$is the profit-maximising price below the level of the price cap in the case of low demand outturn.

Source: Swiss Economics.

The scenario in which an airport charges tariffs below the level of the price cap is not unrealistic and has recent precedent. For example, Budapest Airport has charged passenger fees distinctly below the cap over the past years. The operator argues that this is because it operates in a competitive regional setting with several airports in Central Eastern Europe, including airports in Prague, Vienna, Bratislava, Ljubljana, Zagreb, and Belgrade.[23]

However, given that most airports levy fees close to the level of the price cap, we deem it appropriate to weigh the influence of differences of the level of competition on the Beta less than other factors.[24]

3.2.3 Strong dependency on few airlines

A number of airports stated in their response to our questionnaire that their dependency on only a few airlines is a key risk to their financial performance over the next years. The financial impact from a single airline withdrawing its operations from the airport is potentially very large.

We comprehend that the concentration of airlines may be viewed as a substantial risk by affected airports. However, we deem that the risk is mostly of idiosyncratic nature and not related to overall economic activity. If an airline decides to withdraw its operations from an airport, it is likely that new routes will be introduced at one or several alternative airports. Similarly, an airline bankruptcy will impact airports with few alternative airlines more than large airports with many airlines. However, airlines at more concentrated airports do not have a higher bankruptcy risk

[23] Budapest Airport's response to the European Commission's Inception Impact Assessment of the Airport Charges Directive

[24] For example, all airports under ART's mandate are currently charging prices close to the cap and have been consistently doing so over the recent past.

than other airlines. As such, airports with fewer airlines are less likely to be affected by an airline bankruptcy.[25]

Thus, again we accept that the dependency on few airlines is perceived as a key risk by some airports. However, we do not consider the risk to be systematic in nature, as in the logic of the CAPM, the notional investor would be able to diversify them away.

3.2.4 Conclusion on demand-related factors

From the range of demand-related factors, we deem traffic mix and to some degree competition as relevant drivers of systematic risk.

Table 3 summarizes how we score airports according to their exposure to demand-related factors driving Beta risk.

Table 3: Summary of demand-related variables driving differences in Beta risk between airports

Variable	Description	Weight
Share of LCC	We use the share of LCC flights in total flights as an indication of systematic risk connected to traffic mix. An airport's Beta risk increase with its share of LCC traffic. However, the importance of the factor is low compared to risk related to price cap rigidity.	Low
Share of direct pax	We use the share of passengers that are not in transfer as a proxy variable of the demand elasticity (i.e. the degree of competition), which an airport faces. The airport's risk may increase under certain conditions with the share of passengers not in transfer. However, the variable is a less important driver of differences risks than other factors related to demand.	Very low
Concentration of airlines	We do not consider the risk related to dependency on few airlines to be systematic in nature	None

Source: Swiss Economics

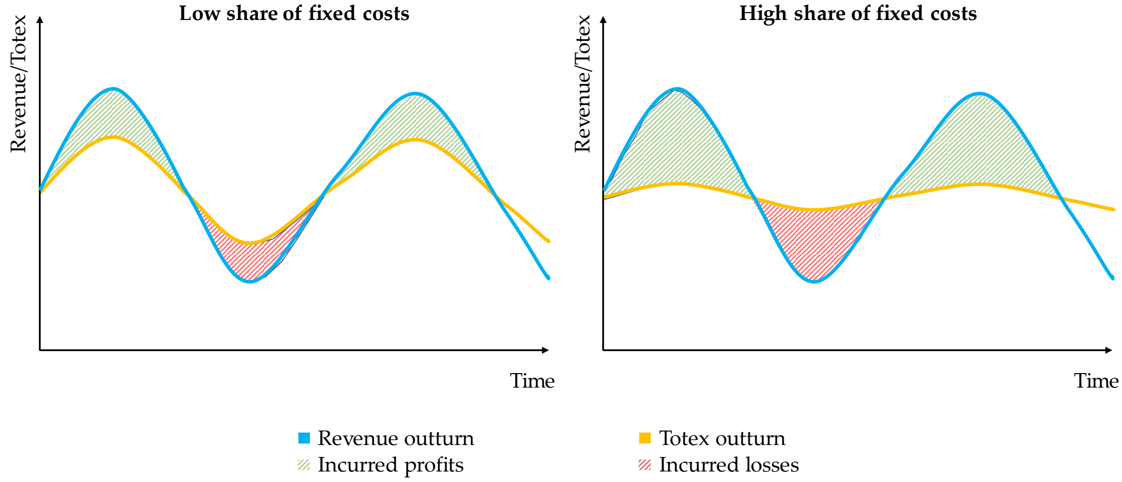
3.3 Supply-side related factors

3.3.1 Cost fixity

Cost fixity determines how exposed an airport is to demand fluctuations (and as such to changes in economic development). The intuition is that regulated entities with a high share of variable costs will always adapt their spending to the level of demand. In the event of a demand downswing the entity with a higher share of variable costs may experience less profit erosion (and thus higher profitability) than an entity, which operates mainly on fixed costs. **Figure 7** illustrates the effects from increased cost fixity on variance in profits.

25 Some stakeholders referred to the Swissair grounding and presented evidence of the following decline in pax at Bale-Mulhouse and Zurich Airport to illustrate the severe impact of an airline bankruptcy on airports. We acknowledge the very significant impact of the grounding for these airports. However, we would argue that other small airports, which had no Swissair presence, were less affected by the grounding than the average large airport with small Swissair presence.

Figure 7: Effects of cost fixity on variation in profits



Source: Swiss Economics.

An important factor determining the level of cost fixity is the extent of new investments. In particular, large expansions, such as new terminals or runways, may lead to a significant increase in depreciation rates and thus amortization charges. This view has been adopted by regulators in other industries. For example, Ofgem (2012) has identified scale of investments as relevant factors for differences of Beta risk across electricity companies in its final proposal for the RIIO framework.

Ideally, we could have used Capex/Totex ratio as an additional indicator of cost fixity. We decided against using this indicator, as data for some of the comparator airports was patchy and unreliable.

3.3.2 Spare Capacity

Capacity constraints may be another reason for why systematic risk differs across airports. In a free market situation, absent of price regulation, supply and demand typically clear at the level of corresponding market prices. However, under a price cap regime it is possible that prices are set so that some excess demand remains unsupplied. Given cost-based airport tariffs, some airlines may be willing to buy more slots than airport capacity allows for. Airport capacity is limited by runway capacity, flight regulation, terminal size, and other factors.

In the case of excess demand, slots are allocated to airlines via alternative mechanisms than purely based on willingness to pay. For example, coordinators for many capacity constrained airports in the EU allocate slots through ‘grandfathering rights’ i.e. airlines are allocated airport slots based on their previous use.[26]

The level of utilization of capacity may impact the level of unexpected profit fluctuations due to demand shifts.[27]

Figure 8 illustrates the effect of capacity constraints and excess demand on the variance of profits.

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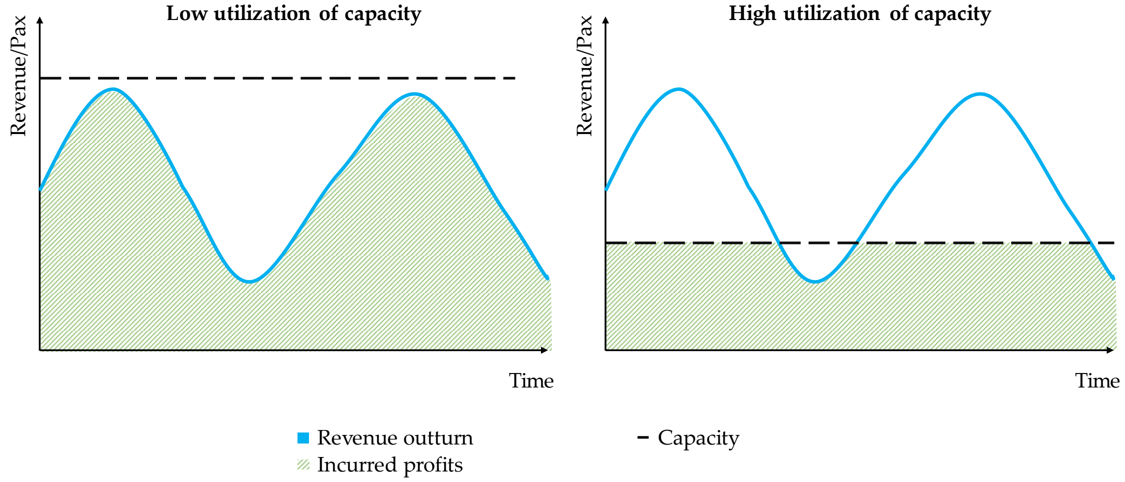
[26] See for example Directorate-General for Internal Policies (2016).

[27] The impact of unexpected demand variation itself is already considered in the Demand-side related factors.

Figure 8: Effects of excess demand and spare capacity on airport Beta risk



Note: Low average capacity utilization means that the airport can supply total demand at the level of the price cap even in the case of high demand outturns. Demand fluctuations are fully translated into profit fluctuations. High average capacity utilization means that in periods of high demand, capacity constraints are limiting the airport's ability to supply to total demand at the level of the price cap. Some excess demand cannot be served, which reduces variation in profits and, as such, systematic risk.

Source: Swiss Economics.

The existence of excess demand implies that airport profits are affected less from demand variations, as an airport remains at existing passenger volume levels (and prices) even under decreased demand.

Some stakeholders argued that spare capacity is too broad as a proxy variable and does not capture temporal investment cycles, planned capacity reductions due to renovations, management's ability to deal with capacity constraints, etc. We agree that reality is likely to be more nuanced than can be captured by a single variable. However, in the context of a high-level risk assessment, we believe it is appropriate to use a simplified and stylised variable such as overall capacity utilisation.

3.3.3 Conclusion on supply-related factors

From the range of supply-related factors, we deem the extent of spare capacity and cost fixity as relevant drivers of systematic risk.

Table 4 summarizes how we score airports according to their exposure to supply-related factors driving Beta risk.

Table 4: Summary of supply-related variables driving differences in Beta risk between airports

Variable	Description	Weight
Spare Capacity Score	We create a score that measures the capacity utilisation of an airport. In other words, the measurement gives insight on whether the airport can handle any excess demand or if he cannot grow any further. Scores range from at capacity (lowest) to very large spare capacity (highest) in 5 increments. Airports are exposed to higher systematic risk with increasing score. However, the importance of the factor is low compared to risk related to price cap rigidity.	Low
Cost Fixity	We use the planned annual investments to RAB ratio as an indication of cost fixity. However, the importance of the factor is low compared to risk related to price cap rigidity.	Low

Source: Swiss Economics

3.4 Other factors

During the stakeholder consultation, some airports and user organisations mentioned other factors, unrelated to regulation, demand or supply as potential sources for differences in Beta risk across airports.

- **Airport size** (e.g. in terms of pax numbers or capital employed) was explicitly or implicitly mentioned by several stakeholders. We are aware of the economic literature that finds evidence of a small cap premium. However, the literature typically roots in extensions of the basic CAPM that are, to our understanding, not consistent with French legal requirements.
- **Financial leverage** was mentioned by one stakeholder. We agree that this is a key factor determining Beta risk. However, the implicit presumption underlying this report is that the comparison of airport Betas will be on the basis of Asset Betas, which are hypothetical and represent the Beta risk for a fully equity-financed company.
- **Project and construction risk** was mentioned by another stakeholder. For airports under ART's mandate, investments are included in the RAB before they are put into service. Cost overruns or project delays are partly covered by revenue allowances. In the stakeholder's view, airports under ART's mandate face reduced risk due to the French particularities related to project and construction risk. In our view, project and construction risk is not systematic, as there is no systematic correlation with overall economic activity. Thus, differences in exposure to this kind of risk cannot be captured through the CAPM's Beta coefficient.

4 Scoring of airports

4.1 Scoring airports under ART's mandate

In the following, we assess to which extent airports under ART's regulation are exposed to differences in factors that affect Beta risk. We evaluate each airport in line with the considerations of Section 3.1**.** Most airports are currently under annual tariff review. Their price caps can be adjusted in the case of short term demand deviations. Thus, we consider price caps of airports under annual tariff review to be very flexible.

Under the current legislation, it is only the Parisian Airports, which are regulated under an ERA of five years.[28] The ERA from 2020, which is currently under stakeholder consultation, contains clauses that define when pre-defined adjustments to the price cap are triggered in case of demand outturns that exceed or fall short of expected demand. Depending on the exact parameters of the final ERA, the adjustments may significantly mitigate the impact of traffic shocks. Moreover, a termination clause states that when traffic falls under a given threshold for three consecutive years, the ERA is cancelled. Thus, even though the risk related to price cap rigidity is higher for the Parisian Airports than it is for other airports under ART's mandate, the regime can hardly be labelled as strict. Our preliminary assessment is that price caps for the Parisian Airports are flexible. The assessment may change depending on the definitive ERA.

During the stakeholder consultation, one stakeholder argued that the Parisian Airports can always choose to cancel the ERA, which should be considered as an ultimate risk protection that implies ERA and annual tariff reviews mean similar risk exposure. However, we understand that within-period cancellation of an ERA has not happened in the past and we deem that it would only be triggered in the case of a very large demand downturn.

Other stakeholders argued that it is counterintuitive that airports under a CER are considered to be more exposed to systematic risk than airports under annual tariff review. According to one stakeholder, investors typically react positively to an airport entering a CER, which would demonstrate a reduction in systematic risk. We disagree with this view. Economic literature and practitioners largely agree that incentive-based regulation means higher firm profits compared to rate of return regulation. Investors may be happy to accept more risk in return to higher expected profits.

Table 5 summarizes our view of differences in price cap rigidity between airports under ART's mandate.

Table 5: Scoring airports under ART's mandate for differences in exposure to risks related to regulation

Airport	Price Cap rigidity	Standardized Score
Bâle Mulhouse Airport	1 - Very Flexible	-8.7
Bordeaux Mérignac Airport	1 - Very Flexible	-8.7
Lyon Saint Exupéry Airport	1 - Very Flexible	-8.7
Marseille Airport	1 - Very Flexible	-8.7
Nantes Atlantique Airport	1 - Very Flexible	-8.7
Nice Airport	1 - Very Flexible	-8.7
Parisian Airports	2 – Flexible	-3.3
Toulouse Blagnac Airport	1 - Very Flexible	-8.7

Note: Price Cap rigidity was translated into numerical values from 1 (Very Flexible) to 4 (Very Strict) and standardized using mean and variance across comparator airports. Standardized Score bases on the standardized value of the Price Cap rigidity score and is multiplied by a weighting factor, in order to reflect the importance of differences in regulatory rigidity as a driver of differences in Beta risk across airports.

Source: Swiss Economics

Demand structure differs between airports under ART's mandate, which is likely to translate into differences in systematic risk. Airports like [✂] are likely to be faced with larger demand swings

[28] Toulouse Blagnac Airport changed to an annual tariff review in 2019. However, if the airport opts for a CER again in the future, the scoring should be re-evaluated.

caused by economic cycles due to their relatively high share of LCC traffic.[29] Less significantly, these airports are mostly point to point airports with low shares of transfer passengers (i.e. high shares of direct pax), which means that they face lower demand elasticities and higher losses in the case of the profit-maximising price falling below the price cap. **Table 6** summarizes our assessment of differences in Beta risk between airports under ART's mandate due to demand-related factors.

Table 6: Scoring airports under ART's mandate for differences in exposure to demand-related risks

Airport	Share of LCC	Share of direct pax	Standardized Score
Bâle Mulhouse Airport	[✂]	[✂]	1.5
Bordeaux Mérignac Airport	[✂]	[✂]	0.7
Lyon Saint Exupéry Airport	[✂]	[✂]	0.5
Marseille Airport	[✂]	[✂]	-0.0
Nantes Atlantique Airport	[✂]	[✂]	0.6
Nice Airport	[✂]	[✂]	0.0
Parisian Airports	[✂]	[✂]	-0.2
Toulouse Blagnac Airport	[✂]	[✂]	0.4

Note: Standardized Score bases on the sum of standardized values of the variables Share of LCC and Share of direct pax. The variables were standardized using mean and variance of comparator airports. The standardized variables were multiplied by a weighting factor in order to reflect their importance compared to other factors in determining differences in Beta risk across airports.

Source: Swiss Economics

Finally, there are differences in the structure of supply, which influence airports' Beta risk. Most airports except the [✂] have [✂], which [✂] their Beta risk.

Table 7 summarises our view on differences in Beta risk between airports under ART's mandate due to differences in the structure of supply.

[29] We have not received a response to our questionnaire from [✂]. We used averages of the reported values in responses from airports of similar size [✂] to impute data for [✂].

Table 7: Scoring airports under ART's mandate for differences in exposure to supply-related risks

Airport	Spare Capacity Score	Investments to RAB	Standardized Score
Bâle Mulhouse Airport	[✂]	[✂]	1.2
Bordeaux Mérignac Airport	[✂]	[✂]	1.2
Lyon Saint Exupéry Airport	[✂]	[✂]	0.2
Marseille Airport	[✂]	[✂]	0.4
Nantes Atlantique Airport	[✂]	[✂]	0.9
Nice Airport	[✂]	[✂]	0.6
Parisian Airports	[✂]	[✂]	0.5
Toulouse Blagnac Airport	[✂]	[✂]	1.3

Note: Spare Capacity Score was translated into numerical values from 1 (At Capacity) to 5 (Very Large Spare Capacities). Spare Capacity Score and Investments to RAB variables were both standardized using mean and variance of comparator airports, weighted in order to reflect their importance compared to other factors in determining differences in Beta risk across airports, The Standardized Score represents the sum of the two standardized values.

Source: Swiss Economics

4.2 List of comparator airports

We use a sample of exchange-listed airports for empirical evidence of comparator Betas. In line with the recommendations of the Thessaloniki Forum of Airport Charges Regulators (Thessaloniki Forum), we focus on airports located within the European Economic Area (EEA) and Switzerland.

Table 8: List of exchange-listed airport stocks

Airport	Stock
AENA Aeropuertos (Madrid, Barcelona, and 48 more Spanish airports)	BME: AENA
Aéroports de Paris (Group)	EPA: ADP
Copenhagen Airport	CPH: KBHL
Fraport (Frankfurt)	ETR: FRA
Zurich Airport	SWX: FHZN

Notes: Aéroports de Paris' operator, Groupe ADP, is listed at Euronext Paris exchange and as such can be used for empirical evidence despite the regulated entities Charles de Gaulle, Orly and le Bourget being part of the group.

Source: Swiss Economics.

We followed the advice of some stakeholders and removed Auckland Airport, Sydney Airport, and Vienna Airport from the original list of empirical comparator airports. Auckland Airport and Sydney Airport were removed because of their large geographic distance to Europe that cast doubt on the external validity of their Betas for European airports.

The removal of Vienna Airport is due to concerns that our framework on risks related to the regulatory environment may not be able to adequately capture some relevant dimensions of how the price cap is implemented by the Austrian regulator. Specifically, one stakeholder highlighted that Vienna's price cap system should be considered strict under our conceptual framework, but it would impose significantly fewer constraints on the airport's pricing behaviour than the regimes for other airports in our list of comparators.

The empirical comparators are complemented with evidence from regulatory precedence on Betas set by European airport regulators in the recent past.

Table 9: List of airports with regulated Betas

Airport	Regulator
Aeroporti di Roma	Italian Civil Aviation Authority (ENAC)
Amsterdam Schiphol Airport	Dutch Authority for Consumers & Markets (ACM)
Dublin Airport	Irish Commission for Aviation Regulation (CAR)
Gatwick Airport	UK Civil Aviation Authority (CAA)
Heathrow Airport	CAA

Source: Swiss Economics Report.

We removed Milano Airport from the list of Betas from regulatory precedence, as it became evident that public information on ENAC's WACC decision did not suffice to approximate the underlying Asset Beta.

4.3 Scoring comparator airports

In a similar manner to airports under ART's mandate, we score comparator airports in terms of their differences in price cap rigidity, demand structure, and supply structure.

Of the comparator airports, only Fraport is regulated under a price cap regime with a comparable flexibility to the French airports with annual tariff reviews.

Large international airports, which the comparator sample mostly consists of, tend to be under tariff regulation with at least some multiannual rigidity. In our view, London Heathrow and London Gatwick's price regulation is the strictest across comparator airports with a regulatory period of five years and little space for adjustments. Dublin Airport's price cap regime is comparable to Heathrow, but we consider the likelihood of state intervention in the case of extreme events to be significantly higher for Dublin Airport as the main gateway for visitors to the country. In addition, Dublin Airport and AENA are both operated by state-owned companies, which increases the likelihood of intervention compared to the privately held UK airports in our view. Zurich Airport operates under a long regulatory period as well, but new determinations can be initiated within the period by Federal Office of Civil Aviation.[30]

We consider the price cap rigidity of regulatory regimes for Aeroporti di Roma, AdP, Amsterdam Schiphol Airport, and Copenhagen Airport to be flexible. All of them have incorporated significant risk sharing mechanisms of some sort.

Table 10 reports our assessment of the price cap rigidity of comparator airports.

30 We increased the assessment of Zurich Airport's price cap rigidity score by a notch, following one stakeholder's response that AdP's price cap should be considered less rigid than Zurich Airport's.

Table 10: Scoring comparator airports for differences in exposure to risks related to regulation

Airport	Price Cap rigidity	Standardized Score
AENA	3 - Strict	2.2
Aeroporti di Roma	2 - Flexible	-3.3
Aéroports de Paris	2 - Flexible	-3.3
Amsterdam Schiphol Airport	2 - Flexible	-3.3
Copenhagen Airport	2 - Flexible	-3.3
Dublin Airport	3 - Strict	2.2
Fraport	1 - Very Flexible	-8.7
London Gatwick Airport	4 - Very Strict	7.6
London Heathrow Airport	4 - Very Strict	7.6
Zurich Airport	3 - Strict	2.2

Note: Price Cap rigidity was translated into numerical values from 1 (Very Flexible) to 4 (Very Strict) and standardized using mean and variance across comparator airports. Standardized Score bases on the standardized value of the Price Cap rigidity score and is multiplied by a weighting factor, in order to reflect the importance of differences in regulatory rigidity as a driver of differences in Beta risk across airports.

Source: Swiss Economics

Comparator airports differ in their risk profiles due to differences in the share of LCC traffic and in the share of transfer passengers. AENA, which includes a collection of holiday destination airports, London Gatwick, as Europe's biggest point to point airport, and Dublin Airport, as Ryanair's main base, all have large shares of LCC traffic, which has an increasing effect on their systematic risk profile.[31][32]

Hub airports like Amsterdam Schiphol Airport, Fraport, and London Heathrow Airport have high share of transfer passengers which increases the sensitivity of demand but decreases systematic risk.

Table 11 summarises our view on how comparator score across demand-related factors affecting Beta risk.

31 One stakeholder argued that AENA's conglomerate structure could mitigate its demand-related risks despite large exposure to LCCs. We do not disagree with this argument, but we think that a conglomerate structure does not fully counterbalance the increased volatility from price sensitive holiday travels.

32 One stakeholder argued that Ryanair's strong presence at Dublin Airport mitigates demand risk for the airport, rather than it increases it, as the airline would be unlikely to move its base to a different airport. In the stakeholder's view, in this particular case the increased share of LCC implies decreased rather than increased risk exposure. We are not convinced by the argument. In our view, the increased demand swings from LCCs is more about the greater GDP elasticity for price sensitive leisure pax than the willingness to switch bases of the airlines catering to this segment of demand.

Table 11: Scoring comparator airports for differences in exposure to demand-related risks

Airport	Share of LCC	Share of direct pax	Standardized Score
AENA	54%	78%	0.8
Aeroporti di Roma	32%	78%	0.2
Aéroports de Paris	[✂]	[✂]	0.2
Amsterdam Schiphol Airport	22%	64%	-0.2
Copenhagen Airport	18%	81%	-0.2
Dublin Airport	38%	93%	0.5
Fraport	4%	45%	-0.9
London Gatwick Airport	50%	91%	0.8
London Heathrow Airport	2%	70%	-0.8
Zurich Airport	21%	72%	-0.2

Note: Standardized Score bases on the sum of standardized values of the variables Share of LCC and Share of direct pax. The variables were standardized using mean and variance of comparator airports. The standardized variables were multiplied by a weighting factor in order to reflect their importance compared to other factors in determining differences in Beta risk across airports.

Source: Swiss Economics

Finally, regarding supply-related factors, there are differences in the level of spare capacity across comparator airports, which drive systematic risk. London Heathrow Airport, London Gatwick Airport, and Amsterdam Schiphol Airport have the highest utilization among comparator airports, which decreases their Beta risk relative airports with significant spare capacity, such as Copenhagen Airport or Dublin Airport.

Table 12 reports our assessment of how comparator airports score against each other with regard to supply-related factors that affect Beta risk.

Table 12: Scoring comparator airports for differences in exposure to supply-related risks

Airport	Free Capacity Score	Investments to RAB	Standardised Supply Score
AENA	4 - Large Spare Capacity	13%	0.4
Aeroporti di Roma	3 - Average Spare Capacity	21%	0.7
Aéroports de Paris	[✂]	[✂]	0.2
Amsterdam Schiphol Airport	1 - At Capacity	6%	-1.5
Copenhagen Airport	4 - Large Spare Capacity	16%	0.6
Dublin Airport	4 - Large Spare Capacity	13%	0.3
Fraport	2 - Little Spare Capacity	19%	0.2
London Gatwick Airport	1 - At Capacity	6%	-1.4
London Heathrow Airport	1 - At Capacity	15%	-0.6
Zurich Airport	4 - Large Spare Capacity	22%	1.2

Note: Spare Capacity Score was translated into numerical values from 1 (At Capacity) to 5 (Very Large Spare Capacities). Spare Capacity Score and Investments to RAB variables were both standardized using mean and variance of comparator airports, weighted in order to reflect their importance compared to other factors in determining differences in Beta risk across airports, The Standardized Score represents the sum of the two standardized values.

Source: Swiss Economics

4.4 Relevant considerations regarding comparator airports

The relevance of comparator Betas does not only depend on the comparability of the airports' risk profiles. A key selection consideration for comparator Betas should be the degree of uncertainty that is tied to the underlying data and methodology used to estimate the comparator Beta.

We set out criteria for how reliable Beta estimates for comparator airports are and propose a discounting factor for comparators that are less reliable than others.

4.4.1 Betas set by regulator

If a comparator Beta originates from a regulatory decision, there exist several reasons for why it may only inaccurately capture the comparator airport's true systematic risk:

- The Beta of the comparator airport may have been inferred from a sample of stock-listed airports itself and as such only approximate the regulated entities true systematic risk.
- At most, regulators determine an airport's Beta once every determination. However, often Beta estimates are not determined from scratch, but previous estimates are sense checked and continued. For example, the CAA is planning on using an Asset Beta for Heathrow's H7 Determination, which originates from before BAA, the holding company, was delisted from the London Stock Exchange in 2006. Thus, Betas set by regulators may not always reflect recent changes in systematic risk.

On the grounds of the uncertainty around regulatory Betas outlined above, we propose to discount the weight given to comparator Betas set by regulators by 25%.

4.4.2 Unregulated activities

Empirical Betas, which are based on the correlation between airport stock returns and market indices, typically do not only reflect the returns of the regulated entity, but also include unregulated activities.

We concluded in **Section 3** that the width of the regulatory perimeter is unlikely to have a significant effect on the Beta of the regulated entity. Aeronautical revenues and airports' commercial revenues (e.g. retail, car parking, etc.) are likely to be closely linked to overall economic activity. However, the combined Beta for regulated and unregulated activities may change significantly depending on the regulatory perimeter. When excluded from the till, the airport may experience different magnitudes of variance in overall profits than when commercial revenues are included in the till.

Airport operators have in recent years increasingly diversified their business to include more and more activities that are not immediately related to the airport business. In 2015 for example, Zurich Airport AG, the holding company of Zurich Airport, has started to build Switzerland's largest construction project for offices and retail space, the CIRCLE. The project is excluded from the regulatory till, but it will nevertheless have an impact on the airport's Beta estimated from stock market data.

Also, as one stakeholder mentioned during the second stakeholder consultation, some listed airport holding companies own minority and majority shares in a substantial number of additional airports. For example, Fraport's holding company holds equity in a total of 30 smaller regional airports distributed.

We discount the weight given to empirically estimated comparator Betas depending on the significance of unregulated activities captured by the Beta estimate. Specifically, if the comparator airport is regulated under a Dual Till approach (or some form of Adjusted Till with significant shares of commercial revenues outside the regulatory perimeter), we discount the weighting given to the comparator airport by 25%. The same discount applies to airport operators under Single Till regulation, but with significant shares of activities that are not directly related to operations of the airport, such as logistics, maintenance, the operation of airport cities or investment activities, such as shares in unrelated and unregulated airports (e.g. in the case of Fraport).[33]

We note that the Betas for the various types of unregulated activities depend on the specific market conditions. However, given that regulation typically leads to a substantial reduction in demand risk through periodic resets of the price cap and other variables, we deem that our approach is conservative from the point of view from an airport under ART's mandate i.e. in our view the empirical Beta of airport stock data including unregulated activities is more likely to overestimate the Beta of the regulated activities rather than to underestimate it.

4.4.3 Conclusion on weights for comparator airports

The discounts discussed above are summed up to result into airport-specific discounting factors to reflect uncertainty around the underlying Beta. The individual discounts are summarised in **Table 13**.

Table 13: Uncertainty discounts

Airport	Discount for uncertainty regarding regulatory Betas	Discount for unregulated activities	Total discount
AENA	0%	25%	25%
Aeroporti di Roma	25%	0%	25%
Aéroports de Paris	0%	25%	25%
Amsterdam Schiphol Airport	25%	0%	25%
Copenhagen Airport	0%	25%	25%
Dublin Airport	25%	0%	25%
Fraport	0%	25%	25%
London Gatwick Airport	25%	0%	25%
London Heathrow Airport	25%	0%	25%
Zurich Airport	0%	25%	25%

Source: Swiss Economics.

Following the removal of overseas airports from the list of comparators after the stakeholder consultation, the resulting total discounts are identical for all remaining comparator airports and cancel each other out. We decided to keep the discounts in the report for two reasons. Firstly, the conceptual point about the uncertainty around empirical evidence on Betas as well as on regulatory precedent remains valid. Secondly, the sample of comparator airports may change over time and new comparators may be introduced that do not need to be discounted.

[33] A more nuanced assessment of the uncertainty with respect to unregulated activities was omitted due to lack of reliable data for comparator airports.

5 Definition of comparator groups

We categorize airports under ART's mandate and comparator airports into three groups depending on their total score for risk drivers in the area of regulation, demand, and supply. Airports in the first (last) group exhibit in our view the lowest (highest) risk profiles.

Using similar intervals for all groups, airports under ART's mandate fall into Groups 1 and 2.

- **Group 1** includes Bâle Mulhouse Airport, Bordeaux Mérignac Airport, Lyon Saint Exupéry Airport, Marseille Airport, Nantes Atlantique Airport, Nice Airport, and Toulouse Blagnac Airport;
- **Group 2** includes the Parisian Airports.

Table 14 reports total scores and group membership for airports under ART's mandate and comparator airports.

Table 14: Grouping of airports under ART's mandate and comparator airports

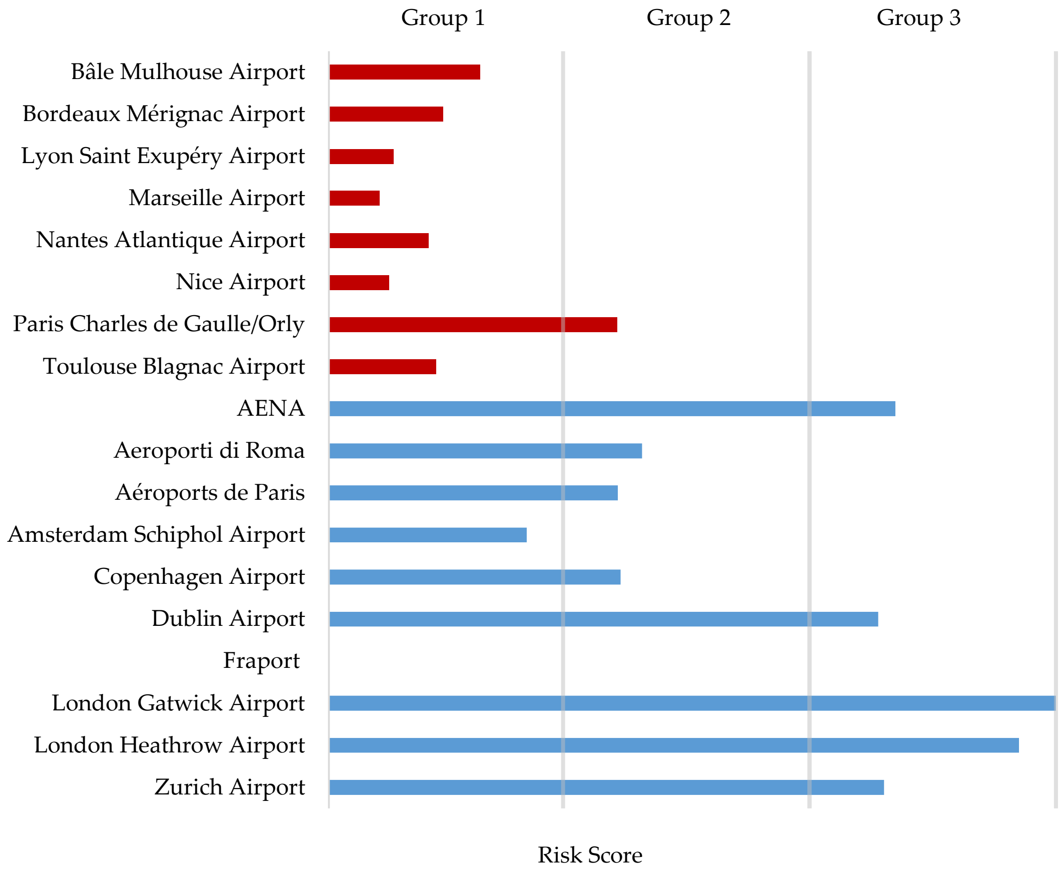
Airport	Standardized Score for regulation-related risks	Standardized Score for demand-related risks	Standardized Score for supply-related risks	Total Standardized Score (Risk Score)	Group Membership
Airports under ART's mandate					
Bâle Mulhouse Airport	-8.7	1.5	1.2	-6.1	**1**
Bordeaux Mérignac Airport	-8.7	0.7	1.2	-6.9	**1**
Lyon Saint Exupéry Airport	-8.7	0.5	0.2	-8.0	**1**
Marseille Airport	-8.7	0.0	0.4	-8.3	**1**
Nantes Atlantique Airport	-8.7	0.6	0.9	-7.2	**1**
Nice Airport	-8.7	0.0	0.6	-8.1	**1**
Parisian Airports	-3.3	-0.2	0.5	-2.9	**2**
Toulouse Blagnac Airport	-8.7	0.4	1.3	-7.1	**1**
Comparator airports					
AENA	2.2	0.8	0.4	3.4	**3**
Aeroporti di Roma	-3.3	0.2	0.7	-2.4	**2**
Aéroports de Paris	-3.3	0.2	0.2	-2.9	**2**
Amsterdam Schiphol Airport	-3.3	-0.2	-1.5	-5.0	**1**
Copenhagen Airport	-3.3	-0.2	0.6	-2.9	**2**
Dublin Airport	2.2	0.5	0.3	3.0	**3**
Fraport	-8.7	-0.9	0.2	-9.5	**1**
London Gatwick Airport	7.6	0.8	-1.4	7.0	**3**
London Heathrow Airport	7.6	-0.8	-0.6	6.2	**3**
Zurich Airport	2.2	-0.2	1.2	3.1	**3**

Note: Three groups were defined in total. The groups were constructed so that each group spans a similar interval of scores with a length of 5.5 starting from an aggregate Score of -9.5 to 7.0.

Source: Swiss Economics

The overall result of our grouping assessment, including airports under ART's mandate and comparator airports, is illustrated in **Figure 9**.

Figure 9: Beta risk groups including all airports



Source: Swiss Economics.

For the Parisian Airports the following comparator airports are in the same risk group:

- Aeroporti di Roma;
- AdP (Group)
- Copenhagen Airport.

For the remaining French airports under ART's mandate, the following comparator airports are in the same risk group:

- Amsterdam Schiphol;
- Fraport.

During the stakeholder consultation, some airports expressed a concern that the sample contains comparator airports that are too big in terms of pax numbers and capital employed in order to serve as a benchmark for French regional airports.[34] However, as outlined in Section **3.4**, our view is that size is not a factor that drives Beta risk. As such, size will not be reflected in the Beta coefficient.

[34] For example, one stakeholder mentioned that many regional airports have received lower credit ratings than AdP in the past. However, this observation does not contradict our argumentation, as Credit Rating Agencies typically assess many other factors than just Beta risk, e.g. the risk that debtors may not be able to repay their debt.

6 Weighting Matrix

Finally, we present a matrix that can be used in combination with a vector of comparator Betas to determine the appropriate level of the Beta for airports under ART's mandate. The matrix containing weights for every combination of ART-regulated airport and comparator airport. Depending on the ART-regulated airport's group membership, a different set of comparator airports applies. Within each group, comparators are weighted equally.

Table 15 presents the weights that are attached to comparator airports depending on the group membership of the airport under ART's mandate.

Table 15: Weighting Matrix

	Group 1	Group 2	Group 3
AENA	0%	0%	20%
Aeroporti di Roma	0%	33%	0%
Aéroports de Paris	0%	33%	0%
Amsterdam Schiphol Airport	50%	0%	0%
Copenhagen Airport	0%	33%	0%
Dublin Airport	0%	0%	20%
Fraport	50%	0%	0%
London Gatwick Airport	0%	0%	20%
London Heathrow Airport	0%	0%	20%
Zurich Airport	0%	0%	20%

Note: For each of the airports under ART's mandate, the matrix attaches equal weights to comparator airports within the same group. Comparator airports in other groups are not considered. No additional weighting is required, as the uncertainty around all comparator Betas is comparable and uncertainty discounts cancel each other out. Percentages may not add up to 100% percent due to rounding.

Source: Swiss Economics

Thus, for ART-regulated airports in Group 1, we propose to use an equally weighted average of comparator Betas from Amsterdam Schiphol Airport and Fraport. For the Parisian Airports, we propose to use an equally weighted average of comparator Betas from Aeroporti di Roma, AdP (Group), and Copenhagen Airport.

7 References

AENA (2018), "Strategic Plan 2018-2021." Retrieved from: http://www.aena.es/en/corporate

AENA (2017), "Airport Regulation Document 2017-2021." Retrieved from: www.aena.es

ART (2019), "Consultation publique, Définition de la méthodologie de détermination des CMPC aéroportuaires. " Retrieved from L'Autorité de régulation des transports: https://www.arafer.fr/actualites/

Commission for Aviation Regulation (2019), "Determination on the Maximum Level of Airport Charges at Dublin Airport 2020-2024". Retrieved from the Commission for Aviation Regulation: https://www.aviationreg.ie

Directorate-General for International Policies (2016). "Research for TRAN Committee: Airport slots and aircraft size at EU airports". Retrieved from European Parliament: https://www.europarl.europa.eu/

Economic Regulation Agreement between the Government and the Aeroport de Paris 2016-2020. Retrieved from Groupe ADP: https://www.parisaeroport.fr/

Fama, E. F. (1990). "Stock returns, expected returns, and real activity". The journal of finance, 45(4), 1089-1108.

Fama, E. F., & French, K. R. (2012). "Size, value, and momentum in international stock returns". Journal of financial economics, 105(3), 457-472.

Lerner, A. P. (1934). "The Concept of Monopoly and the Measurement of Monopoly Power". The Review of Economic Studies 1(3), 157-175.

Markowitz, H. (1952), "Portfolio selection". Journal of Finance, 7(1): 77-91.

Ofgem (2012), "RIIO-GD1: Final proposals – Finance and uncertainty supporting document". Retrieved from Ofgem: https://www.ofgem.gov.uk/

Oxera (2017). "The continuing development of airport competition in Europe". Prepared for ACI Europe.

Profillidis, V., and George Botzoris. "Air passenger transport and economic activity."Journal of Air Transport Management 49 (2015): 23-27.

Schinwald, C., & Hornung, M. (2014). "Methodical approach to determining the capacity utilisation of airports: The development of the European air traffic system between 2008 and 2012." Deutsche Gesellschaft für Luft-und Raumfahrt-Lilienthal-Oberth eV.

Thessaloniki Forum of Airport Charges Regulators (2016). "Recommendations for the Setting and the Estimation of the WACC of Airport Managing Bodies". Retrieved from: https://www.aviationreg.ie/

A. Appendix

A.1 Expected impact of risks

This report focuses entirely on the drivers that affect differences in Beta risk i.e. the costs related to uncertainty that cannot be diversified away.

However, regulated companies may also be compensated for the expected impact of systematic *and* idiosyncratic risks through Opex allowances. Opex allowances may be implemented in one of the following ways:

- **Via past realizations:** For risks associated with events that occur frequently, it is likely that past Opex outturn reflects their expected impact well.
- **Via accounting reserves**: Most accounting standards have set out rules for when and how reserves may be set aside for risks that are likely to materialise. Typically, accounting guidelines require firms to account for risks with a high likelihood of realisation by building reserves.
- **Extra Opex allowances:** Risks in connection to unlikely, yet impactful events may be accounted for by additional Opex allowances on the level of the best estimate of annual costs resulting from such risks, i.e. probability times impact.

The CAPM does not consider idiosyncratic risks or any kind of risks, which are uncorrelated to the market portfolio, to be relevant for the level of returns investors expect.

A.2 Questionnaire to airports under ART's mandate

Date: 5 November 2019, Version v1.1

A.2.1 Introduction

Swiss Economics has been commissioned by the Autorité de régulation des transports (l'Autorité) to identify and assess the factors responsible for differences in the level of financial risk between French airports. For this mandate, we prepared this questionnaire that is designed to help us collect the required information and data for such an assessment. We kindly ask the relevant airport representatives to provide us with their response in English or French by November 21, 2019.

The questionnaire is structured as follows:

- First, we aim to identify financial risks and upside potentials that French airports are exposed to.
- Second, we aim to get a better understanding of airports' regulatory constraints and the remuneration mechanism.
- Third, we survey the data that may serve as evidence for differences of risk exposure between airports.

A.2.2 Financial risks

Identification of risks and upside potentials

Q.1 What do you consider to be the main risks to your airport's financial performance over the next 5 years? Please provide a brief explanation for why you consider the risks (if any) as relevant.

Q.2 What do you consider to be the main sources of upside potential for your airport's financial performance over the next 5 years? Please provide a brief explanation for why you consider the upside potentials (if any) as relevant.

A.2.3 Economic regulation and remuneration

Methodology underlying remuneration mechanism

Q.3 Please indicate whether your airport is currently in an economic regulation agreement with the French Government. If so, please provide us with a copy of the agreement.

Q.4 If your airport is currently not in an economic regulation agreement and therefore under annual tariff review, please provide the following information:

- The date of the most recent tariff approval decision for your airport
- An indication of the period covered in the most recent tariff approval decision for your airport
- A description of revenue and asset classes covered by the tariff (i.e. single till, dual till, or adjusted single till)
- A description of ex-post adjustments for tariff levels, which depend on inflation, passenger/flight volumes, service/quality level agreements, or investment activity (if any).
- A description of retrocession mechanisms (if any).

A.2.4 Data request

Passenger data

Q.5 For FY 2018, please provide the number of passengers who travelled through your airport. Please differentiate between arriving passengers, departing passengers, and passengers on connecting flights.

Q.6 For FY 2018, please indicate the share of business passengers and leisure passengers travelling through your airport.

Q.7 For FY 2018, please indicate the share of passengers travelling through your airport who were flying on intercontinental routes, continental routes, and domestic routes.

Airline data

Q.8 For FY 2018, please provide the number of airlines that operated from your airport.

Q.9 For FY 2018, please provide the number of intercontinental routes, continental routes, and domestic routes that were operated from your airport.

Q.10 For FY 2018, please provide the number of intercontinental flights, continental flights, and domestic flights that were operated from your airport.

Q.11 For FY 2018, please provide the share of flights operated by low cost carriers (i.e. Easyjet, Eurowings, Ryanair, Vueling, Wizz Air, etc.) from your airport.

Q.12 For FY 2018, please provide information on your airport's capacity utilisation (e.g. Peak-Load/Base-Load, runway throughput, average delay, etc.).

Financial data

Q.13 For the 2014-18 period, please provide information on the level of aeronautical and non-aeronautical revenues generated by your airport.

Q.14 For the 2014-18 period, please provide information on the level of opex and capex incurred at your airport.

Q.15 For the 2014-18 period, please provide information on the level of the closing regulatory asset base or capital employed.

Q.16 Please provide information on the nature and extent of planned airside and landside investments at your airport over the next 5 years.

Q.17 Please indicate whether you have received or expect to receive aid (e.g. direct grants, subsidised loans, etc.) from governmental organisations during the past 5 years or in the next 5 years. If you have received in the past (or expect to receive in the future) state aid, please provide a brief description of its nature and extent.

A.3 Available data

Our analysis is based on data provided to us by the airports under ART's mandate in their responses to our questionnaire. For comparator airports, data has been collected from annual reports, airports' websites, or regulatory documents.

Departing, arriving and transit passengers

For airports under ART's mandate, we use responses from the questionnaire. For comparator airports we use, where available, 2018 calendar year numbers retrieved from annual reports.

Share of Low-Cost Carriers

Where the statistics on the share of LCC traffic have not been published by the respective comparator airports in their annual reports, we tried to find a reference point, on which our estimation could be based on. **Table 16** all the describes the data for comparator airports.

Table 16: Comparator Airports: Share of LCC

Comparator Airport	Share of LCC	Comment
AENA	54%	Aena (2018) strategic plan p. 8
Copenhagen Airport	18%	The Independent reports a share of 18% for LCC traffic[35]
Fraport	4%	Mentioned by a news article of Reuters[36]
Zurich Airport	21%	As an approximation, the share of destinations that are offered by a low-cost carrier out of all destinations has been taken.
London Heathrow	2%	London is so capacity restricted, that LCC's use other airports in London.
London Gatwick	50%	As an approximation, the share of destinations that are offered by a low-cost carrier out of all destinations has been taken.
Aeroporti di Roma	32%	As an approximation, the share of destinations that are offered by a low-cost carrier out of all destinations has been taken.
Amsterdam Schiphol Airport	42%	As an approximation, the share of destinations that are offered by a low-cost carrier out of all destinations has been taken.
Dublin Airport	38%	As an approximation, the share of destinations that are offered by a low-cost carrier out of all destinations has been taken.
AdP (Group)	[✂]	The share is estimated to be [✂] than the aggregate from CDG, Orly and le Bourget, because [✂].

Table 17 describes the data on LCC for airports under ART's mandate.

Table 17: Airports under ART's mandate: Share of LCC

French Airport	Score	Comment
Parisian Airports	[✂]	Response to questionnaire
Côte d'Azur / Nice Airport	[✂]	Response to questionnaire
Lyon Saint Exupéry Airport	[✂]	Response to questionnaire
Toulouse Blagnac Airport	[✂]	Response to questionnaire
Marseille Airport	[✂]	Response to questionnaire
Bâle Mulhouse Airport	[✂]	Response to questionnaire
Bordeaux Mérignac Airport	[✂]	Response to questionnaire
Nantes Atlantique Airport	[✂]	Response to questionnaire

Planned investments

Information on planned investments was drawn from annual reports and newspaper articles. We use plan costs of future investments and divide them by the duration of the investment phase.

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35 https://www.independent.co.uk/travel/news-and-advice/copenhagen-open-for-low-cost-flights-2123794.html

36 https://de.reuters.com/article/fraport-strategy/interview-frankfurt-airport-eyes-more-low-cost-flights-fraport-ceo-idUKL5N1CD2PL

Price Cap rigidity

Information on the length of the regulation period and scope for within period adjustments was collected from the website of the regulation authority or in the annual report of the airports.

Table 18: Comparator Airports: Price Cap rigidity Score

Comparator Airport	Score	Comment
AdP (Group)	Flexible	AdP has a 5-year regulation agreement. However, the CER contains a number of adjustments to the cap, including for when demand outturns deviate from plan numbers.
AENA	Strict	Tariffs are generally fixed for a 5-year period. They may only be changed because of the company's performance in terms of quality and fulfilment of strategic plans (AENA, 2017 p. 10) but not because of demand fluctuations. However, Spanish government, in the form of Enaire, holds a majority of the company's stock, which makes amendments to the price more likely in the event of extreme demand outturns.
Aeroporti di Roma	Flexible	Rome has a 5-year regulation agreement, including a range of adjustments to tariffs under certain scenarios. The annual change is, for example, dependent on the traffic forecast. Deviations of +/-5% from the forecast are borne by the airport, but larger deviations lead to tariff adjustments.
Amsterdam Schiphol Airport	Flexible	Tariffs are fixed for 3 years without options for Schiphol to adjust the pricing. However, we understand that there exist relatively far-reaching risk sharing mechanisms for Opex and Capex.
Copenhagen Airport	Flexible	The airport proposes tariffs which then are approved by the regulator. These tariffs appear to be sensitive to investments. Furthermore, route discounts can be implemented for new destinations.
Dublin Airport	Strict	Tariffs are fixed for a period of 4 to 5 years. However, state intervention seems more likely for Dublin Airport than for airports under a comparable regulatory regime given its importance as national gateway.
Fraport	Very Flexible	Fraport does not have a multi-year agreement and can initiate consultations at its own discretion.
London Gatwick Airport	Very Strict	No adjustment within the 5-year regulation agreement. The airport is privately held, with the French infrastructure company VINCI holding a majority stake.
London Heathrow Airport	Very Strict	No adjustment within the 5-year regulation agreement. The airport is owned fully by Spanish infrastructure company Ferrovial.
Zurich Airport	Strict	Zurich has economic regulation agreements of up to 4 years. The Federal Office of Civil Aviation authority may adjust tariffs in case revenues start to diverge too much from underlying costs, e.g. due to unexpected demand outturn. However, the airport may only trigger a new determination of charges in the event of unexpected costs or unexpected regulatory interventions but not in the case of demand fluctuations.

Table 19: Airports under ART's mandate: Price Cap Rigidity Score

French Airport	Score	Comment
Bâle Mulhouse Airport	Very Flexible	Annual agreement which can be extended to two years, if the airport chooses so.
Bordeaux Mérignac Airport	Very Flexible	Annual agreement which can be extended to two years, if the airport chooses so.
Côte d'Azur / Nice Airport	Very Flexible	Annual agreement which can be extended to two years, if the airport chooses so.
Lyon Saint Exupéry Airport	Very Flexible	Annual agreement which can be extended to two years, if the airport chooses so.
Marseille Airport	Very Flexible	Annual agreement which can be extended to two years, if the airport chooses so.
Nantes Atlantique Airport	Very Flexible	Annual agreement which can be extended to two years, if the airport chooses so.
Parisian Airports	Flexible	AdP has a 5-year regulation agreement. However, the CER contains a number of adjustments to the cap, including for when demand outturns deviate from plan numbers.
Toulouse Blagnac Airport	Very Flexible	Annual agreement which can be extended to two years, if the airport chooses so.

Capacity utilisation

In order to measure the degree of capacity utilisation, a scoring system has been implemented which ranges from "Very Large Spare Capacity" to "At Capacity".

Generally, the focus of the assessment is on the airport's runway system, as this usually represents the bottleneck of the entire air transport system (Schinwald & Hornung, 2014). **Table 20** lists all the airports considered, their respective score and an explanation to why the score has been chosen for that airport. Schinwald & Hornung (2014) (further referred to as S&H) uses a methodical approach to determine the capacity utilisation 75 major airports. Where available, we cross check our analysis with their rating.

Table 20: Comparator Airports: Capacity Utilisation Score

Comparator Airport	Score	Comment
AdP (Group)	[✂]	[✂] average capacity utilisation, [✂] of the time at peak hours.
AENA	Large Spare Capacity	Madrid and Barcelona have relatively high capacity utilisation based on S&H. However, AENA also consist of many regional airports with presumably more spare capacity.
Aeroporti di Roma	Average Spare Capacity	70% average capacity utilisation, 45% of the time at peak hours.
Amsterdam Schiphol Airport	At Capacity	All major infrastructure is highly constrained and a movement cap restricts further growth.
Copenhagen Airport	Large Spare Capacity	Copenhagen on average operates at 60% of total capacity and operates at peak hours around 40% of the time (S&H) this translates to an average score.
Dublin Airport	Large Spare Capacity	68% average capacity utilisation, 38% of the time at peak hours.
Fraport	Little Spare Capacity	Fraport on average operates at 77% of total capacity and operates at peak hours around 66% of the time (S&H).
London Gatwick	At Capacity	Second busiest airport with only one runway[37]
London Heathrow	At Capacity	Very likely the most utilized airport in the world operating at 98%/99%[38]
Zurich Airport	Large Spare Capacity	67% average capacity utilisation, 43% of the time at peak hours.

[37] https://timesofindia.indiatimes.com/city/mumbai/now-mumbai-worlds-busiest-airport-with-only-one-runway/articleshow/58652790.cms.

[38] https://www.wired.co.uk/article/heathrow-third-runway-plans-expansion.

Table 21: Airports under ART's mandate: Capacity Utilisation Score

French Airport	Score	Comment
Bâle Mulhouse Airport	[✂]	The Airport has capacity for [✂] passengers and currently processes [✂]. Runway operates at [✂] of total capacity.
Bordeaux Mérignac Airport	[✂]	The capacity utilisation of Bordeaux is at [✂]
Côte d'Azur / Nice Airport	[✂]	The average peak hour in a day is at around [✂] of full capacity. On various days, the peak hour reaches true capacity constraint.
Lyon Saint Exupéry Airport	[✂]	Lyon has [✂] peaks per day, where the airport operates at full capacity. Most of the time, the runways system is used appropriately.
Marseille Airport	[✂]	Open 24h per day and has around 270 aircraft movements/day.[39] Marseille states that the two runways operate at [✂] of total capacity.
Nantes Atlantique Airport	[✂]	[✂]
Parisian Airports	[✂]	Same reasoning as ADP (Group)
Toulouse Blagnac Airport	[✂]	Runways operate at [✂] of total capacity.

39 https://www.marseille-airport.com/professionals/airlines/key-facts-figures.

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