Study on the Determinants of Cost of Capital of Bangalore International Airport Limited (BIAL)

June 2020

IIMB
तेजस्वि नावधीतमस्तु
भारतीय प्रबंध संस्थान बेंगलूर
INDIAN INSTITUTE OF MANAGEMENT BANGALORE

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Executive Summary

This report provides an estimate of the Cost of Equity (CoE) for Bangalore International Airport Ltd (BIAL). A benchmark set of "comparable" international airports are used to estimate the systematic risk exposure of BIAL aero assets under a target gearing ratio, as described in the Capital Asset Pricing Model (CAPM). The Cost of Equity computation also accounts for BIAL specific attributes such as revenue till structure, ownership structure and scale of operations by using a proximity score weighted approach, which factors the closeness of BIAL to the set of "comparable" airports. Based on a reasonable set of assumptions, the report provides the following estimates of Cost of Equity:

Variable (Col 1)	BIAL (Col 2)
Asset Beta based on Proximity Score Weights of comparable set	0.562659
Target gearing ratio (Debt/Debt + Equity)	48%
Target gearing ratio (Debt/Equity)	0.9231
Equity Betas	0.9262
Risk Free Rate	7.56%
Equity Risk Premium	8.06%
Cost of Equity	**15.03%**

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Chapter 1 – Introduction

The airport infrastructure sector has been undergoing a phased change during the past 15 years. The first Public Private Partnership (PPP) model of airport operations was implemented in Delhi, Mumbai, Bangalore and Hyderabad airports starting in 2004. While Delhi and Mumbai were brownfield projects, the other two were greenfield in nature. As with any infrastructure project, these projects involved high Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) mobilization. To ensure viability of airport investment, it is standard practice to provide a reasonable return to investors by charging airport users an appropriate tariff.

The Airports Economic Regulatory Authority (AERA) was established in 2008 for fixing aero tariffs and User Development Fee (UDF) at different airports.[1] AERA uses the Capital Asset Pricing Model (CAPM) to determine the Cost of Equity (CoE) and hence the FRoR. As mandated by the Act, the tariffs are determined at a periodicity of 5 years.[2] This report computes the CoE (and illustrates the process to compute FRoR) for the Bangalore International Airport Ltd. (BIAL).

1.1. Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model (CAPM) has evolved and has been used effectively for some time now across industries the world over. Equation 1.1 depicts the CAPM[3]

$$R_E = R_f + \beta_E (R_M - R_f),$$

Equation 1.1 – CAPM

where

R_E = Expected return (and the company's cost of equity capital)

R_f = Risk-free rate.

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[1] http://aera.gov.in/upload/uploadfiles/files/AERAACT.pdf as viewed on 28 Feb 2020

[2] http://aera.gov.in/content/innerpage/faqs.php as viewed on 28 Feb 2020

[3] While in our study here, we have used the CAPM model, there are also other models available for exploration. Some of these being, the Arbitrage Pricing Theory and other variants of the CAPM (e.g., Breeden's Consumption CAPM and Merton's ICAPM) are theoretically sophisticated models that are more general than the CAPM. However, for all practical purposes, the plain CAPM is by far the most widely accepted model used to estimate the cost of capital.

R_M - R_f = Equity Risk Premium (ERP).

β_E = Equity beta.

Various methods are employed for determining R_f, R_M and β_E. **We use this CAPM equation (Equation 1.1) throughout this report for the computation of Cost of Equity.**

The NIPFP study[4] commissioned by AERA around 2011 had argued and proposed a rate between 11.64% and 13.84% as the Cost of Equity. However, the NIPFP study is dated in the sense that Equity Risk Premiums are time varying and the information set as of 2011 (the time-period of the NIPFP study) differs from the current information set (as of 2018). As is evident from Eq. (1), the rate of return or CAPM rate depends on 3 inherent factors.

a. Risk-free rate, R_f
b. Equity Risk Premium (ERP), $R_M - R_f$
c. Equity β_E

While it is relatively easy to determine R_f, the other two factors are difficult to estimate in the case of India. Some estimates of the long-term Equity Risk Premium (ERP), and hence, long-term expected returns (R_M) by Damodaran[5] and others[6,7] are available in literature. The equity β_E estimation can also yield a range of values depending on the assumptions employed.

Fair Rate of Return (FRoR)

The Fair Rate of Return (FRoR) is essentially the weighted average cost of capital evaluated at a normative debt to equity ratio. It reflects the cost of equity and the cost of debt and can be thought of as the return demanded by the providers of capital (debt and equity holders). Using an illustrative cost of debt (since cost of debt must be estimated annually using the latest information), we illustrate the computation of FRoR in Chapter 3 (section 3.2.6 and Equation 3.4).

4 "Estimating Cost of Capital for Private Airports in India", NIPFP, Dec 2011
5 http://pages.stern.nyu.edu/~adamodar/ as seen on 10 Sep 2018
6 Dimson, Marsh and Staunton (DMS); Triumph of the Optimists: 101 Years of Global Investment Returns (Princeton University Press, 2002)
7 The Global Finance Data (GFD) from www.globalfinancialdata.com as viewed on 28 Feb 2020

1.2. Overview of Airport Sector

Traditionally, airports have been managed by governments the world-over with private participation limited to fuel farms, cargo handling, etc. However, more recently, with demanding passengers (looking for better quality infrastructure with contemporary amenities), private participation has become imperative. It has been observed from experience in other sectors (e.g., ports, roads, etc.) that this mode of operation maximizes efficiency. Also, the government gains monetarily by selling its stake. The British Airports Authority or BAA was the first airport to be publicly listed and traded in 1987.[8] However, owing to high losses triggered by expansions and high operating costs, it finally delisted in 2006. However, other airports like Auckland, Sydney, Thailand (AoT), Malaysia (MAHB), etc. have consistently been successful.

While privatization brings in efficiency and a level of comfort and luxury to the end user, it also imposes a cost on them. The cost is mostly levied in the form of tariffs and fees by the private operator to recoup the CAPEX and OPEX incurred. In order to protect the interests of the end user, regulatory authorities all over the world cap the tariffs that can be levied. For this purpose, airports are classified as based on a "Till Model" as follows:[9]

- Single Till – All airport revenues (including aero and non-aero) are taken into consideration when determining the level of airport usage charges.
- Dual Till – Only aero revenues are taken into consideration when setting airport usage charges.
- Hybrid Till – Aero revenues along with a percentage of non-aero revenues are considered for setting airport usage charges.

Typically, aero revenues include landing and parking charges, aerobridge usage charges, UDF, fuel throughput charges, cute counter charges, and unauthorized stay charges. Non-aero revenues would be car park charges at airport premises, hotels and other business establishments, duty free shops, etc. Cargo may be aero or non-aero depending on the regulatory norms.

[8] https://www.forbes.com/global/2003/0609/043.html#46dc54645c4b as viewed on 28 Feb 2020
[9] *Mark Smith, Brian Pearce; IATA Economics Briefing N°6: Economic Regulation

The breakeven revenue for a sustainable airport operation is estimated using Equation 1.2.

$$ARR = PV(ARR_t) = \sum_{t=1}^{n}(ARRt), \text{ where}$$

$$\boldsymbol{ARR_t = (FRoR \times RAB_t) + D_t + O_t + T_t - (f \times NAR_t),}$$

Equation 1.2 – Breakeven Returns

where

ARR = Aggregate **Aero** Revenue Requirement for a given time period

PV = Present Value

t = Estimation Time period

n = Max(t) in the current control period

FRoR = Fair Rate of Return

RAB = Regulatory Asset Base for a given Till

D = Depreciation

O = Operations' Cost

T = Tax Liability

NAR = Non-Aero Revenues

f = fraction of Non-Aero Revenue subsidising aero revenue

= 0 for dual till;

= 1 for single till;

= fraction (0, 1) for hybrid till.

BIAL uses a hybrid till structure with 30% of non-aero revenues (***f***, in Equation 1.2) subsidizing Aggregate Revenue Requirement (ARR).

1.3. Project Scope and Overview

This study proposes to build on the previous experiences of AERA to determine an appropriate CAPM rate for the Cost of Equity (CoE) for Bangalore International Airport Ltd. (BIAL) for the control period 2019–2024. It proposes to construct a series of scenarios for varying ERP and β_E. The scope of work involves:[10]

a) Study of relevant environment, trends in airport capitalization

[10] Ref Letter: AERA/20010/RFP Study/COE/2018-19/14400 dated 17.07.2018.

b) Study airport-specific determinants of Cost of Capital with specific focus on the Cost of Equity
c) Recommendations on Cost of Equity
d) Follow-on activities

The detailed "Terms of Reference"[10] is provided in Appendix 1.

The next chapter (chapter 2) of this report starts with a study of airports' regulatory practices all over the world. The emphasis here is on the regulatory bodies' stance on the methodology for determining CoE for their jurisdictional airports. This is followed by a section on shortlisting airports that are similar in structure and operation vis-à-vis BIAL. **This "comparables" set would be used to estimate the underlying beta risk and leverage – crucial inputs for determining CoE**. We analyze recent trends in the capitalization structure and funding mechanisms of these comparable firms and examine their performance in the recent past. Next, we carry out a similar exercise for BIAL. This is followed by how CoE is determined in this airport and the takeaways for BIAL therein. In the next section, we provide details of unique features of the Indian market (e.g. demand outstripping supply, external shocks, etc.) that influence the CoE. Finally, we wind up this chapter with a discussion on the trends prevalent generally in other infrastructure space, for e.g., Investment Infrastructure Trusts (InVITs).

Chapter 3 is devoted to estimating CoE. We first start by highlighting the methodology followed by data availability and collection. Next, the analyses of the said data with its assumptions and caveats are provided. Finally, we conclude this chapter with all the results. The key recommendations at the end of each discussion are given under the title of "Recommendations", wherever applicable. A final summary of all recommendations made throughout this study is presented at the end of Chapter 3.

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Chapter 2 – Current Environment and Trends in Airports Capitalization

Airports were traditionally managed by their respective governments the world over. However, this trend has changed considerably in the past two decades. Demanding passengers and competition have forced privatization. A variety of uncertain factors, such as accurate demand estimation, regulatory environment, macro-economic environment, etc., play a major role in determining the economic viability of running an airport. Hence, private players demand some level of guaranteed returns on the equity they invest.

This chapter begins with an overview of the regulatory practices followed for various international airports, with emphasis on the regulatory bodies' stance on the methodology for determining CoE for their jurisdictional airports. An initial assessment suggests that all airports advocate the use of the CAPM methodology to determine the CoE. The key factor that drives the CAPM-based CoE estimate is the estimate of (beta) risk in an airport. We rely on a standard procedure of identifying comparable airports that will be used to estimate the (beta) risk of Bangalore airport. We measure the "comparability" of an international airport to Bangalore airport in terms of a proximity score that accounts for differences in three key dimensions that characterize the functioning of airports:

(i) Revenue till mechanism
(ii) Ownership structure
(iii) Operations metric.

This analysis allows us to shortlist the most proximate airports into a set of comparable airports. Further downstream in chapter 3, we use this set of "comparables" to estimate the underlying beta risk and leverage – crucial inputs for determining CoE.

We analyze recent trends in the capitalization structure and funding mechanisms of these comparable airports and examine their performance in the recent past. We document these trends vis-à-vis the corresponding trends in Bangalore airport. This analysis helps us understand how other factors that are not explicitly accounted for in the CAPM methodology may provide guidance on the procedure of estimating the cost of equity of Bangalore airport. While a few interesting trends emerge from our analysis, we conclude that there are no systematic conclusions that one can make regarding their impact on the cost of equity. More importantly, it is likely the case that (beta) risk factor in the CAPM methodology implicitly accounts for these trends.

In additional analysis, we also examine the issue of realized returns to equity investors in airports using three approaches:

(i) Calculate the internal rate of return based on book values.

(ii) Evaluate the return implicit in a divestment transaction involving BIAL.

(iii) Discuss trends in other infrastructure projects, for e.g. highway monetization using InVITs.

2.1. Airports' Economic Regulatory Framework Worldwide

In order to understand the regulatory framework across the world, we studied 12 countries' Regulatory Authorities regulating more than 25 airports. We documented the following:

- Till structure
- Methodology used to compute CoE
- Prescribed leverage
- Capitalization guidelines for airports

A detailed consolidation of the study is presented in Table R1. The following are the key takeaways:

- **Cost of Capital Methodology:**
  - None of the regulators mandate the use of CAPM as a method to estimate CoE but most airports use it as a standard.
  - Dublin (Ireland) has a loaded WACC computation methodology that includes additional factors like passenger pass-through time, load, baggage handling time, etc.
- **Extent of Private Participation:** Except for the United Kingdom, all regulators/governments mandate at least 10% holding in their airports.
- **Till Structure:** Most airports apart from Singapore and Brazil follow a single or a dual till mechanism. Singapore and Brazil follow a hybrid till.
- **Leverage (D/E ratio):** The regulators do not mandate or limit the operators to follow a specific leverage. The 5-year actual leverage based on shareholders' fund (SF) and paid-up equity (PE) is discussed in Table R1.

- Changi Airport, wholly owned by the government, has the lowest leverage using both SF and PE, i.e. 6.80% and 13.62%, respectively, across all the international airports discussed here.
- Heathrow Airport has the highest leverage using both SF and PE, i.e. 83.41% and 99.79%. This situation arose because nominal share capital was reduced by a factor of 10 and transferred to distributable reserves, which were paid to equity holders. This action resulted in lowering of equity and thereby abnormally high leverages.
- Malaysia Airport Holdings Berhad (Holding Company) and Airports of Thailand (Holding Company) use a debt and equity mix (SF 43.75% and PE 66.15%) that matches the average leverage across all the international airports discussed here.

- **Dividend Distribution:** There is no mandate by any of the regulators to pay out dividends.
  - Malaysia Airport Holdings (MAHB) has made it a policy as a company to declare 50% of its profits as dividends.
  - Airports of Thailand have a policy of paying at least 25% of its profits as dividends.

Given this understanding of the international regulatory scenario and capitalization structure, we next move on to understand various international airports' operation in terms of their funding mechanism and returns they make for their private investors. For this purpose, we first shortlist a set of international airports based on their proximity to BIAL in these features. Next, we document the methodology used for shortlisting these airports.

Table R1: Regulatory Framework Worldwide

S. No.	Country Col(1)	Regulating Authority Col(2)	Norms for Till Specified Col(3)	Calculation of COE specified(Yes/No) Col(4)	Book Debt to Shareholders' Funds / Book Debt to Paid-Up Equity Capital (5-Year Avg.) Col(5)	Norm for Share Ownership Structure Col(6)
1	Australia[11]	Australian Competition and Consumer Commission (ACCC)	Dual Till	Not mandated, but uses CAPM, by way of Building Block Methodology.	• Sydney – 72.00%/49.48% • Melbourne – 75.78%/95.96%	• ACCC does not mandate • The top 21 holders (~91.20% holding) in Sydney do not include any of the government authorities.
2	New Zealand[12]	Commerce Commission (CC)	Dual Till	• Not Mandated • The CC takes an expert opinion from NERA Economic Consulting (which uses CAPM) • CC computes WACC as per best available estimates, defining a range • The commission then compares it with post-tax IRR, a combination of target return for Aeronautical Pricing Activities and the forecast revenue of other regulated activities. • CC checks whether the IRR falls within WACC range as computed earlier and makes a decision on WACC with the help of substantial supportive information.	• Auckland – 28.61%/81.33%	• CC does not mandate • But in Auckland, ~45.19% of the total shares are publicly held and traded • Again ~22.15% of the shares are held by Auckland Municipal council
3	United Kingdom[13]	Civil Aviation Authority (CAA)	Single Till	• Not Mandated • However, CAA uses CAPM	• Heathrow – 83.41%/99.79% • Gatwick – 80.14%/82.79%	• CAA does not mandate • 100% Shares of Heathrow Airport are held by a private parent company FGP Topco Ltd.

[11] https://www.accc.gov.au/
[12] https://comcom.govt.nz/
[13] https://www.caa.co.uk/home/

Table R1: Regulatory Framework Worldwide

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4	South Africa[14]	No information available publicly	Single Till	• Airport charges are regulated through the use of a price cap formula[14] • CPI-X, which limits the increase in a basket of revenue weighted tariffs to a rate of inflation (efficiency factor – X) • The X-factor is determined by applying the building blocks methodology whereby each block of activities is identified, namely operating costs, depreciation, return on capital and taxation.	Data Not Available	No mandated norm but South African government owns 74.6%
5	South Korea	No information available publicly.				
6	Malaysia[15]	Malaysian Aviation Commission (MAVCOM - Primary Economic Regulator)	Single Till	• Not Mandated • MAVCOM uses CAPM to estimate cost of equity.	Malaysia Airport Holdings Berhad (MAHB) – 43.75%/74.46%	Malaysia Airports owns a number of airports
7	Ireland[16]	Commission for Aviation Regulation (CAR)	Single Till	• Not mandated • Uses CAPM to compute WACC with additional factors like load, baggage handling time, etc.[16]	Dublin Airport Authority PLC – 48.26%/84.75%	State ownership
8	Indonesia	No information available publicly.				

[14] http://www.airports.co.za/business/investor-relations/economic-regulation
[15] https://www.mavcom.my/en/home/
[16] http://www.aviationreg.ie/_fileupload/2014final/2014%20Final%20Determination.pdf

Table R1: Regulatory Framework Worldwide

S. No.	Country Col(1)	Regulating Authority Col(2)	Norms for Till Specified Col(3)	Calculation of COE specified(Yes/No) Col(4)	Book Debt to Shareholders' Funds / Book Debt to Paid-Up Equity Capital (5-Year Avg.) Col(5)	Norm for Share Ownership Structure Col(6)
9	Singapore[17]	Civil Aviation Authority of Singapore	Hybrid Till (70–80%)[17]	CoE is computed as a sum of: • Computed pre-tax weighted average cost of capital (WACC) on the average regulated asset base • Computed pre-tax WACC on the average security asset base not recovered	Changi Airport Group – 6.80%/ 13.62%	Fully government owned
10	Netherland[18]	Human Environment and Transport Inspectorate	Dual Till	Mandates use of WACC based on CAPM	Schipol Group – 34.52%/ 95.98%	PPP
12	Thailand[19]	Civil Aviation Authority of Thailand	Dual Till	Not mandated but uses CAPM	Airports of Thailand – 20.90%/ 66.15%	70% mandatorily government owned
13	Brazil[20]	National Civil Aviation Agency (ANAC)	Hybrid Till	• Not Mandated • ANAC uses CAPM to estimate cost of equity.	Data Not Available	PPP up to 60% observed

[17] https://comcom.govt.nz/__data/assets/pdf_file/0016/61090/IATA-IM-review-draft-decisions-cross-submission-18-August-2016.pdf as seen on 10 Mar 2019
[18] https://english.ilent.nl/
[19] https://www.caat.or.th/en/
[20] http://www.anac.gov.br/en

2.2. Comparable Airports (Comparable to BIAL)

To get a list of airports comparable to BIAL, we first listed all international airports in the 12 afore mentioned countries with at least 50% private ownership. Then, we assigned weights to each of these airports based on the following parameters.

Intuition of the Proximity Score

The Proximity Score provides a Euclidean distance measure of a benchmark airport (from the comparable set) relative to the airport under consideration (BIAL, in this case). The proximity score considers three dimensions of comparison: (i) till mechanism, (ii) ownership structure, and (iii) operational scale. By construction, the proximity score for BIAL would be 0, but the proximity score of the benchmark international airport in the comparable set would depend on how different it is with respect to BIAL, with a high score indicating a dissimilar airport and a low score indicating a more similar airport.

- Revenue till structure:
  - 1 – Single Till or where information is not available
  - 2 – Dual Till
  - 3 – Hybrid Till
- Ownership structure:
  - 1 – if 100% Government Owned/Funded
  - 2 – if Government / private owned/funded, not being Public Private Partnership
  - 3 – if Public Private Partnership Funded
- Operations Scale (OpS): For each comparable airport, *k*, we computed the ratios of passenger, cargo, and aircraft movement of these airports to that of BIAL in each of the years from 2015 to 2017. Note that all comparable airports are international airports. These ratios are based on past 3 years' data as available from the respective airports' websites/annual reports. Next, an equal weighted sum for these airports is

computed using average of the ratios under each category (passenger, cargo and air traffic) as per Equation 2.1[21]:

$$OpS_k = \sum_{i=2015}^{i=2017} \left(\frac{1}{3}\right) * R_{Pi} + \left(\frac{1}{3}\right) * R_{Ci} + \left(\frac{1}{3}\right) * R_{Ai}$$

Equation 2.1 – Operations Scale

where

OpS_k = Operations scale for comparable airport k

i = Year 2015, 2016 and 2017

R_{Pi} = Ratio of passengers of the comparable airport to that of Bangalore airport, Equation 2.2,

$$R_{Pi} = \frac{P_i}{P_B}$$

Equation 2.2 – Passenger Ratio

P_i = No. of passengers for the comparable international airport in year i

P_B = No. of passengers for BIAL in year i

R_{Ai} = Ratio of aircraft movements of the comparable airport to that of Bangalore airport, Equation 2.3 – Air Traffic Ratio,

$$R_{Ai} = \frac{A_i}{A_B}$$

Equation 2.3 – Air Traffic Ratio

A_i = No. of aircraft movements for a comparable international airport in year i

A_B = No. of aircraft movements for BIAL in year i

[21] By construction, the OpS score for BIAL with respect to BIAL (itself) would be 3. To see this, note that each of the ratios (R_{Pi}, R_{Ci}, R_{Ai}, for passenger, cargo and air traffic, respectively) for a given year would be equal to 1 by definition, and therefore an equally weighted average of these ratios must be equal to 1. Then, cumulating these numbers over the 3 years (2015 to 2017) would yield an OpS score of 3. If the OpS score for an international airport from the comparable set with respect to BIAL is 6, then we can conclude that the international airport's scale of operation is about twice (score of 6 divided by 3) of that of BIAL.

R_{Ci} = Ratio of cargo of the comparable airport to that of Bangalore airport, Equation 2.4,

$$R_{Ci} = \frac{C_i}{C_B}$$

Equation 2.4 – Cargo Ratio

C_i = Total cargo movement in metric tonne for a comparable international airport in year *i*

C_B = Total cargo movement in metric tonne for BIAL in year *i*

- Finally, the proximity score for comparable airport, k, with respect to Bangalore airport (B) is denoted by $PS_{k,B}$. It is the net Euclidean Distance from each of the parameters w.r.t. BIAL (Equation 2.5)

$$PS_{k,B} = \sqrt{(RT_B - RT_k)^2 + (OS_B - OS_k)^2 + (OpS_B - OpS_k)^2}$$

Equation 2.5 – Proximity Score w.r.t. BIAL

RT_B = Revenue Till Score of BIAL

RT_k = Revenue Till Score of comparable airport, *k*

OS_B = Ownership structure Score of BIAL

OS_k = Ownership structure Score of comparable airport, *k*

OpS_B = Equal Weighted Operations Scale of BIAL

OpS_k = Equal Weighted Operations Scale of comparable airport, *k*

Table 2.1 reports the scores of all airports considered with their weights w.r.t. BIAL. As observed, Incheon Airport is out of bounds w.r.t BIAL. We discard this in the final analyses.

Table 2.1: Proximity scores of different airports w.r.t BIAL

The table represents the difference between the scores for BIAL and the respective airport. The proximity score is defined as $\mathbf{PS}_{\mathrm{k,B}} = \sqrt{(\mathbf{RT_B} - \mathbf{RT}_\mathrm{k})^2 + (\mathbf{OS_B} - \mathbf{OS}_\mathrm{k})^2 + (\mathbf{OpS_B} - \mathbf{OpS}_\mathrm{k})^2}$, where *RT* stands for revenue till, *OS* is Ownership and Funding Mechanism and *OpS* is Operations. The subscripts B and *k* represent Bangalore and the comparable airport, respectively. MAHB is the holding company of Kuala Lumpur Airport. AoT is the holding company of Bangkok Airport.

S. No.	Airport (Col 1)	Revenue Till (RT_B - RT_k) (Col 2)	Ownership Structure (OS_B - OS_k) (Col 3)	Operations (OpS_B - OpS_k) (Col 4)	Proximity Scores ($PS_{k,B}$) (Col 5)
	Bangalore	0.00	0.00	0.00	0.0000
1	Melbourne	1.00	1.00	-0.89	1.6716
2	Auckland	1.00	1.00	1.19	1.8500
3	Johannesburg	2.00	1.00	-0.04	2.2364
4	Gatwick	2.00	1.00	-0.94	2.4245
5	Sydney	1.00	1.00	-2.32	2.7171
6	Dublin	2.00	2.00	0.17	2.8333
7	Amsterdam	1.00	1.00	-8.34	8.4582
8	Changi	0.00	2.00	-8.34	8.5737
9	Heathrow	2.00	1.00	-8.75	9.0281
10	MAHB	2.00	1.00	-9.87	10.1161
11	Incheon	2.00	2.00	-10.36	10.7347
12	AoT	1.00	1.00	-11.83	11.9111

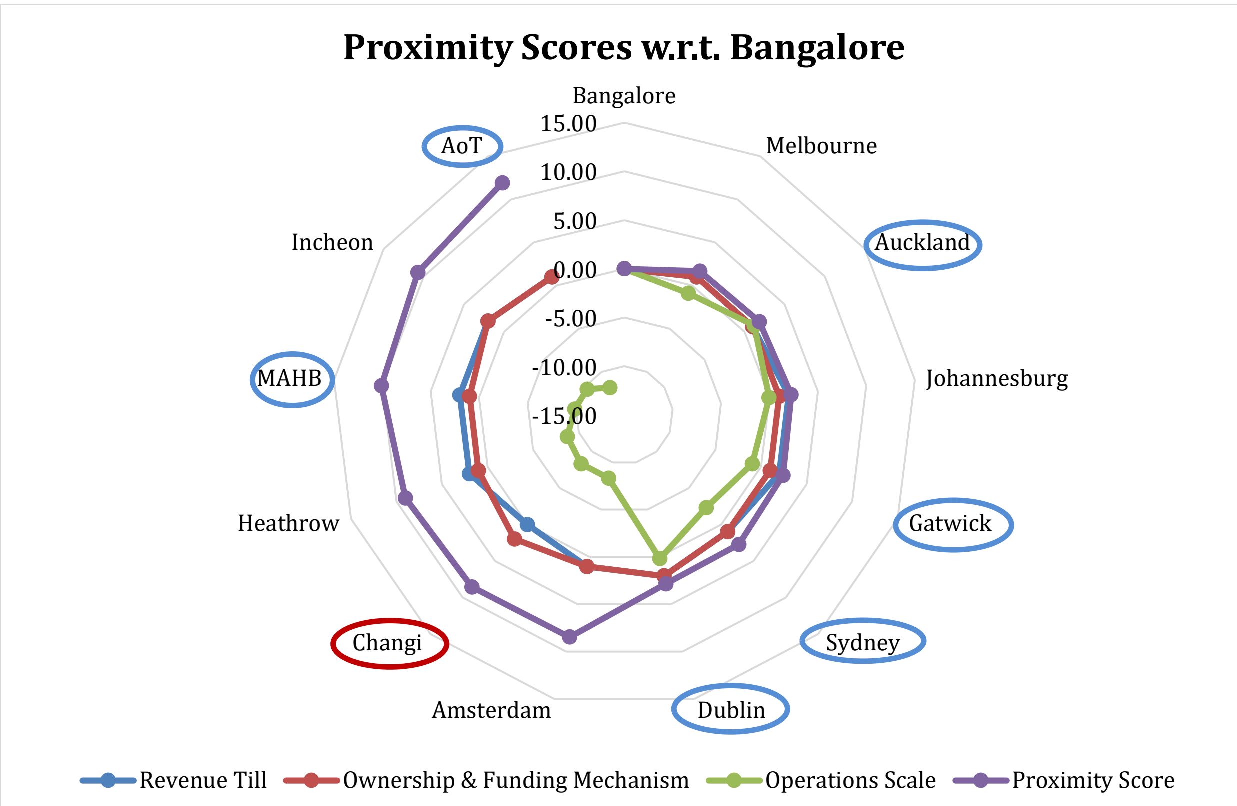
We deliberately avoided the US and Canadian airports as their administrative, operations and governance structure are significantly different from this set. Also, there is negligible government participation in these airports. The Brazilian airports are relatively new to the concept of privatization (~2011). Hence, we did not include airports from Brazil also.

We shortlisted 7 airports for a detailed study based on the overall proximity scores of these airports. The criterion for the shortlist was governed by the proximity score, data availability, and to ensure that we have a healthy mix of similarity and dissimilarity to compare as well as contrast. *Fig 2.1* map these airports w.r.t. BIAL on a radar. The radar sweeps in the clockwise direction, with the proximity score spiraling outwards, establishing the proximity to BIAL. Hence, Sydney would be closest to both BIAL while Incheon would be the farthest in terms of score. The scores range from ~1.6716 for Melbourne to ~11.9111 for AoT. The lower the score, the nearer the airport is w.r.t. BIAL.

Heathrow and Melbourne were excluded from the list to avoid geographical clustering (giving preference to Sydney and Gatwick, respectively, because of their proximity to BIAL). In short, if two airports in the comparable set are from the same region (e.g., Sydney and Melbourne are both in Australia), we picked Sydney because the airport is "closer" to BIAL based on the proximity score. We also dropped the less similar airport (Melbourne) from the same region. Also, lack of comprehensive data made us exclude Amsterdam airport, Incheon airport and Johannesburg Airport.

Fig 2.1: Airport Proximity Scores w.r.t. Bangalore

The chart depicts the scores of various parameters (Revenue Till, Ownership Structure, Operations and the Overall Proximity Score) of various international airports w.r.t. BIAL. All scores originate at BIAL (all scores are 0 here). As one sweeps clockwise, the Proximity Score moves away from Bangalore, thus making Sydney the nearest airport to Bangalore and Incheon the farthest. Negative scores are possible only for Operations score. Melbourne and Heathrow airports were excluded to avoid geographical clustering (giving preference to Sydney and Gatwick, respectively). The 6 airports (Sydney, Gatwick, Auckland, MAHB, AoT and Dublin) encircled in ***blue*** and 1 airport (Changi) encircled in ***red*** are used for comparative study vis-à-vis BIAL (sec 2.2). The airports encircled in ***blue*** (Sydney, Gatwick, Auckland, MAHB, AoT and Dublin) are used for asset beta computation of BIAL as discussed in chapter 3 (sec *3.2.1*). MAHB is the holding company of Kuala Lumpur Airport. AoT is the holding company of Bangkok Airport.



Data Sources: Individual airports' website; balance sheets and regulators' website.

Recommendation (Comparable Set of International Airports for BIAL)

- *Note that different sets of international airports may form the comparable set depending on the question being asked and the availability of data regarding this question for the comparable airport.*
- *For the comparative study vis-à-vis BIAL (sec 2.2), the comparable set consists of 7 airports: Sydney, MAHB, AoT, Auckland, Gatwick, Dublin and Changi. For asset beta computations, the comparable set consists of Sydney, Auckland, Gatwick, Dublin, AoT and MAHB.*

We next analyze these airports vis-à-vis BIAL for its capitalization structure, funding mechanism and investors' returns.

2.2.1. Capitalization and Ownership Structure

Heathrow is 100% privately owned by Heathrow Airport Holdings Limited with no government stake. The erstwhile government entity of British Airports Authority (BAA) was privatized in 1987 and raised capital through the open market. It also constituted a part of FTSE 100 with peak operating profits of GBP 11 million in the mid-1990s. It was delisted in 2006 following a takeover by a consortium of operators led by Spanish MNC, Ferrovial, S.A. This consortium currently operates Heathrow. Its current ownership structure is shown in

Table **2.2**.[22]

The Gatwick airport was also originally part of BAA and then Ferrovial, S.A. However, recently, they sold their entire stake to a group led by the Global Infrastructure Partners. Table 2.3 shows the current pattern.

[22] https://www.heathrow.com/company/company-news-and-information/company-information as viewed on 28 Feb 2020

Table 2.2: Ownership structure of Heathrow Airport

Shareholders (Col 1)	Share (Col 2)
Ferrovial	25.00%
Qatar Holding	20.00%
Caisse de dépôt et placement du Québec	12.62%
Government of Singapore Investment Corporation	11.20%
Alinda Capital	11.18%
China Investment Corporation	10.00%
Universities Superannuation Scheme	10.00%
Total	**100.00%**

Source: https://www.heathrow.com/company/company-news-and-information/company-information

Table 2.3: Ownership structure of Gatwick Airport

Shareholders (Col 1)	Share (Col 2)
Global Infrastructure Partners	41.95%
Abu Dhabi Investment Authority	15.90%
California Public Employees' Retirement System	12.78%
National Pension Service of Korea	12.14%
Future Fund Board of Guardians	17.23%
Total	**100.00%**

Source:
https://www.gatwickairport.com/globalassets/documents/business_and_community/investor_relations/yearend-june2018/gatwick-airport-limited-financial-statements-31-march-2018---final-signed-v2.pdf

Sydney and Auckland are publicly listed companies with the ownership structure as depicted in Table 2.4 and Table 2.5, respectively.

Table 2.4: Ownership structure of Sydney Airport

Shareholders (Col 1)	Share (Col 2)
HSBC Custody Nominees (Australia) Limited	22.75%
BNP Paribas Nominees Pty Ltd	18.21%
J P Morgan Nominees Australia Limited	17.95%
Citicorp Nominees Pty Limited	5.42%
Balance Retail Holdings	35.67%
Total	**100.00%**

Source:
https://assets.ctfassets.net/v228i5y5k0x4/7gQkThyOPKmwAycmQIOmOc/37f1710697644fe2fd8c1ca6790ad7dc/2017_Sydney_Airport_Annual_Report.pdf

Table 2.5: Ownership structure of Auckland Airport

Shareholders (Col 1)	Share (Col 2)
Auckland Council Investments Limited	22.15%
New Zealand Central Securities Depository Limited	45.19%
Balance Retail Holdings	32.66%
Total	**100.00%**

Source:
https://corporate.aucklandairport.co.nz/investors/results-and-reports

The two major international airports at Bangkok (Suvarnabhumi Airport and Don Mueang) are owned and operated by a holding company, Airports of Thailand Public Company Limited (AoT). This holding company is a government-owned publicly listed company.[23] Totally, 70% of the ownership is held by the state's Finance Ministry with foreign ownership capped at 30%, other major shareholders include Thai NVDR Company Limited (4.49%), South East Asia UK (Type C) Nominees Limited (2.76%) and State Street Europe Limited (1.67%).

[23] www.airportthai.co.th as viewed on 28 Feb 2020

The Kuala Lumpur airport manages on very similar lines of Bangkok by Malaysia Airport Holdings Berhad (MAHB), a holding company, in Table 2.6.

Table 2.6: Ownership structure of Malaysia Airport Holdings Berhad (MAHB)

Shareholders (Col 1)	Share (Col 2)
Khazanah Nasional Berhad	33.21%
Citigroup Nominees (Tempatan) Son Berhad (Employees Provident Fund Board)	10.06%
Balance Retail Holdings	32.66%
Total	**100.00%**

Source: http://mahb.listedcompany.com/misc/ar/ar2017.pdf

The Changi airport and Dublin airport are fully state-owned airports, through subsidiary companies.

As of 2017-18 fiscal year, BIAL was held by a consortium led by the FIH Mauritius Investments Ltd.. The Indian government (state/central or their subsidiary) has a 26% stake in each of these. The shareholding patterns (**as per fiscal year 2017-18 annual reports**) of the four (4) major Indian private airports (Bangalore, Delhi, Mumbai, and Hyderabad) are provided in Table 2.7 through Table 2.10.

Table 2.7: Ownership structure of Bangalore International Airport Ltd. (BIAL)

Shareholders (Col 1)	Share (Col 2)
Airport Authority of India	13.00%
Karnataka State Industrial and Infrastructure Development Corporation Limited (KSIIDC)	13.00%
Siemens Project Ventures GmbH	26.00%
FIH Mauritius Investments Limited	48.00%
Total	**100.00%**

Source: Annual Report of BIAL 2017-18

Table 2.8: Ownership structure of Delhi International Airport Ltd. (DIAL)

Shareholders (Col 1)	Share (Col 2)
Airport Authority of India	26.00%
GMR Airports Limited	64.00%
Fraport AG Frankfurt Airport Services Worldwide	10.00%
Total	**100.00%**

Source: Annual Report of DIAL 2017-18

Table 2.9: Ownership structure of Mumbai International Airport Ltd. (MIAL)

Shareholders (Col 1)	Share (Col 2)
Airport Authority of India	26.00%
GVK Airport Holdings Limited	50.50%
Bid Services Division (Mauritius) Limited	13.50%
ACSA Global Ltd.	10.00%
Total	**100.00%**

Source: Annual Report of MIAL 2017-18

Table 2.10: Ownership structure of Hyderabad International Airport Ltd. (HIAL)

Shareholders (Col 1)	Share (Col 2)
Airport Authority of India	13.00%
Hon'ble Governor of Telangana	13.00%
MAHB (Mauritius) Private Limited	11.00%
GMR Airports Limited	63.00%
Total	**100.00%**

Source: Annual Report of HIAL 2017-18

2.2.2. Funding Mechanism

A balance sheet analysis of the comparable set of airports suggests that they are mostly in a mature phase with little CAPEX requirement. Most of their funding requirement of the set of comparable firms is due to OPEX. This requirement is met from their operational revenues. In the case of listed firms, additional options are available to raise capital. As highlighted in Table 2.4 and Table 2.5, the Asset Management Companies (AMCs) and pension funds are a major shareholder in Australia and New Zealand. In the case of Malaysia and Thailand, the holding company is listed. Unlike Indian private players who are in the general infrastructure space, these companies are exclusively in the airports' sector.

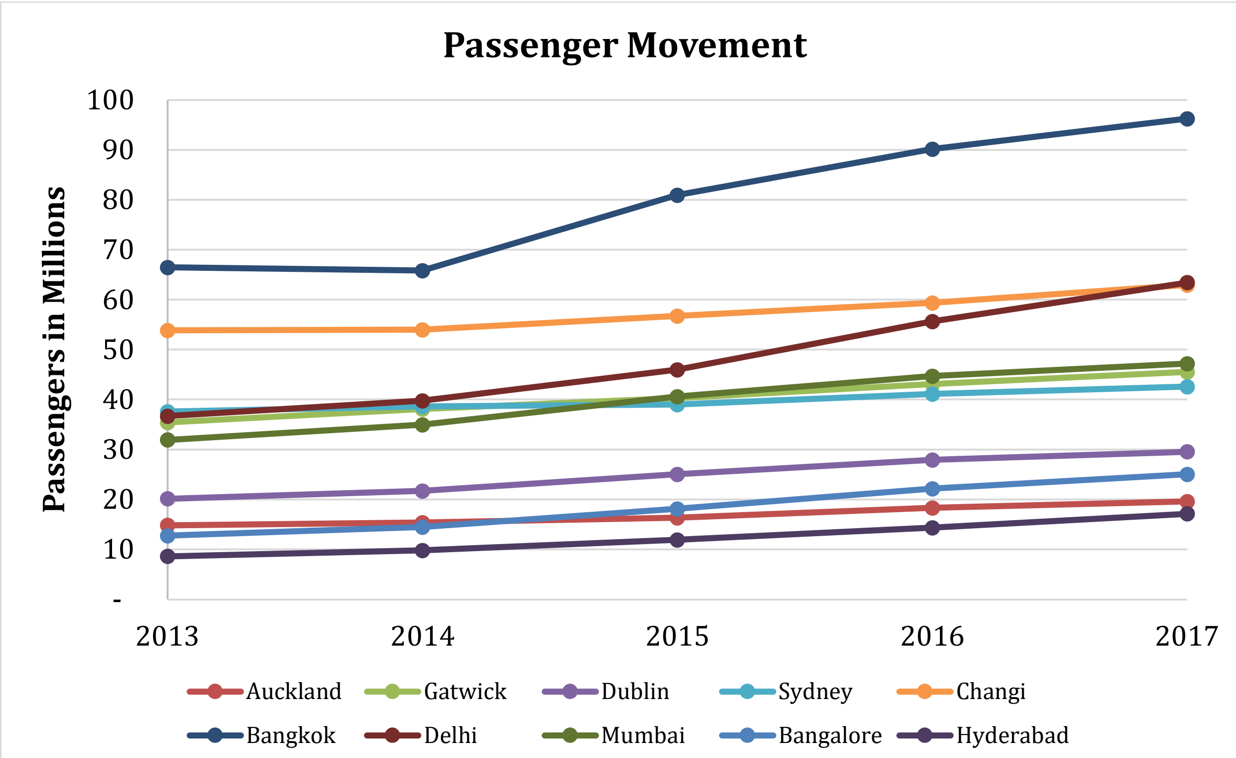
2.2.3. Trends in Airports Operations'

Fig 2.3 – Fig. 2.6 show the recent trends of passenger movement, total revenue, revenue/ passenger and Earnings After Tax (EAT) for all airports. As seen from these charts, all parameters indicate a healthy state, with the following key takeaways:

- All airports have experienced a steady growth in passenger volumes (Fig 2.3) over the period of 5 years. Further, some airports such as, Bangkok and Delhi have outdone others in this respect.
- Revenue trends are also in sync with passenger trends (Fig 2.4) except for Delhi (2017) and Hyderabad (2013).

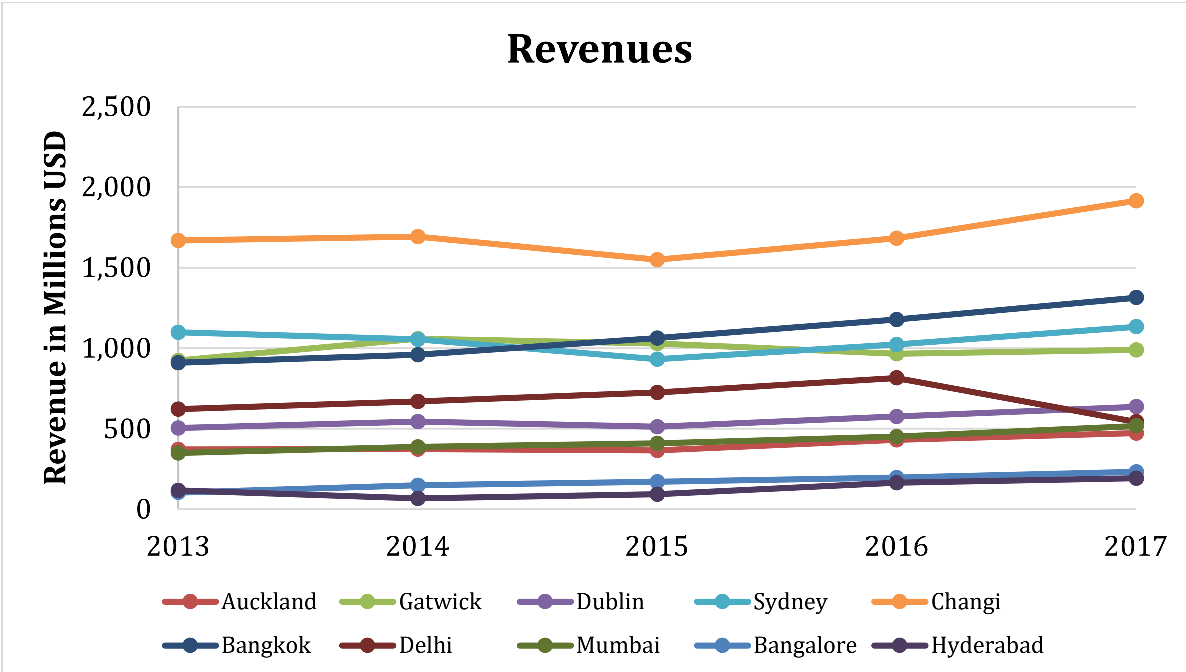
- Earnings After Taxes (EAT) have also been on an upward trajectory except for Changi airport – Fig 2.6.

Fig 2.2: Passenger Movement Trends



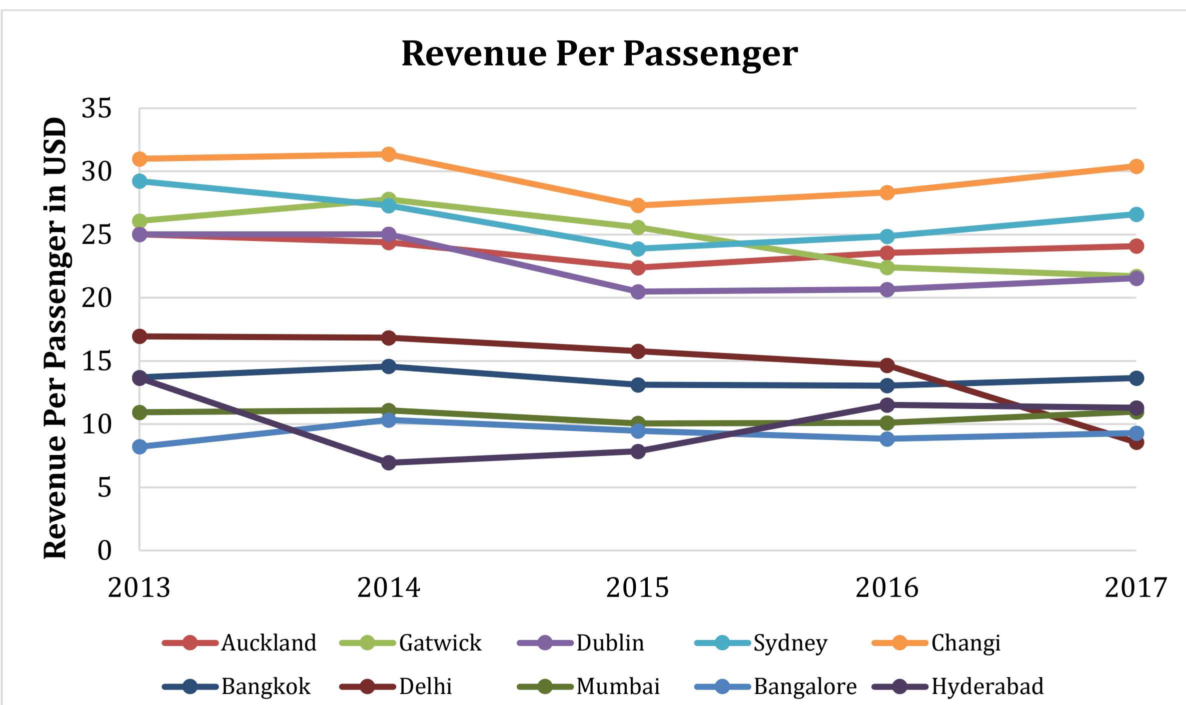
Data Source: Passenger and traffic statistics published by the respective airports' official website for international airports and the Airports' Authority of India's website for Indian airports

Fig 2.3: Revenue Trends



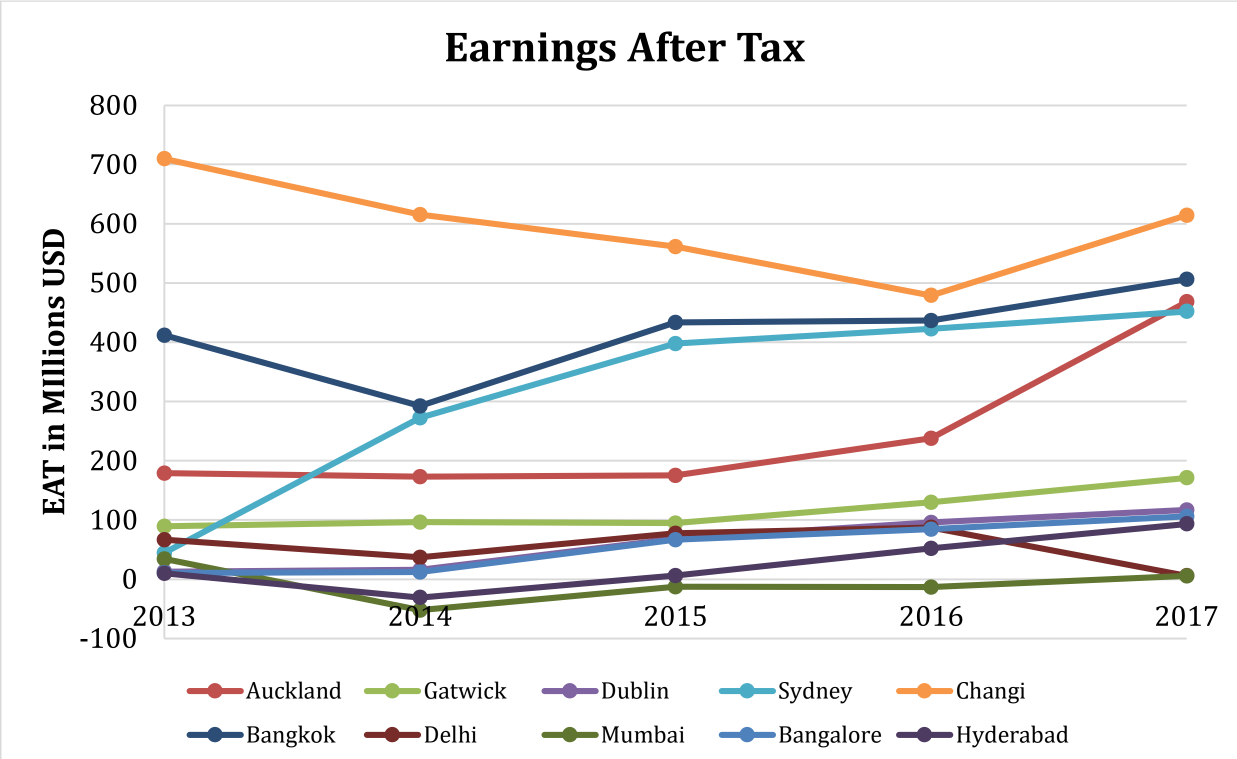
Data Source: Balance sheets of the respective airports

Fig 2.4: Revenue Per Passenger Trends



Data Source: Balance sheets and passenger movement data from official websites

Fig 2.5: Earnings after Tax Trends



Data Source: Balance sheets of the respective airports

Given these insights, we now try to draw some lessons for the Indian airports. We tried to establish a correlation between EAT vs. revenue per passenger. The hypothesis is, with an increase in passenger movement and EAT, revenue per passenger should be fairly stable or decrease. In other words, if traffic as well as EAT is healthy, the total airport charges per passenger should be constant or decrease because there is room for lowering tariffs and airports being public services are under various forms of explicit or implicit public scrutiny. Table 2.11 presents this scenario for our comparable set of airports and Table 2.12 presents this scenario for Indian airports.

Table 2.11 : Relationship between Revenue Per Passenger vs. EAT (Comparable Set)

[In this table, we try to test the following hypothesis: Does increase in passenger movement and EAT stabilize the Revenue per Passenger? This seems to be true for the comparables' set.]

Airport (Col 1)	EAT Trend (Col 2)	Passenger Movement Trend (Col 3)	Revenue Per Passenger Trend (Col 4)	Correlation Coeff. (Col 5)
Auckland	↑	↑	↔	0.9908
Sydney	↑	↑	↔	0.7234
AoT*	↑	↑	↔	0.1352
Singapore	↓	↑	↔	0.3149
Gatwick	↑	↑	↔	0.6333
Dublin	↑	↑	↔	0.0857

Data Source: Balance sheets and official website of individual websites
*Includes only passenger data, revenue data and earnings after tax data, for Bangkok and Don Mueang Airports only, not the holding company, Airports of Thailand as a whole.

Table 2.12: Relationship between Revenue per passenger vs. EAT (Indian Airports)

[In this table, we try to test the following hypothesis: Does increase in passenger movement and EAT stabilize the Revenue per Passenger? This seems to be true for the comparables' set (Table 2.11). It is not so for Indian airports.]

Airport (Col 1)	EAT Trend (Col 2)	Passenger Movement Trend (Col 3)	Revenue Per Passenger Trend (Col 4)	Correlation Coeff. (Col 5)
Mumbai	↑	↑	↑	0.1122
Delhi	↑	↑	↓	0.7528
Hyderabad	↑	↑	↑	0.6237
Bangalore	↑	↑	↑	0.3218

Data Source: Balance sheets and AAI's official website

As can be seen from Table 2.11, the hypothesis holds true for the comparables' set of airports, while not so for all the Indian airports. A plausible explanation is that the Indian airports are still in a maturing phase while the comparables' set has matured. This trend in Indian airports may probably see a reversal in medium to long term.

Next, we studied the returns that investors in these airports have earned over the past 5 years (2013–17). For this, we take the approach of computing the Internal Rate of Return (IRR) for all the airports. Internal Rate of Return (IRR) is the compounded annual rate of return that the investor earns annually for his investment over a given period.[24] Fig 2.6 shows the results. The key takeaways are as follows:

1. Auckland and Sydney being listed companies with pension and long-term mutual funds, show the way forward for good airport funding and management. The healthy IRR suggests access to long-term funds can ease pressure on OPEX. Furthermore, any future plans for expansion can be envisaged with lower rates for CAPEX and lower Cost of Debt (CoD).
2. Airports of Thailand: The Regulator does not mandate any dividend distribution. However, AoT as a company has a policy to pay out at least 25% of total profits as dividend.[25] On average, they have paid USD 197.26 million in the past 5 years and have the highest IRR in the group.
3. In case of Dublin, as per National Aviation Policy 2015, it is stated that profitable commercial state companies should pay financial dividend to the state; the guideline figure is 30% of profit after tax**.** Dublin has been gradually earning profits and dividend has been paid from the year 2015 onwards. However, a low IRR of 4% is due to losses incurred before 2015.
4. Even in the Indian airports, AERA does not mandate dividend payments; however, airports have recently started paying out dividends to their investors. Apart from MIAL, all others (BIAL, HIAL and DIAL) have been consistently profitable over the 5 years. However, the BIAL and HIAL have declared dividends in the past 2 years, while DIAL has declared only in 2017-18. MIAL has consistently seen losses in the first four years and is yet to declare dividends.

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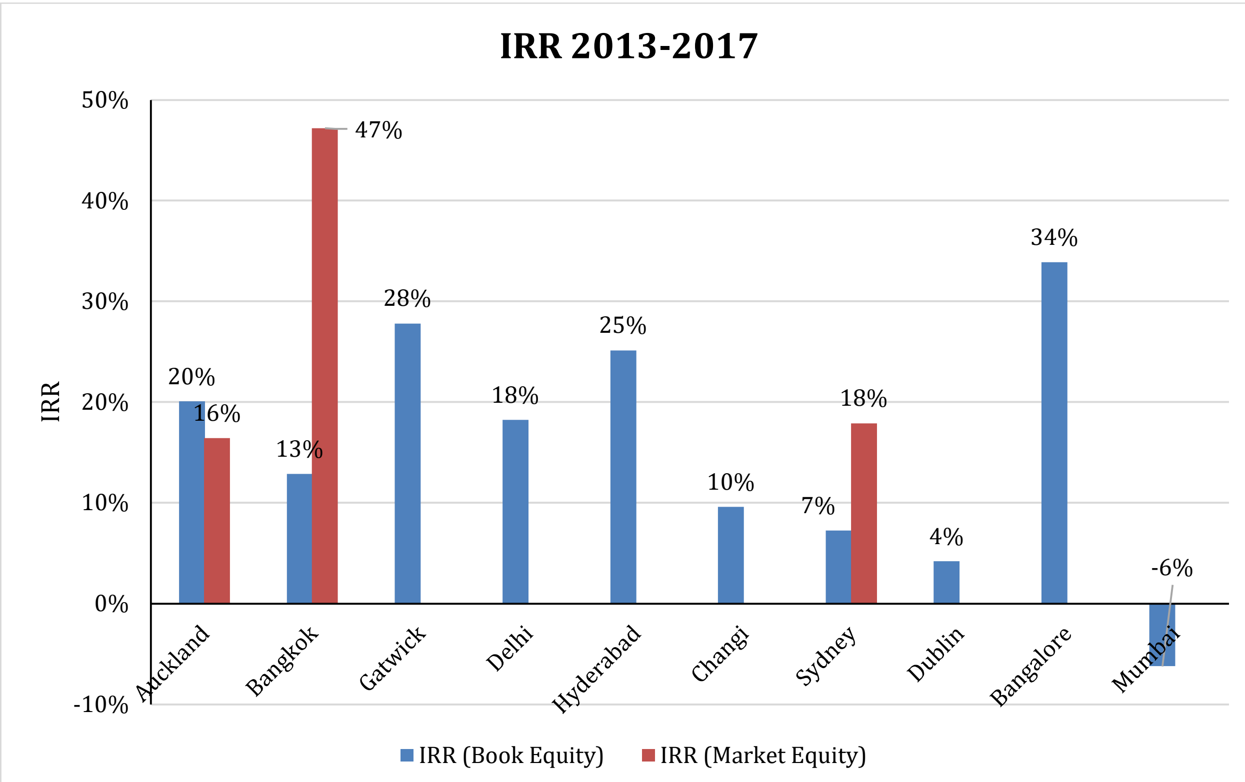
[24] https://corporatefinanceinstitute.com/resources/knowledge/finance/internal-rate-return-irr/ as viewed on 28 Feb 2020

[25] http://investor.airportthai.co.th/dividend.html as seen on 1 Mar 2019

Fig 2.6: Past 5 years' IRR based on Book and Equity Returns

Internal Rate of Return (IRR) is the compounded annual rate of return that the investor earns annually for his investment over a given period of time[24]. We computed the IRR based on book equity and their market capitalization (wherever applicable). The book equity method considers beginning equity, all dividends accrued (2013–2017) and ending equity (including retained earnings). The IRR based on market equity is the annualized market return based on market prices (including dividends for 2013–2017).



Data Source: Respective balance sheets of individual airports and Bloomberg for market data

2.2.4. Operators' Returns: A Case of BIAL Divestment

In the FY 2009-2010, Bangalore Airport & Infrastructure Developers Private Limited (BIADPL), a fully owned subsidiary of GVK Power & Infrastructure Limited, purchased a stake of 43% from Flughafen Zurich AG, Switzerland and L&T Infrastructure Development Projects Limited at a cost of INR 1,173.107 Crores. Again, during FY 2011-2012 BIADPL infused a further capital of INR 613.820 Crores. However, for strategic reasons, they offloaded 33% of their stake for a consideration of 2,202 Crores to Fairfax India Holdings Corporation (FHC). Then, in FY 2017-18, they completed the exit by selling off their remaining stake of 10% at 1,290 Crore. During their holding period, they also received a dividend of INR 16.54 Crores in the year 2016-2017. The net profit turns out to be ~95% or

INR 1,783 Crores over 9 years. We performed an annual Internal Rate of Return (IRR)[24] analysis to understand the real returns accrued to BIADPL. Table 2.13 details the working of the same.

Table 2.13: IRR computation for BIAL divestment (All amounts in INR Crore)

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Investments	(1,173)		(614)	0	0	0	0	0	0
Dividend	0	0	0	0	0	0	0	166	0
Sale proceeds	0	0	0	0	0	0	0	2,2017	1,290
Cash flows for IRR	(1,173)	0	(614)	0	0	0	0	2,2183	1,290
				IRR					**10.57%**

Data Source: Balance Sheets of BIAL and GVK from 2009 – 2018

As observed from Table 2.13, the net IRR is 10.57% per annum for the given holding period of 9 years from 2009–'18. This appears to be quite close to the AERA recommended return for the control period 2016–21, viz. ~11.33%, but lower than BIAL's submission of 17%.[26]

2.3. Determinants of CoE used in the Comparables' Set

As we saw in section 2.1, although none of the regulators mandate the CAPM methodology, all the airport operators use the CAPM to determine the Cost of Equity. We know that the risk-free rate and ERPs in the CAPM equation (Equation 1.1) are macro-economic in nature, but the key in CoE determination is the equity beta. Regulators of Auckland airport, Heathrow airport, Gatwick airport and Dublin airport state the betas that they use in their CoE computations. Table 2.14 – Table 2.17 show the asset and equity betas for different control periods used in Heathrow, Gatwick, Dublin and Auckland across control periods.

[26] AERA Consultation Paper No. 05/ 2018-19 from file: AERA/20010/MYTP/BIAL/CP-II/2016-17/Vol-III

Table 2.14: Auckland Regulator Betas

Auckland					
		Betas			
Determined By (Col 1)	Control Period (Col 2)	Equity (Col 3)		Asset (Col 4)	
		Low	High	Low	High
Commerce Commission	July 2008 - June 2012	0.68	1.08	0.50	0.70
Commerce Commission	July 2013 - June 2017	0.89		0.60	
Commerce Commission	July 2017 - June 2022	1.10	0.74	0.70	0.60

Data Source: Final Report - Auckland International Airport's Pricing Decisions (July 2017 – June 2022), dated 01 November 2018, ISBN No. 978-1-869456-65-8
https://comcom.govt.nz/regulated-industries/airports/projects/review-of-price-setting-event-3#projecttab

Table 2.15: Heathrow Regulator Betas

Heathrow					
		Betas			
Determined By (Col 1)	Control Period (Col 2)	Equity (Col 3)		Asset (Col 4)	
		Low	High	Low	High
Civil Aviation Authority	April 2008 - March 2013	0.90	1.15	0.56	
Civil Aviation Authority	April 2014 - December 2019	1.10		0.50	
NERA Estimated	January 2020 - December 2024	1.30	1.40	0.55	0.60

Data Source: Economic Regulation of Heathrow and Gatwick Airports (2014-2019), February 2014
http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=6074

Table 2.16: Gatwick Regulator Betas

Gatwick					
		Betas			
Determined By (Col 1)	Control Period (Col 2)	Equity (Col 3)		Asset (Col 4)	
		Low	High	Low	High
Civil Aviation Authority	April 2008 - March 2013	1.00	1.30	0.80	
Civil Aviation Authority	April 2014 - December 2019	1.13		0.56	

Data Source: Economic Regulation of Heathrow and Gatwick Airports (2014-2019), February 2014
http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=6074

Table 2.17: Dublin Regulator Betas

Dublin					
		Betas			
Determined By (Col 1)	Control Period (Col 2)	Equity (Col 3)		Asset (Col 4)	
		Low	High	Low	High
NERA Estimated	2006 - 2009	1.40		0.70	
NERA Estimated	2010 - 2014	1.20	1.40	0.60	0.70
Commission of Aviation Regulation	2015 - 2019	-	-	0.50	0.60

Data Source: Maximum Level of Airport Charges at Dublin Airport, dated 07 October 2014
https://www.aviationreg.ie/_fileupload/2014final/2014%20Final%20Determination.pdf
https://www.nera.com/content/dam/nera/publications/2009/the-cost-of-capital-for-dublin-airport.pdf

Dublin airport uses a complicated model based on operational metrics/ad hoc assumptions to make marginal adjustments to betas. This is perhaps fair for the case given that:

- It is a fully government-owned enterprise.
- It experiences volatility in passenger movement through different seasons. Hence, it may be justified.

This approach, however, cannot be used as a use case for India for two reasons. Firstly, BIAL is part of a consortium with large private ownership. Secondly, the demand is quite inelastic and non-volatile, as will be showcased in the next section.

2.4. Sensitivity of Betas – Indian Scenario

Betas used in the CoE computation essentially capture the "riskiness" of the asset at hand. What are the real risks? From a CAPM perspective, the real risk is the demand risk, which governs beta estimates. All markets highlighted from Table 2.14 to Table 2.17 are mature and mostly saturated. So, the betas are essentially measuring the true demand risk in these countries. What is the demand risk in India? In order to understand this, we analyzed the month-on-month passenger growth rate. Further, we regressed this growth rate as a function of monthly stock returns for BIAL. The passenger growth rate can be viewed as a proxy for demand risk. The stock return captures external economic conditions. Essentially, what would happen should the external market conditions significantly change? A high value of the slope would indicate high risk and vice-versa. We found very low regression coefficients (~0.3), thus establishing that the demand in India is inelastic and highly constrained by supply. Appendix 3 details the methodology and results of this analysis.

2.5. Prevalent Trends in other Infrastructure Space

Securities and Exchange Board of India (SEBI) framed guidelines to set up the Infrastructure Investment Trust or InVITs similar to REITs. The structure of the same is showcased in Fig 2.8.

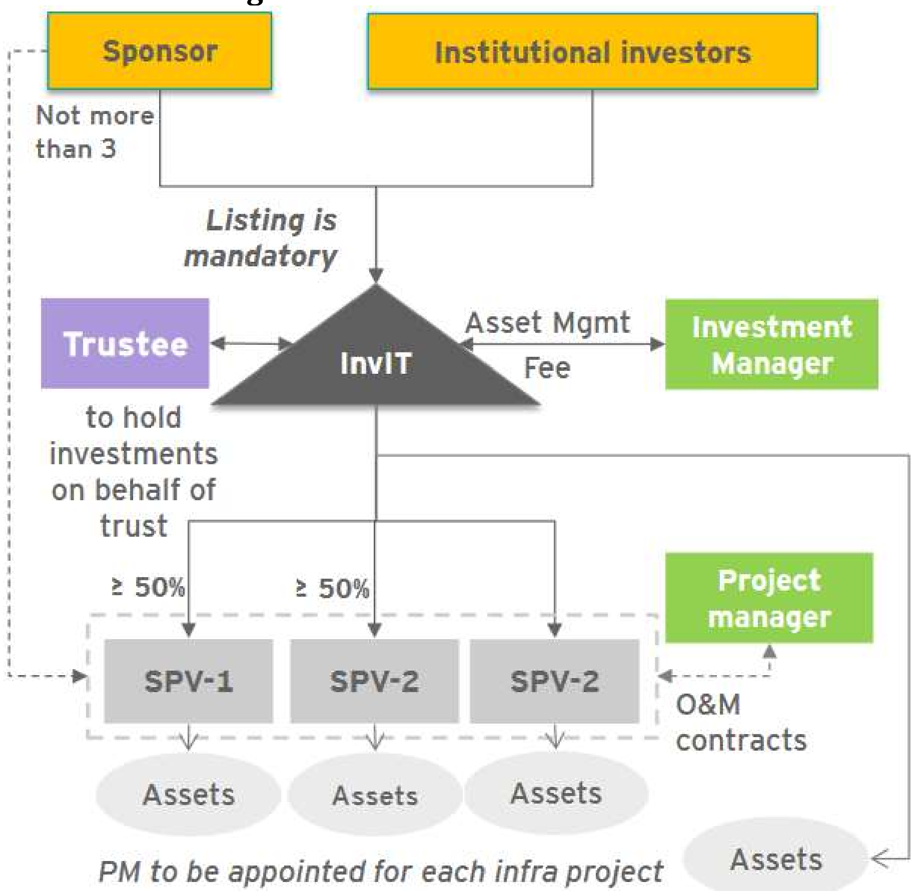
Essentially, these InVITs function as a mutual fund, enabling direct investment of possible individual/institutional investors in infrastructure to a portion of the income as return. As per the regulations, completed and revenue generating projects in PPP mode are eligible to be securitized through this procedure. A number of projects in the roads and power sector are part of InVITs.

As of 2018, a prominent InVITs in the road space was IRB InVIT Fund sponsored and managed by IDBI. This had an income of 5,157 Cr. with 13 road projects. Another prominent

InVIT in the power sector was IndiGrid sponsored and managed by the Sterlite group. This had an income of 406 Cr with 6 project SPVs.

From the AERA perspective, this financing alternative could be one of the serious options to consider for raising capital and thus lowering the CoE. This approach especially takes importance given the number of new airports coming up for privatization.

Fig 2.7: Framework for InVITs[27]



Source: https://www.ey.com/Publication/vwLUAssets/EY-infrastructure-investment-trusts-invit/%24FILE/EY-infrastructure-investment-trusts.pdf

27 https://www.ey.com/Publication/vwLUAssets/EY-infrastructure-investment-trusts-invit/%24FILE/EY-infrastructure-investment-trusts.pdf as viewed on 28 Feb 2020

2.6. Conclusion

In this chapter, we saw the regulatory framework of various airport regulators across the world with a focus on CoE. The key takeaways are as follows:

- All of them use CAPM as a method to estimate CoE but none mandate it.
    - Only Dublin uses a complicated model based on operational metrics/ad hoc assumptions
- D/E ratios are not mandated, however, the actual D/E ratios using shareholders' fund and paid-up equity range from 43.75% to 81.33%.

Next, we identified airports that were closest to BIAL w.r.t. operations, ownership structure and till. Then, we studied these comparable airports for any lessons for Indian airports in general, and BIAL. A valuable lesson to be drawn is that CAPEX requirements can be addressed through the open market route. Also, we concluded that while other airports are in a mature or saturated phase, Indian airports are still in a growth phase with high potential. Furthermore, this argument is strengthened by the demand analyses of Indian airports. Also, we looked at other sectors like road and power and how InVITs is helping cash flows.

Given we have now identified our comparables' set, we are all set to go ahead with CoE estimation for BIAL. As we have established the distance of these airports, we evolve methodologies to impute the betas for BIAL. The next chapter is devoted to establishing these estimates and determining CoE and providing an illustrative example for FRoR computation.

Chapter 3 – Determination of Cost of Equity and Fair Rate of Return

Airport regulators world over use the Capital Asset Pricing Model (CAPM) to estimate the Cost of Equity (CoE) for their private operators. Further, these costs are estimated in blocks of time period keeping in mind the current macro-economic realities as well as operational requirements. This is true of AERA as well. It is done for 5 years "Control Periods". The current control period ends in 2019 and the next 5 years' control period is from April 2019 – Mar 2024 for BIAL. In this chapter, we estimate the CoE and provide an illustrative example of FRoR computation for BIAL. As highlighted in chapter 2, we identified 7 international airports that were very similar to BIAL in terms of their operations, funding mechanism and till structures and studied them in detail. Further, we also highlighted the pertinent lessons for Indian airport operators and regulators therein.

First, we revisit the CAPM methodology and state the assumptions and the relevance therein. Next, we elaborate on the process of elucidating the individual components of CoE, viz., Betas (assets as well as equity), risk-free rate and the Equity Risk Premium (ERP). Finally, we provide an illustrative example of the CoD and FRoR computation.

3.1. Capital Asset Pricing Model

The Capital Asset Pricing Model was developed in the 1960s by Sharpe[28] (1964) and Lintner (1965).[29] It can be used to estimate a project's cost of capital, which is the expected rate demanded by potential investors. The cost of capital is used to assess the value of risky cash flows from investment projects made by businesses. According to the CAPM, the project's cost of capital is linearly related to a measure of project risk (known as Beta), which essentially captures the sensitivity of the project's cash flows to the state of the economy. The greater is the sensitivity, the greater is the risk faced by potential investors and the greater is the expected return of these investors, or the cost of capital. Thus, estimating the

[28] Sharpe, William F. 1964. Capital asset prices: A theory of market equilibrium under conditions of risk. Journal of Finance 19 (September): 425–42.
[29] Lintner, John. 1965. The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. Review of Economics and Statistics 47 (February): 13–37.

beta of the project is required to estimate the cost of capital. Equation 1.1 **(highlighted below) is used to compute the Cost of Equity (CoE).**

$$CoE = R_f + \beta_E (R_M - R_f),$$

where

CoE = Cost of Equity

R_f = Risk-free rate.

$R_M - R_f$ = Equity Risk Premium (ERP).

β_E = Equity beta.

Assumptions

- Homogeneous expectations (distinguishes from portfolio theory)
- Quadratic utility or multivariate normality of returns
- Rational, risk-averse investors
- Perfect capital markets
- Unrestricted short selling
- Borrowing and lending at the riskless rate

Relevance of CAPM

The empirical validity of the CAPM has been debated by academics and researchers.[30,31] However, it is by far the most widely accepted by business practitioners to determine the cost of capital.

[30] Fama, Eugene F., and French, Kenneth R.; 1992. The cross-section of expected stock returns. Journal of Finance 47 (June): 427–65.

[31] Jagannathan, Ravi, and Wang, Zhenyu. 1993. The CAPM is alive and well. Research Department Staff Report 165. Federal Reserve Bank of Minneapolis

Discussion Summary on Estimation Approach

- *While the CAPM is a theoretical model based on assumptions that do not necessarily hold in the real world, its simplicity and intuitive appeal have made it the on-going favorite model for determining cost of equity in any market- based economy. Our procedures for determining Cost of Equity using the Capital Asset Pricing Model are consistent with the best practices adopted by international airport regulatory authorities and by regulatory authorities across the world in a wide range of utilities (Table R1, Ch. 2).*
- *In particular, the CAPM says that the cost of equity should be related to fundamental risk, as measured by correlation with the market portfolio, and more importantly, points out that idiosyncratic difference in firms should NOT affect the cost of equity because investors in a market-based economy hold portfolios rather than individual assets and thus are able to diversify away the idiosyncratic risk exposure. In short, idiosyncratic factors can be ignored.*
- *Given the conceptual underpinnings of CAPM (as pointed out above), the standard approach is to find a comparable set of firms and impute a cost of capital based on the cost of capital for a comparable set of firms. We account for idiosyncratic differences between the comparable set of firms and BIAL in the computation of cost of capital for BIAL. More specifically, our approach accounts for differences in financial leverage, operational scale, revenue till arrangement, and ownership structure. In summary, we use a procedure that is consistent with the application of the CAPM but still accounts for idiosyncratic differences. Our approach is also unique in that it is driven by actual data considerations rather than plausible motivations for drivers of cost of equity.*

3.2. Methodology for CoE Estimation

As seen in section 3.1, we need three components to estimate the CoE using CAPM. These components are the risk-free rate (R_f), equity beta and the equity risk premium (*ERP*). R_f and *ERP* are mostly macro-economic in nature and thus one can rely on time-series data to estimate these variables. However, determining the equity beta is the more challenging, especially for unlisted companies such as BIAL. As will be discussed in section 3.2.1, we overcome this issue by using a set of comparable airports. We use the R_f that is available from public sources and have our own estimates for ERP (study by Anshuman, Biswas, Jain and Sharma, 2019).[32] This estimated value of ERP is comparable to Damodaran's[5] estimates. For the Cost of Debt (*CoD*), we use the ratings agencies' ratings for BIAL and estimate the Cost of Debt (*CoD*) for BIAL.

3.2.1. Methodology Summary

Now that we have the Comparables' Airports Set and computed their respective Proximity Distance Scores w.r.t. BIAL (sec 2.2), we can now move on to estimating the Cost of Equity (CoE) and providing an illustrative example of Fair Rate of Return (FRoR) computation. Here are the steps involved in the process:

1. Unlever the betas of listed Comparable Airports (secs 3.2.2, 3.2.3 and 3.3.2)
2. Next, we Estimate Asset Betas for BIAL (secs 3.2.4 and 3.3.3) with Proximity Distance Scores (sec 2.2) as inputs
3. Next, we Re-lever Asset Betas to get Equity Betas for BIAL (secs 3.2.5, 3.3.4 and 3.3.5) with Target Gearing Ratios (sec 3.3.4) as inputs
4. Next, is the important step of evaluating ***CoE*** **(sec 3.3.8)** with Equity Risk Premium or ERP (sec 3.3.6) and Risk Free Rate (sec 3.3.8) as inputs
5. Finally, we illustrate the computation of the ***FRoR*** **(sec 3.3.8)** with Cost of Debt or CoD (sec 3.3.7) as input. Please note that this computation is for illustrative purpose only as CoD is time sensitive. These have to be estimated based on information available at that point in time in future.

[32] Anshuman, Biswas, Jain, and Sharma (2019); Predictability of Equity Risk Premium in India.

The entire process is summarized as a flowsheet in Appendix 4.

3.2.2. Un-levering the Betas of the Listed firms in the Comparable Airports' Set

We restrict the comparable set from 7 airports to 6 airports because estimating betas requires market prices or regulator estimated asset betas, and thus, we are limited to using airports that are listed companies or have an estimate of asset beta, as suggested by the regulator of the respective country for the forthcoming control period. From our original set of 7 airports, Sydney, Airports of Thailand and Malaysia Airport Holdings Berhad airports are listed airports for which we can compute equity betas based on market data. We use the following methodology to estimate the equity betas:

- Estimate the equity betas for listed airports from our comparables' set, viz. Airports of Thailand (AoT), Malaysia Airport Holdings Berhad (MAHB) and Sydney Airport from Bloomberg.
- Un-lever these to find the corresponding asset betas using Equation 3.1.

$$\boldsymbol{\beta_A = \frac{\beta_E}{[1 + (1 - T_{C)} * \frac{D}{E}]}}$$

Equation 3.1 – Unlevering Betas

where

β_A = Asset Beta,

β_E = Equity Beta,

T_C = Marginal Tax Rate,

D/E = **Actual** Market Debt to Equity Ratio

- Estimate market debt to equity using historical data of the comparable airports

3.2.3. Regulatory Betas for Unlisted firms in the Comparable Airports' Set

Dublin and Gatwick airports are unlisted but have estimates for asset betas from their respective regulators. Auckland airport is a listed airport and its beta can be estimated from market data, but the New Zealand regulatory authority has assigned a specific value for the

Auckland Airport asset beta after extensively analyzing market data and other airport-specific information. In this case, we give preference to the regulator assigned asset beta because it is based on a comprehensive study. We drop Changi airport because of lack of market data as well as regulatory information on asset beta.

3.2.4. Estimating Asset Betas for BIAL

Next, we estimate the asset betas for BIAL by two (2) different methods, viz.:

1. Equal weighted average of these 6 airports' asset betas
2. Weighted average of these 6 airports' asset betas. The weights are the inverse proximity score from BIAL using Equation 3.2**.**

$$\boldsymbol{\beta}_A = \frac{\sum_{k=1}^{4}\left(\frac{\boldsymbol{\beta}_k}{PS_{k,B}}\right)}{\sum_{k=1}^{4}\left(\frac{\mathbf{1}}{PS_{k,B}}\right)}$$

Equation 3.2 – Weighted Avg. Betas

where

i = Years 2015, 2016 and 2017

$ß_A$ = Unlevered Asset betas for BIAL

$ß_k$ = Unlevered asset betas for comparable airports, k, viz. MAHB, Sydney, AoT and Regulator estimated Asset Betas, for Auckland, Gatwick, and Dublin airports.

$PS_{k,B}$ is the proximity score of the comparable airport, k, with respect to BIAL.

The proximity score weighted (PSW) betas represents a more refined estimate of the true asset betas in contrast to the equally weighted counterpart as it is accounts for the similarity between the Indian airport and the airport in the comparable set.

3.2.5. Re-levering the BIAL's Asset Betas to get Equity Betas

We estimate equity betas for BIAL by re-levering the asset betas assuming a **Target** market Debt to Equity (D/E) ratios using Equation 3.3.

$$\boldsymbol{\beta_E = \beta_A * [1 + (1 - T_C) * \frac{D}{E}]}$$

Equation 3.3 – Re-levering Betas

where

β_A = Asset Beta,

β_E = Equity Beta,

T_C = Marginal Tax Rate,

D/E = **Target** Market Debt to Equity Ratio

If we observe Equation 3.3 carefully, we find that we need a term of (target) *market D/E ratio*. However, for unlisted companies like BIAL, only the book D/E ratios are available through their balance sheets and annual account statements.

3.2.6. Cost of Equity and FRoR

With all components of CoE now available, we can compute the CoE using the CAPM equation. Once we have CoE, we can also compute FRoR using the Equation 3.4.

$$\boldsymbol{FRoR = (R_D * g) + R_E * (1 - g)}$$

Equation 3.4 – Fair Rate of Return

where

$\boldsymbol{g}$ **=** Target Debt to (Debt + Equity) Ratio

$\boldsymbol{R_D}$ **= Cost of Debt**

$\boldsymbol{R_E}$ **= Post-Tax Cost of Equity**

Apart from CoE, the Cost of Debt (CoD) and the marginal tax rate are the key components of Equation 3.4. The Cost of Debt (CoD) is estimated as the coupon rate for bonds issued with similar ratings as BIAL. Currently, BIAL is rated as AA/stable by CRISIL.[33]

The entire process flow with relevant sections numbers is showcased in Appendix 4.

3.3. Results and Discussion

In this section, we present all the relevant results leading up to the computation of CoE and FRoR. We start with shortlisting of airports for beta computations followed by asset and equity betas for them. This is followed by a section on Cost of Debt and finally the CoE and FRoR.

3.3.1. Shortlisting Relevant Airports for Asset Betas for BIAL

The comparable set consists of six international airports. Of these, three airports, Sydney, MAHB and AoT are traded companies. Traded airports are chosen to ensure that their equity betas are readily available for computation from a commercial source like Bloomberg. The asset betas for these airports are computed from the estimated equity betas. For the other three airports, Auckland, Gatwick and Dublin, the country regulatory authorities have provided direct estimates of asset betas for the forthcoming control periods.

3.3.2. Results Related to Estimating Asset Betas of Airports in the Comparable Set

The asset betas of the comparable international airports are unlevered to obtain the equity betas. Table 3.1 shows the equity and asset betas of AoT, MAHB and Sydney. Please note, the equity betas are obtained from Bloomberg and corresponding asset betas are estimated by un-levering using Equation 3.1. As highlighted, the asset betas range from 0.40 for Sydney to 0.86 in AoT.

[33] https://www.crisil.com/en/home/our-businesses/ratings/company-factsheet.BIAL.html as viewed on 28 February 2020

Table 3.1: Asset and Equity Betas for 3 Comparable International Airports

Note: The equity betas are directly sourced from Bloomberg. The asset betas are computed as $\beta_A=\beta_E/[1+(1-T_C)*D/E]$ (*Equation 3.1*). *** Indicates the significance level of 99% CI

Airport (Col 1)	Equity Beta[34] (Col 2)	Marginal Tax Rates[35] (Col 3)	3-Year Avg. Market Debt Equity (Col 4)	Asset Beta[36] (Col 5)
Sydney	0.5641***	30.00%	0.5859	0.4000
MAHB	1.0573***	24.00%	0.4927	0.7693
AoT	0.8895***	20.00%	0.0456	0.8582

Data Sources: Bloomberg for Equity Betas; Deloitte Inc. for marginal tax rates

Table 3.2: Regulator Estimated Asset Betas for 3 Comparable International Airports

Airport (Col 1)	Regulator Asset Beta (Col 2)	Reference (Col 3)
Auckland	0.60	Table 2.14
Dublin	0.55*	Table 2.17
Gatwick	0.56	Table 2.16

*The regulatory authority has provided two estimates: a low asset beta and a high asset beta. We use the simple average of the low asset beta (0.50) and the high asset betas (0.60), i.e., 0.55.

3.3.3. Results Related to Estimation of Asset Betas for BIAL

Using the methodology described in section 3.2.1, we first computed the asset betas for BIAL by two different techniques, viz. equally weighted and proximity score weighted (Equation 3.2). As discussed earlier as well, the proximity score weighted (PSW) betas better represents the true asset betas over the equally weighted counterpart as it accounts for the similarity between the Indian airport and the comparables' set.

[34] Source: Bloomberg data from 2016 – 2018 weekly returns
[35] https://www2.deloitte.com/global/en/pages/tax/articles/global-tax-rates.html, as viewed on 28 Feb 2020
[36] $\beta_A=\beta_E/[1+(1-T_C)*D/E]$ – Equation 3.1

Table 3.3: Asset Betas for BIAL.

Equally weighted is simple average of comparables' asset betas. PSW is the weighted average of the asset betas with the weights being the (inverse) Proximity Score of the airport (Equation 3.2).[37] The proximity score weighted (PSW) beta is a more refined estimate that accounts for airport-specific information.

	Equally Weighted Average Asset Beta	Proximity Score Weighted Average Asset Beta
BIAL	0.6229	0.562659

Recommendation (Proxy for Asset Beta of BIAL)

- *We discussed the two different ways to compute proxies for assets betas of BIAL. Our recommendation based on the proximity score weighted beta estimate is more reliable. The equally weighted approach is useful only when the comparable set of airports is picked from the same environment.*
- *Statistically speaking, if the sample consists of observations from different distributions with different population means, taking a simple statistic like the sample average will be biased. In such cases, a weighted average rather than a simple average in which the weights recognize the degree of difference between the sample observation and the relevant population distribution is considered. Our proximity score weighted beta approach accounts for the "closeness" of the comparable airports to BIAL.*
- *The recommended asset betas are BIAL -* ***0.562659***

[37] $\beta_A = \dfrac{\sum_{k=1}^{4}\left(\frac{\beta_k}{PS_{k,B}}\right)}{\sum_{k=1}^{4}\left(\frac{1}{PS_{k,B}}\right)}$ (Equation 3.2 – Weighted Avg. Betas)

3.3.4. Re-levering Asset Betas of BIAL

Re-levering the asset betas to estimate the equity betas for BIAL is done by assuming a target gearing ratio using Equation 3.3.

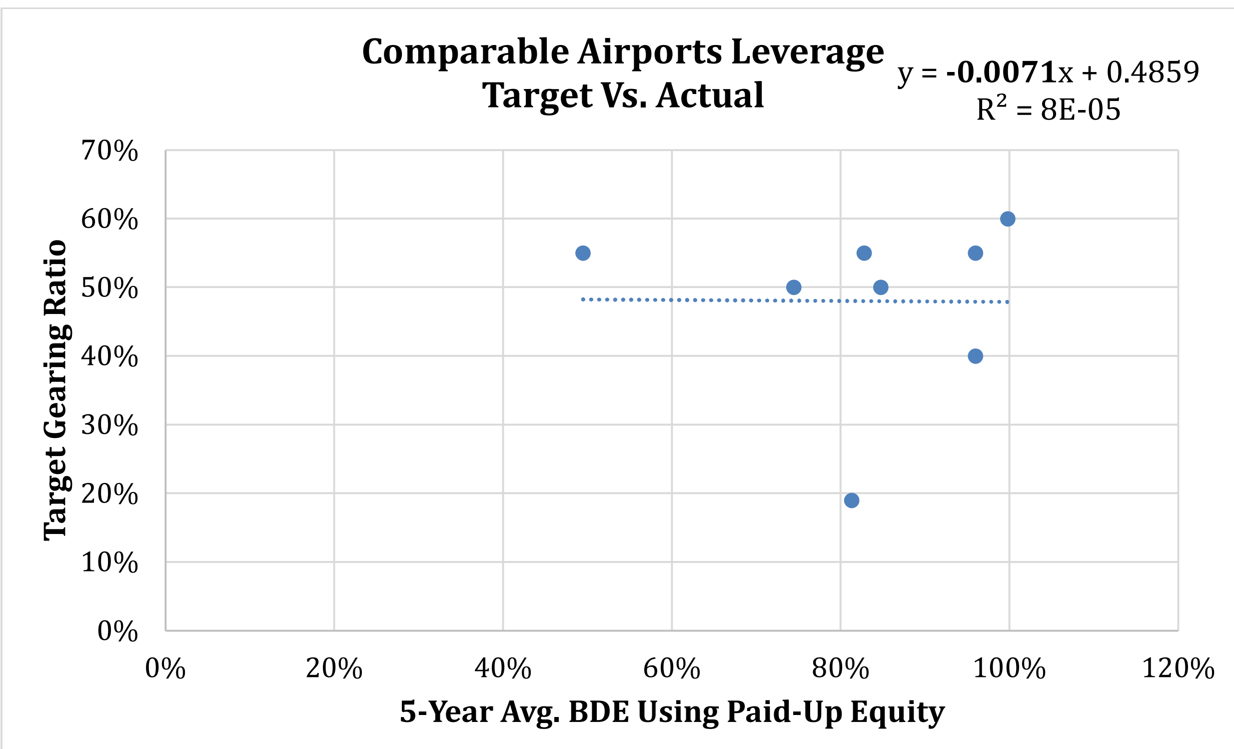
Table 3.4: Target Gearing Ratios

Airport (Col 1)	**Target Gearing Ratio** (Col 2)	**5-Year Avg. BDE based on Paid-Up Equity (based on Share Holder Fund)** (Col 3)	**Citation** (Col 4)	**Source** (Col 5)
Auckland	19.00%	81.33% (28.61%)	Review of Auckland International Airport's pricing decisions and expected performance (July 2017 – June 2022), November 2018, Pg. 97, Table A1.	https://comcom.govt.nz/regulated-industries/airports/projects/review-of-price-setting-event-3#projecttab
Heathrow	60.00%	99.79% (83.41%)	UKRN, Cost of Capital – Annual Update Report, June 2018, Pg. 11, Table	https://www.ukrn.org.uk/wp-content/uploads/2018/11/2018-UKRN-Annual-WACC-Summary-Update-v2.pdf
Gatwick	55.00%	82.79% (80.14%)	UKRN, Cost of Capital – Annual Update Report, June 2018, Pg. 11, Table	https://www.ukrn.org.uk/wp-content/uploads/2018/11/2018-UKRN-Annual-WACC-Summary-Update-v2.pdf
Sydney	55.00%	49.48% (72.00%)	Pricing Proposal 2016-2021, Pg. 16, Table 9	http://www.airservicesaustralia.com/wp-content/uploads/2016%E2%80%932021-Pricing-Proposal.pdf
Melbourne	55.00%	95.96% (75.78%)	Pricing Proposal 2016-2021, Pg. 16, Table 9	http://www.airservicesaustralia.com/wp-content/uploads/2016%E2%80%932021-Pricing-Proposal.pdf
Dublin	50.00%	84.75% (48.26%)	Commission for Aviation Regulation, Maximum Level of Airport Charges at Dublin Airport 2014 Determination, Pg. 90, Para 7.118.	https://www.aviationreg.ie/regulation-of-airport-charges-dublin-airport/2019-determination.841.html
MAHB	50.00%	74.46% (43.75%)	MAVCOM Aeronautical Charges Framework, October 2018, Pg. 26, Table 9. (Is 40-60%, but a mid-point average of the two taken)	https://www.mavcom.my/wp-content/uploads/2018/10/181019_Aeronautical-Charges-Framework-Consultation-Paper-Final-1.pdf
Amsterdam	40.00%	95.98% (34.52%)	Amsterdam Airport Schiphol Operation Decree, 2017, WACC - Part C of Appendix to Article 32, Pg. 19.	https://www.schiphol.nl/en/download/b2b/.../1T8kLVjBBmOiaKqOO4WC0K.pdf
Average	**48.00%**	**83.07% (58.31%)**		

In Table 3.4, one can see the gearing ratios employed by different international airports for computing the weighted average cost of capital (WACC) in column (2). The column (3) shows the average 5-year book debt to equity ratio (based on paid-up equity capital, as has been done in the case of BIAL). It is evident that the gearing ratio is significantly lower than the book debt to equity ratio for all international airports.[38] The average gearing ratio is 48% but the 5-year average of the book debt to equity ratio is 83%. Further, we plotted the best-fit linear trend between these two variables, as shown in the chart below. We can see that R-square is virtually 0 suggesting that the two variables are unrelated. Furthermore, both the economic and statistical relation between the two variables is negligible. The coefficient is virtually 0 and the t-stats are also insignificant.

Fig 3.1: Regression Results for Market D/E (MDE) vs. Book D/E (BDE)

From the data in Table 3.4, we regress the Target Gearing Ratio for the comparable set as a function of their Actual 5-Year Average Book D/E (2013 – 17) period.



[38] We were able to use a larger comparable set of international airports – this gives us more confidence in the estimates.

There may be a good reason to use a lower target gearing ratio than the gearing ratio suggested by actual debt to equity values. First, the WACC should reflect a long-term steady state gearing ratio which may not be reflected in the current gearing ratio. Second, the WACC is supposed to be determined using market value weights for debt and equity. Since equity values tend to rise over time, it is natural that market value based debt to equity ratios will be much lower than book debt to equity measures. While the airports do not explicitly mention this factor as a reason for using lower target gearing ratios than that suggested by book ratios, we believe that this factor could be a significant reason.

To get additional confirmation, we consider the four airports for which we have listed equity securities and estimate the 5-year average of the market debt to equity ratio. The 5-year average leverage using market capitalization (MDE) for the comparable set of airports (4) is equal to 0.3503 (D/E) or 25.94% (D/D+E). These figures are also much lower than book debt to equity ratios. Given these findings, we can be reasonably assured that the low gearing ratio of the international airports is consistent with the idea that market-based debt to equity ratios should be used in computing the cost of capital.

As an additional benchmarking exercise, we also estimated the relation between the market debt to equity and the book debt to equity ratio of a typical infrastructure firm in India. To estimate the relation between market debt to equity ratio and book debt to equity ratio, we first regressed MDE on BDE for various infrastructure companies, using price data for 37 listed infrastructure companies over the recent 5 years. In other words, we estimated the following empirical relation between the two variables, under the restriction that the intercept is 0.

$$MDE = f * BDE$$

Equation 3.5 – BDE/ MDE Relation

where ***f*** is the regression coefficient.

The total valid data points in the clean sample were 121. The filters used to remove outliers in the data were an upper cap of 5 for BDE (equivalent of BDE 83:17) and a lower bound of 0 (no debt). Table 3.5 shows a total of 37 infrastructure companies, which have 121 market debt equity data points for 5 financial year end (2014-2018) that are regressed against the book debt equity. However, all 37 companies were not traded over these 5 years; some were traded for 4 years out of 5 and so on. A detailed table of such companies can be found in Appendix 2.

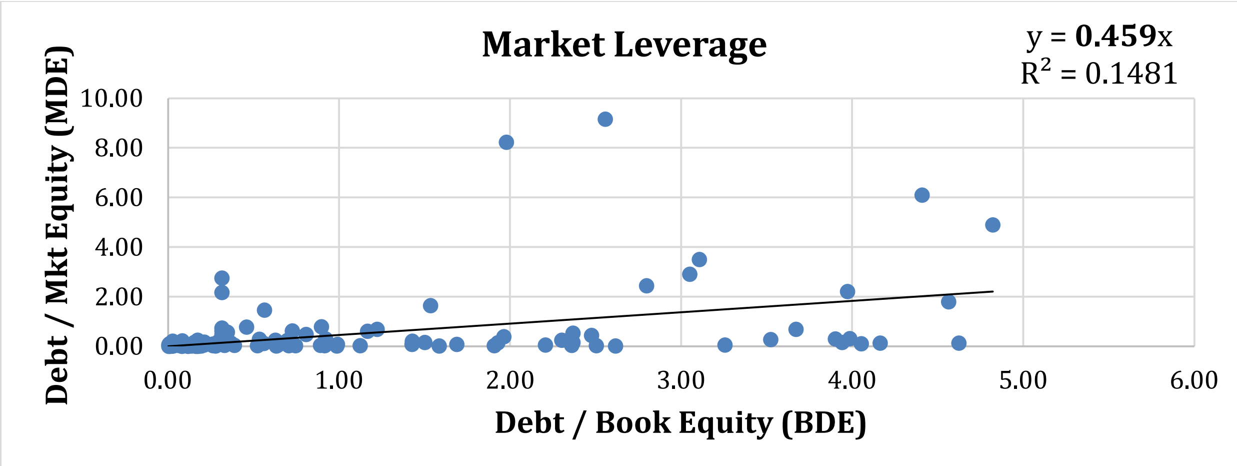
Table 3.5: Number of Infra Companies for MDE to BDE Relation

Availability of Leverage Data (No. of Years) (Col 1)	No. of Companies (Col 2)	Data Points (Col 3)
5	13	65
4	4	16
3	7	21
2	6	12
1	7	7
Total	**37**	**121**

We use this regression coefficient to impute the MDE for BIAL by using the BDE of BIAL. Once we obtain the imputed MDE, we compute equity betas of BIAL for various market leverages (MDE) using Equation 3.3. Fig 3.2 and Table 3.6 highlight the results.

Fig 3.2: Regression Results for Market D/E (MDE) vs. Book D/E (BDE)

We regress Market D/E (MDE) for 37 listed Indian infrastructure stocks as a function of their Book D/E over the 5-year (2013–17) period, forcing intercept to 0. The slope gives the typical multiple for converting a given BDE to the corresponding MDE. Hence, MDE = m*BDE; where m is the slope. It turns out to be 0.459 in this case.



Data Source: CMIE Prowess Equity Database

Table 3.6: BDE vs. MDE regression results.

We regress Market D/E (MDE) for 37 listed Indian infrastructure stocks as a function of their Book D/E over the 5-year (2014–18) period, forcing intercept to 0. The slope gives the typical multiple for converting a given BDE to the corresponding MDE. As seen from the table, the slope is significant at 99% CI.

	Coeff. (Col 1)	Std Error (Col 2)	t Stat (Col 3)	p-value (Col 4)	Lower 99.0% (Col 5)	Upper 99.0% (Col 6)
Intercept	0	N/A	N/A	N/A	N/A	N/A
MDE/ BDE (slope)	0.459	0.072	6.382	4.17E-09	0.271	0.648

The MDE/BDE ratio is the slope and conversion multiplier. As observed from Fig 3.2 and Table 3.6, the relationship turns out to be

$$MDE = 0.459 * BDE$$

Equation 3.6 – MDE/BDE (Actual)

Also, the coefficients are significant at 99% confidence levels (refer to p-values of Table 3.6).

Now, assuming a BDE of 2:1, we can infer that the market debt to equity ratio can be estimated as 0.459*2 = 0.918 for a typical infrastructure company in India. This number translates into a gearing ratio of 47.86%, again a number that is reasonably close to the average gearing ratio of the set of comparable international airports.

The two independent approaches to assessing the gearing ratio based on market price data provide confidence to us that setting the gearing ratio for BIAL on the basis of the average gearing ratio of a set of comparable international airports will be a procedure consistent with global best practices.

Discussion/Recommendation for Gearing Ratio

- *The target gearing reflects a long-term steady state gearing ratio that is lower (and unrelated) to the current debt to equity ratio.*

- *As per valuation concepts, the gearing ratio used in calculating cost of equity should be based on market value estimates of debt and equity. The fact that the target gearing ratio is typically lower than the actual debt equity ratio is consistent with an approach that uses market value based debt to equity ratio. As a benchmark, we examined the Indian infrastructure space and found that infrastructure firms employ, on average, a market debt to (debt + equity) ratio of 47.86%. The estimate from this analysis is reasonably close to the 48% gearing ratio used on average by international airports.*

- *Firms often employ high gearing ratio in the hope of reducing the cost of capital. This perception is based on a fallacious argument. While it may seem that a higher percentage of cheaper debt capital would reduce the cost of capital, what is ignored is that the risk of residual equity in highly levered firms increases, thereby offsetting the benefits of sourcing more debt capital (even the cost of incremental debt capital increases as the amount of debt increases). A target gearing ratio lower than the typical debt to equity ratio in a regulated public service discourages firms from employing excessive gearing in the hope of reducing their cost of capital. Thus, regulators often rely on a target gearing ratio to help maintain financial resilience of regulated firms in the long term.*

- *We recommend that the average gearing ratio (D/D+E) of 48% can be used to a proxy for the gearing ratio of BIAL to estimate their Cost of Equity and Fair Rate of Return.*

3.3.5. Results Related to Estimation of Equity Betas for BIAL

We set the target gearing ratio for BIAL using the average gearing ratio of international airports (48%), We then re-lever the asset betas proxies of BIAL using Equation 3.3 to get the equivalent equity betas.

$$\boldsymbol{\beta_E}\ (\boldsymbol{BIAL}) = \boldsymbol{\beta_A} * \left[\mathbf{1} + (\mathbf{1} - \mathbf{T_C}) * \frac{\mathbf{D}}{\mathbf{E}}\right]$$

$$= 0.562659 * [1 + (1 - 0.3) * 0.9231]$$

$$\boldsymbol{\beta_E}\ (\boldsymbol{BIAL}) = \mathbf{0.9262}$$

Equation 3.7 – Equity Beta for BIAL

Discussion Summary (Equity Beta)

*With the target gearing ratio of 48%, we re-levered the proximity score weighted (PSW) asset betas using Equation 3.3 and arrived at the optimal equity beta as: **BIAL: 0.9262**.*

3.3.6. Equity Risk Premium

The ERP is an essential input in the implementation of the Capital Asset Pricing Model. It captures the additional return demanded by investors for holding equity shares in contrast to holding risk-free deposits (say in a bank in which the deposit is insured against default). It reflects the investing population's desire for taking up equity risk. It can be time varying. For instance, during the financial crisis, investors' tolerance for risk was extremely low and the equity risk premium was very high. Hence, it must be re-estimated periodically.

There are various estimates of equity risk premium, depending on the methodology used and the time period considered[39]. The most popular method is to use the historical risk premium as a proxy for the equity risk premium (ERP) going forward. This estimate has been found to be the best predictor of future ERP.[40] In general, the other predictors (e.g., dividend yield, earnings to price ratio, default spread, etc.) fare worse than the historical average as a predictor of ERP. More recent literature has reported that a composite measure, based on average of several predictors, fares slightly better than the historical average. The second method is to rely on the implicit forward-looking ERP (also referred to as the Implied ERP) based on the current value of the stock market index. Using a simple Gordon Growth model based on dividend growth estimates, one can back out the ERP that is consistent with current valuations of the stock market. Finally, one can also rely on a survey methodology to infer the consensus view of ERP.

We rely on three approaches. First, we use estimates of Indian ERP based on historical averages over the 2001-2018 period. Asset pricing studies are typically dependent on a much longer time series to infer meaningful estimates. However, an emerging market like India, which underwent significant structural changes over time (the pre-liberalization period prior to 1990s and the advent of market liberalization during the 1990s) renders prior data questionable and also of lower reliability due to various exogenous reasons. Consistent with these arguments, Anshuman et al (2019) rely on data from the post-2001 period. They report a geometric mean of 7.78% as the estimate of ERP.[41]

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[39] For instance, a recent study by Manish Saxena (*Valuation Insights: Equity Risk Premium (ERP) for Indian Market*, Grant Thornton, October 2015) has quoted ERP's ranging from 4.0% - 12.50% from various studies such as Jayant Varma & Samir Barua (2006), JM Morgan Stanley (2006), Rajneesh Mehra (2006), Banco de Portugal (2008), Morgan Stanley (2010), VC Circle (2010), ISES Survey (2011) and Goldman Sachs (2011-12). However, the studies are outdated, and their ERP estimates cannot be used for estimating Cost of Equity for Bangalore Airport for the 3rd Control Period. The paper can be found at, as viewed on 28 Feb 2020: https://www.grantthornton.in/globalassets/1.-member-firms/india/assets/pdfs/grant_thornton-valuation_insights-october_2015.pdf

[40] Ivo Welch Brown and Amit Goyal; A Comprehensive Look at The Empirical Performance of Equity Premium Prediction; The Review of Financial Studies / v 21 n 4 2008.

[41] Anshuman, Biswas, Jain and Sharma, "*Predictability of Equity Risk Premium in Indian Equity Markets*", IIM Bangalore working paper (2019), https://www.iimb.ac.in/node/6984

As argued in Damodaran,[42] we also rely on the geometric mean as a proxy for the ERP for long-term projects. The CAPM is a one-period model and arithmetic means works well only if the annual returns in the stock and bond markets are serially uncorrelated. However, stock and bond returns are serially correlated in actual data. This serial correlation is particularly important when we estimate ERP for longer horizons (say, 10 years). In summary:

- Arithmetic mean is more appropriate to use if the returns are uncorrelated.
- Geometric mean is more appropriate for longer horizons in which returns are found to be serially correlated.

Second, we rely on a study by Grant Thornton that estimates a forward-looking ERP for India. This ERP estimated is an imputed measure based on the Gordon Growth model. The inputs are market index data and estimates of dividend growth rates of stocks in the market index. The study uses Nifty market index as a proxy for the market index. The NIFTY market index consists of 50 leading Indian companies that fairly represent all the leading industry sectors in India. To estimate the forward-looking ERP, the study uses a 3-stage Gordon's Growth Model. In their study, for Financial Year (FY) 2018-20, the study uses a growth rate of 13% during FY 2021-25 based on the nominal GDP for India as calculated by IMF, a growth rate of 10% for the period from FY 2026 onwards, and a perpetual growth rate of 7.50% henceforth. Under these assumptions, the study estimates a forward ERP estimate of 8.00%[39].

Third, we also try out Damodaran's approach of computing the Indian equity risk premium based on the U.S implied equity risk premium. The advantage of this approach is that the mature market risk premium has been derived from a much longer historical time series (1960-2018). Damodaran derives the Indian ERP by *adding* an adjustment factor that reflects the sovereign risk estimate of the Indian equity markets. To derive this adjustment factor, Damodaran employs two proxies, one based on rating of sovereign bonds and the other based on CDS spreads, and, in both cases, modifies this adjustment factor by the average ratio of equity volatility and bond volatility across emerging markets (= 1.23). For

[42] http://people.stern.nyu.edu/adamodar/New_Home_Page/AppldCF/derivn/ch4deriv.html, as viewed on 28 February 2020.

instance, Damodaran's estimate of ERP for India based on bond ratings is given by the following: 5.96% (mature market implied risk premium) + 1.23*2.15% = 8.60%. Damodaran's CDS based Indian ERP is given by 5.96% + 1.23*(1.85%-0.30%) = 7.87%.[43]

Discussion Summary (Equity Risk Premium)

We focused on three recent studies that document the equity risk premium for India. Our primary criterion is that the estimates should be based on market data.

(i) Anshuman et al. (2019) give an estimate of 7.78% based on the historical mean, which is known to be best predictor of ERP across the world (Welch and Goyal (2008), Anshuman et al (2019)). However, the accuracy of ERP estimates also depends on the length of the sample period. The greater the duration, lower are the standard errors. Anshuman (2019) is based on a relatively shorter period (2001-2018).

(ii) Damodaran recommends two estimates: 7.87% based on CDS spreads and 8.60% based on bond ratings, which are known to be sluggish. Damodaran's estimates are based on adjusting the mature country's ERP and therefore is an indirect measure of Indian ERP that only partially reflects the Indian market price data.

(iii) The Grant Thornton report (2017) gives a forward-looking estimate of 8%. It is based on market data but is also based on subjective estimates of dividend growth rates given by analysts.

Given that these three studies give estimates based on critical assumptions, we define the proxy for ERP in our study as the simple average of the four estimates, i.e., our proxy for ERP is (7.78% + 7.87% + 8.60% + 8%)/4 = 8.06%. This averaging procedure helps eliminate the effect of biases implicit in each of the three studies.

3.3.7. Cost of Debt – Illustrative Purpose only

The following section provides an estimate of the cost of debt of BIAL at the end of 2019 as an illustrative exercise. In general, cost of debt (CoD) must be estimated annually based on the latest information as of that date. The estimates developed for cost of debt in this section

[43] The CDS for US of 30 bp has been subtracted from the Indian CDS of 185 bp to get an estimate of the adjusted CDS for India.

have no other purpose than to illustrate the computation of the Fair Rate of Return (FRoR), as discussed further down. Both CoD and FRoR estimates in this report have no bearing on future annual CoD and FRoR estimates, which would have to be estimated based on information available at that point in time in future.

To estimate the Cost of Debt (CoD) of comparable debt instruments in India, we considered a total of 16,782 debt instruments (Debt Instruments, Commercial Papers and Certificate of Deposit) that are active as per NSDL.[44] Of these, 1,056 are 'AA' or equivalent rated as per CARE, CRISIL, ICRA and Brick Work Ratings. BIAL is rated "AA" by CRISIL, as of 31/07/2019. The number of debt instruments issued, from 01/01/2018 till 28/02/2020 of the said rating is 132. Of these, 9 were by infrastructure companies. Table 3.7 gives the average coupon rate of these 9 instruments.

Table 3.7: Estimation of Cost of Debt (CoD) – For Illustrative Purpose only

Debt Instrument Issuer	No. of Instruments Issued	Coupon Rate
Greater Hyderabad Municipal Corporation	1	8.90%
Greater Hyderabad Municipal Corporation	1	9.38%
Green Infra Wind Energy Limited	1	9.65%
Indore Municipal Corporation	1	9.25%
Kalpataru Satpura Transco Private Limited	1	8.65%
Municipal Corporation Bhopal	1	9.55%
North Eastern Electric Power Corporation Limited	1	8.75%
Talwandi Sabo Power Limited	1	8.55%
Talwandi Sabo Power Limited	1	9.23%
Overall Cost of Debt (Simple Average of the 9 rates)	**9.10%**	

Source: https://nsdl.co.in/downloadables/list-debt.php

The average rate of 9.10% is consistent with CRISIL's assessment of BIAL in July '19.[33] More recent estimates based on the latest data suggest a return around 10%.

[44] https://nsdl.co.in/downloadables/list-debt.php as viewed on 28/02/2020.

Discussion Summary (Cost of Debt – Illustrative Purpose Only)

- *We estimated the average yields of bonds of comparable infrastructure companies (AA bonds). The estimate was 9.10%.*
- *More recent data suggests revised estimate of around 10%.*
- *For FRoR calculations, we use the same CoD of 9.10% for BIAL since the exercise is for illustrative purpose only. .*
- *Going forward, AERA should seek inputs from the airport operator and accordingly estimate the Cost of Debt as market conditions evolve.*

3.3.8. Cost of Equity (CoE) and Fair Rate of Return (FRoR)

Using the equity betas shown in Equation 3.7, we compute the CoE using the CAPM. Here, we discuss the recommended CoE and FRoR estimates for BIAL. For the forthcoming control period (2019–24), Table 3.8 show these results. The entire process flow with relevant sections numbers is showcased in Appendix 4.

Table 3.8: Variables Used to Estimate CoE and FRoR

The re-levering is based on the following equation $\beta_E=\beta_A*[1+(1-T_C)*D/E]$ – (Equation 3.3 – Re-levering Betas). Also, the asset betas (β_A) used are the Equally Weighted betas (**0.6229**) for BIAL. Also, the asset betas (β_A) used are the Proximity Score Weighted (PSW) betas, **0.562659 for BIAL**. The Cost of Debt (R_D) is for illustrative purpose only

1. Asset Beta (Proximity Score Weighted) *(β_A)*	
BIAL	0.562659
2. Risk Free Rate *(R_f)*	
10-Year GOI Bonds, 18-Year Daily Avg.	7.56%
3. Equity Risk Premium *(ERP)*	
Simple Average of estimates from four studies	8.06%
4. Cost of Debt* *(R_D)*	
Estimated using 'AA' rated Debt Instruments from NSDL	9.10%

*Illustrative Purpose only. Refer section 3.3.7 for details

Table 3.9: Estimation of Cost of Equity (CoE) for BIAL

This table summarizes the results for BIAL and highlights the 2 important variants of D/E ratios. Of these, we recommend target gearing ratio of 0.9231 or 48:52. The asset betas are the Proximity Score Weighted (PSW) weighted betas, given by $\boldsymbol{\beta}_A = \frac{\sum_{k=1}^{4}\left(\frac{\beta_k}{PS_{k,B}}\right)}{\sum_{k=1}^{4}\left(\frac{1}{PS_{k,B}}\right)}$ (Equation 3.2). Further, these are converted to equity betas by re-leveraging using the equation $\beta_E=\beta_A*[1+(1-T_C)*(D/E)]$ – (Equation 3.3 – Re-levering Betas). The CoE is computed using the CAPM equation, $\boldsymbol{R_E = R_f + \beta_E (R_M - R_f)}$, Equation 1.1. FRoR is computed as $\boldsymbol{FRoR} = (\boldsymbol{R_M} * \frac{D}{D+E}) + [\boldsymbol{R_E} * (\mathbf{1} - \frac{D}{D+E})]$, Equation 3.4.#

Airport: BIAL (Col 1)	Gearing Based on Target Gearing Ratio (Col 2)	Gearing based on MDE-equiv of BDE 2:1 (Col 3)
Asset Beta	0.562659	0.562659
Gearing Ratio (D/E)	0.9231**	0.9180***
Gearing Ratio (D/D+E)	48.00%	47.86%
Equity Beta	0.9262	0.9242
Risk Free Rate	7.56%	7.56%
Equity Risk Premium	8.06%	8.06%
Cost of Equity	**15.03%**	**15.01%**
Cost of Debt$	9.10%	9.10%
Fair Rate of Return##	**12.18%**	**12.18%**

The tariff computation reflects a pass through of the annual taxes payable, thus the Cost of Equity (R_E) used in the FRoR formula is a post-tax cost of equity. Since taxes are covered by tariffs, tax deductibility of interest is irrelevant for the airport operator and the cost of debt should not reflect any interest tax shield benefits.

**Target Gearing Ratio – calculated using average suggested gearing by the regulators of 8 comparable international airports.

***Market Debt Equity equivalent of BDE using the factor 0.459.

$Illustrative only considering 2018 debts. This varies significantly depending on market conditions as discussed in section 3.3.7

FRoR is an illustrative computation only and varies significantly depending on CoD as discussed in section 3.3.7

Recommendations for Cost of Equity

Our final recommendation for CoE is based on the following parameters:

- *Gearing Ratio: Target gearing ratio of 48%.*
  - *As a benchmark, we also presented CoE and FRoR estimates based on other assumptions about the gearing ratio.*
- *Risk-Free Rate of 7.56%*
- *ERP of 8.06%*
- *Proximity Score Weighted (PSW) Asset Betas*
  - *BIAL: 0.562659*

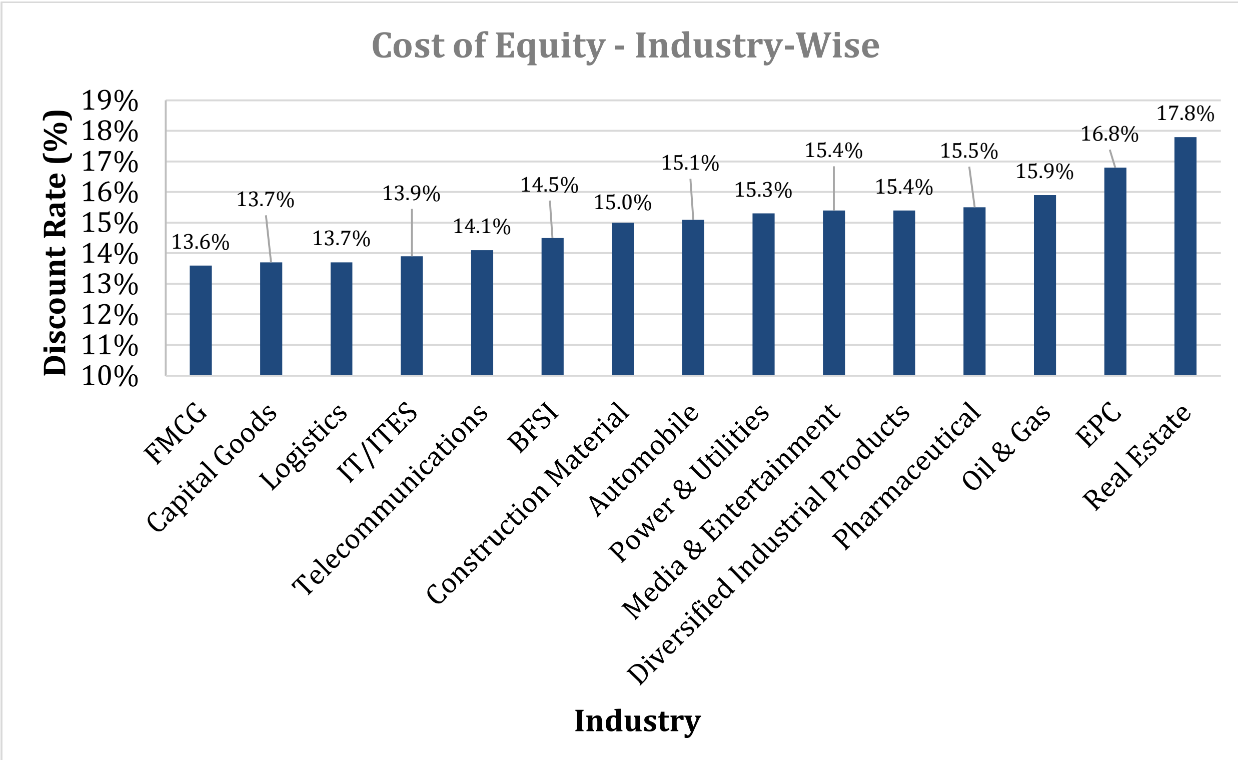
- ***CoE estimate** of BIAL is **15.03%***
  - *We present here the survey-based estimates of CoE across sectors in the Indian economy. Fig 3.3 gives the sectoral CoEs for India.*

*Illustrative **FRoR** estimates are based on an illustrative cost of debt of 9.10% (note that these are not recommendations):*

- *FRoR of BIAL: **12.18%***

Fig 3.3: CoE by Sector[39]

The chart shows the sector-wise breakup of CoE in India.



Source: Navin Vohra, Cost of Capital – India Survey, 2017, Ernst & Young

3.4. Conclusion and Final Recommendation

In this section, we estimated the Cost of Equity (CoE) and provided an illustrative example of Cost of Debt (CoD) and Fair Rate of Return (FRoR) computations. First, we computed a proximity score weighted average beta of a comparable set of international airports as a proxy for the asset beta of BIAL. Next, we re-levered this asset beta into an equity beta using the recommended target gearing ratio, as determined by the average suggested gearing ratio of a comparable set of international airports. The equity beta was then used to compute the Cost of Equity as per the CAPM. We discussed the Cost of Debt (CoD) was provided as an illustrative example of determining FRoR. The final recommendations are shown in Table 3.10.

Table 3.10: Final Recommendations

Variable (Col 1)	BIAL (Col 2)
Asset Beta based on Proximity Score Weights of comparable set	0.562659
Target gearing ratio (D/D+E)	48%
Target gearing ratio (D/E)	0.9231
Equity Betas	0.9262
Risk Free Rate	7.56%
Equity Risk Premium	8.06%
Cost of Equity	**15.03%**
Cost of Debt (CRISIL Rating)$	9.10%
Fair Rate of Return#	**12.18%**

$Illustrative purpose only considering 2019 debts. This varies significantly depending on market conditions as discussed in section 3.3.7

#FRoR is an illustrative computation only and varies significantly depending on CoD as discussed in section 3.3.7

3.4.1. Utility for Estimating CoE (and FRoR Computations)

Based on varying set of assumptions, multiple other variants of CoE and FRoR are possible with varying estimates of betas, ERP, Risk-Free Rate, etc. The MS-Excel utility (AERAExcelUtility.xlsm) supplied along with this report gives all possible variants discussed in this study. It gives the CoE and FRoR based on user inputs for different variables. This section discussed the said Excel Utility. The Utility opens to the screenshot provided in Fig 3.4. As can be observed, the user has a choice of 5 variables' input, viz.

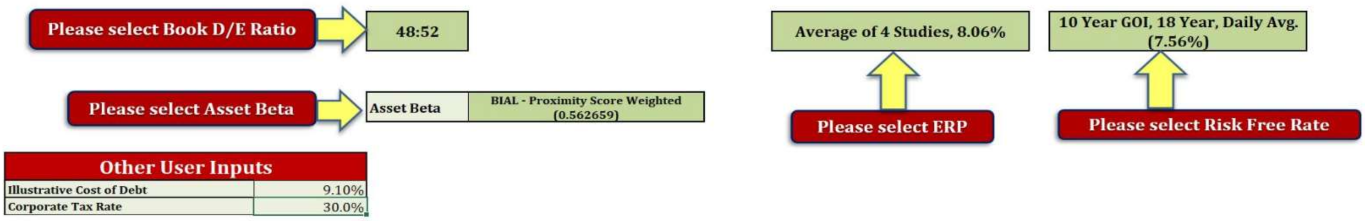
1. Target capital structure based on book D/E Ratio (BDE): This ranges from 35:65 to 85:15 with step increment of 5%.
2. Equity Risk Premium (ERP): four different choices of ERP are available:
    a. Damodaran, 2019, (Scaled CDS) – 8.60%
    b. Damodaran, 2019, (Scaled DS) – 7.87%

c. Anshuman et al. – 7.78%

d. Grant Thornton, Forward Estimate – 8.00%

We employ a simple average of these 4 estimates (a-d) – 8.06%

Fig 3.4: Screenshot of User Inputs in Excel Utility



Note: **Cost of Debt** (CoD) in this fig. is illustrative only considering 2019 debts. This varies significantly depending on market conditions as discussed in section 3.3.7
Ref: AERAExcelUtility.xlsm

3. Risk-Free Rate: 4 different values of Risk-Free Rates are available:
    a. 10-Year GOI bonds daily averaged over 18 years – 7.56%
    b. 1-Year T-Bill – 6.81%
    c. 3-Year GOI Bonds – 7.15%
    d. 10-Year GOI Bonds, current (Jan 2019) – 7.6%
4. Asset Beta: As discussed, the proximity score weighted as well as the equal weighted betas is available as user input options.

Once these choices are made, the Utility automatically takes the corresponding values and displays the same.

Fig 3.5 shows the same. The results are displayed as highlighted in Fig 3.6.

Fig 3.5: Values corresponding to the variables based on user input

Values Derived from User Choices	
Target Gearing Ratio	48.00%
Equity Risk Premium	8.06%
Risk Free Rate	7.56%
Asset Beta	0.562659

Fig 3.6: Final Output in the Excel Utility

Output	
Equity Beta	0.9262
Cost of Equity	15.03%
Illustrative Fair Rate of Return	12.18%

Note: **Fair Rate of Return** (FRoR) is an illustrative computation only and varies significantly depending on CoD as discussed in section 3.3.7

Appendix 1: Summary of ToR Relevant for BIAL Cost of Capital

1. Background[45]

The Authority had determined 'Cost of Equity' for private sector in the year 2011. Now 7 years have been lapsed, hence the Authority intends to conduct the study afresh in the current scenario to perform its statutory regulatory functions.

The Cost of Capital of FRoR (Fair rate of Return) is a significant influencer when Rate of Return Regulation is the opted method of Economic Oversight. The intent of such rate of return is to embody the reasonable return expectation of ALL investors in the project. Regulatory precedents at the time of choosing such Economic Oversight in India favored the use of WACC in which the COE would be determined with the help of the CAPM model.

While other determinants such as debt and capital structure, cost of debt, leverage levels etc., are explicit or evident, it is Cost of Equity in the FRoR formula (that determines WACC), which remains the challenge.

2. Scope of Work

a) Study of relevant environment, trends in airport capitalization
b) Study airport-specific determinants of Cost of Capital with specific focus on Cost of Equity
c) Recommendations on Cost of Equity
d) Follow-on activities

3. Study of the current environment and trends in airport capitalization

Assist the Authority in:

a) Study of capitalization structure, funding mechanisms, divestment deals reported in recent projects in Asia/Europe, investor returns and co-relation to their return models in these cases.

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[45] Ref: Annexure 1 of agreement signed between IIMB and AERA on 16 Mar 2020

b) Study recent airport asset divestment cases witnessed in PPP/Other projects in India and/or region. Understand implication of such deals on stakeholder behavior, impact on return models, passenger tariff & capital gains realized & their co-relation to FRoR & Cost of Equity & reason for absence of co-relation.

c) Prepare an observation summary stating how and why cases from a) and b) have impacted and influenced the determinants of FRoR, in particular Cost of Equity, CAPM model and its underlying premises.

d) Trace developments in both Business and Regulatory environment from 2009 (beginning of Airport regulation) to evaluate the impact of change in underlying assumptions for CAPM model.

e) Study to also cover prevalent trends and developments in other regulated infrastructure intensive industries like Power, Roads, etc.

4. Study airport-specific determinants of Cost of Capital with specific focus on Cost of Equity

In the background of study detailed above, an airport-specific study should be undertaken according importance to all determinants of Cost of Capital, but specifically focusing on Cost of Equity including:

a) **Capital Employed Structure:** Study the components of the capital employed, suitability to the airport project, its feasibility and sustainability.

b) **Share-holding pattern:** Study the composition of shareholders, their holding period, their prevalent divestment scenario and opportunities and possible impact on Cost of Equity.

c) **Cost of Equity:** Study the impact of the cost of equity determined for the previous control periods, suggestions for improvement, impact on the passenger fee/ aeronautical charges. Study of the scenario must also cover expectations on return or cost of equity, risk-free return, equity market risk premium, equity beta, asset beta, taxation, etc.

d) **Dividend distribution policy:** Study the specific airport's dividend distribution policy, and application of Dividend relevance theory in determination of Cost of capital.

Other Determinants

a) **Cost of debt:** Impact of actual cost of debt for previous control periods, variance to projections, suggestions for improvement, impact on passenger fee/aero charges

b) **Debt Structure, Leverage level:** Assessment of the efforts of the Airport in raising Debt via different avenues, Debt service cost reduction & negotiation efforts

c) **Debt standing & Market perception of the Airport/Major shareholder:** Risk profile of the Airport operator and/or its largest shareholder and consequent impact on cost of debt.

5. Recommendations on Cost of Equity

Recommendations to include:

a) Cost of Equity – Risk-free return, risk premium and beta levels

b) Feasibility of adopting a normative approach with regards to the optimum capital structure and debt-equity gearing

c) Alternative models for determination of cost of equity

6. Follow-on Activities

a) Assist in drafting of consultation paper for determination of cost of equity and undertaking stakeholder consultations and consolidating comments received from various stakeholders, preparing clarifications on comments thereof.

b) Assist in drafting the Order on determination of cost of equity.

Appendix 2: Set of Indian Infrastructure Companies

A data set of 37 Indian Infrastructure companies for 5 Years (2014-18) was used to establish the relationship between Market and Book Debt Equity of a company in Equation 3.6. However, not all 37 companies traded in those 5 years. The following table clearly shows which company was traded in the financial year out of such 5 years:

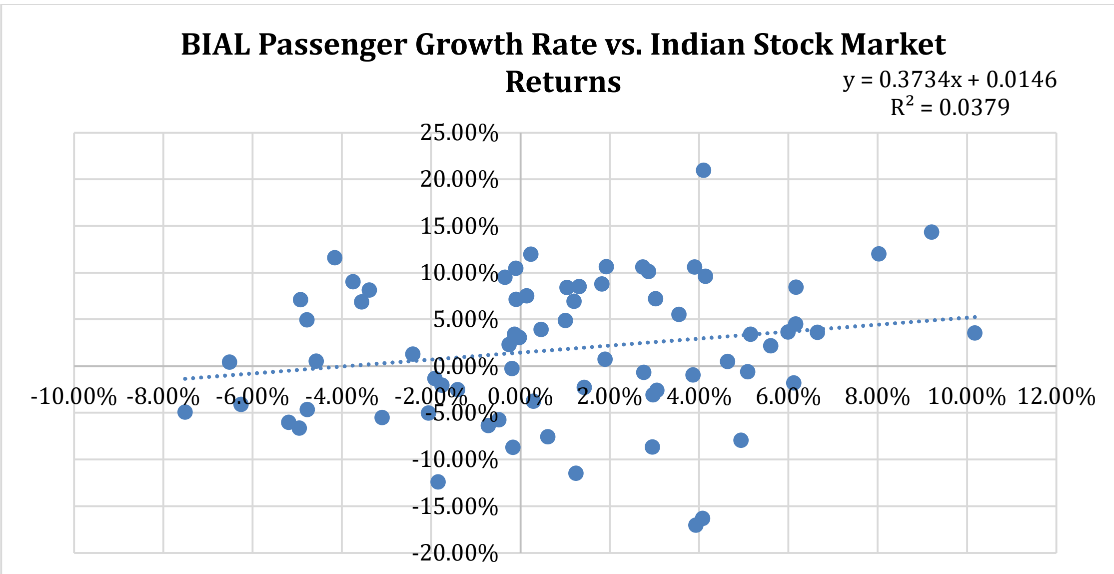
S. No.	Company Name (Col 1)	Traded in Financial Year (Col 2)	Number of years (Col 3)
1	B S Ltd.	2014 - 2018	5
2	C C L International Ltd.	2014 - 2018	5
3	G P T Infraprojects Ltd.	2014 - 2018	5
4	G T L Ltd.	2014 - 2018	5
5	I T D Cementation India Ltd.	2014 - 2018	5
6	Jyothi Infraventures Ltd.	2014 - 2018	5
7	N C C Ltd.	2014 - 2018	5
8	Nu Tek India Ltd.	2014 - 2018	5
9	P N C Infratech Ltd.	2014 - 2018	5
10	Precision Electronics Ltd.	2014 - 2018	5
11	R P P Infra Projects Ltd.	2014 - 2018	5
12	Shriram E P C Ltd.	2014 - 2018	5
13	Vishvas Projects Ltd.	2014 - 2018	5
14	Indo-Asian Foods & Commodities Ltd.	2014 - 2017	4
15	Navkar Builders Ltd.	2014 - 2017	4
16	Sadbhav Infrastructure Project Ltd.	2015 - 2018	4
17	Simplex Projects Ltd.	2015 - 2018	4
18	Excel Realty N Infra Ltd.	2014 - 2016	3
19	Gammon Infrastructure Projects Ltd.	2015 - 2017	3
20	K E C International Ltd.	2014 - 2016	3
21	M B L Infrastructures Ltd.	2014, 2016 - 2017	3
22	Marg Ltd.	2015 - 2017	3
23	Maruti Infrastructure Ltd.	2016 - 2018	3
24	Ruchi Infrastructure Ltd.	2014 - 2016	3

25	Capacit'e Infraprojects Ltd.	2017 - 2018	2
26	Essar Ports Ltd.	2014 - 2015	2
27	G M R Infrastructure Ltd.	2014 - 2015	2
28	P V V Infra Ltd.	2016 - 2017	2
29	Pratibha Industries Ltd.	2017 - 2018	2
30	Suvidha Infraestate Corpn. Ltd.	2014 - 2015	2
31	Atlanta Devcon Ltd.	2016	1
32	Dilip Buildcon Ltd.	2017	1
33	I L & F S Engg. & Construction Co. Ltd.	2014	1
34	Kalpataru Power Transmission Ltd.	2014	1
35	Prime Focus Ltd.	2018	1
36	Valecha Engineering Ltd.	2017	1
37	Yuranus Infrastructure Ltd.	2015	1

Appendix 3: Demand Function in the Indian Context

Charts 1 shows the results for BIAL. The regression comprises month-on-month stock returns from 2013–2018 to the month-on-month passenger growth rate in the same period for BIAL.

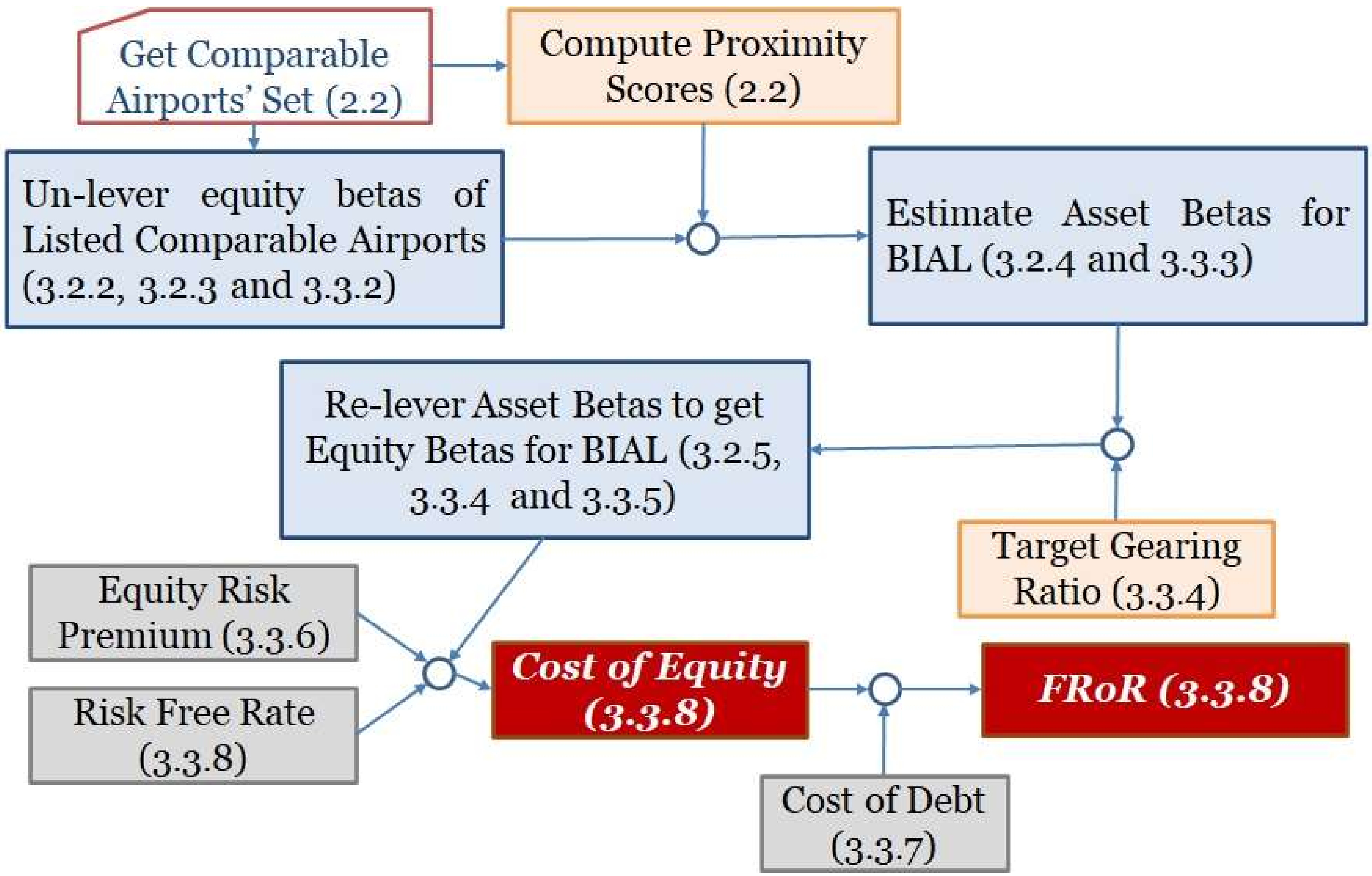
Chart 1: BIAL Passenger Growth Rate vs. Indian Stock Market Returns from 2013–2018



	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99.0%	Upper 99.0%
Intercept	0.0146	0.0091	1.6112	0.1117	-0.0035	0.0326	-0.0035	0.0326
slope	0.3734	0.2266	1.6479	0.1039	-0.0786	0.8253	-0.0786	0.8253

As highlighted in the charts, the slopes (proxies for asset betas) is ~0.37 for BIAL. However, while demand risk is low, there could be other uncertainties playing out.

Appendix 4: Flowchart to compute Cost of Equity (CoE) and FRoR*



**** The numbers in bracket indicate the respective section number in the report.***

Appendix 5: Section-wise Indexing of Terms of Reference (ToR)

Clause 3a. Study of capitalization structure, funding mechanisms, divestment deals reported in recent projects in Asia/Europe, investor returns and co-relation to their return models in these cases.

Subject	Section(s) of the Report	Comments/Caveats
Document cases on airport divestments in Asia/Europe with focus on:		
Capitalization	2.2.1	
Funding mechanism	2.2.2	
Investor returns	2.2.3	
Correlation to their return models	2.2.3	The last part of section discusses this and also does a comparative study w.r.t. Indian airports (Ref. Table 2.11, Table 2.12 and Fig. 2.7)

Clause 3b. Study recent airport asset divestment cases witnessed in PPP/Other projects in India and/or region. Understand implication of such deals on stakeholder behavior, impact on return models, passenger tariff & capital gains realized and their co-relation to FRoR & Cost of Equity and reason for absence of co-relation.

Subject	Section(s) of the Report	Comments/Caveats
Same as 3a for Indian airport disinvestment in all respects along with	2.2.1 – 2.2.3	
Implications on stakeholder behavior	2.2.4	The case of Bangalore divestment is discussed. MIAL could not be discussed for lack of recent data
Impact on return models, passenger tariff and capital gains and their correlation to FRoR	2.2.3	Indian Airports (DIAL, BIAL, MIAL and HIAL) are compared to international comparables in terms of their IRR
Reason for absence of correlation	Last part of the section 2.2.3	Explicitly gives parameters to find the correlation and the absence currently observed (Ref Table 2.11 and Table 2.12)

3c. Prepare an observation summary stating how and why cases from a) and b) above have impacted and influenced the determinants of FRoR in particular Cost of Equity, CAPM model and its underlying premises.		
Subject	**Section(s) of the Report**	**Comments/Caveats**
1. Document Determinants of FRoR (CoE in focus) 2. Impact of 3(a) and 3(b) on the same	2.3	
3d. Trace developments in both Business and Regulatory environment from 2009 (beginning of Airport regulation) to evaluate the impact of change in underlying assumptions for CAPM model	2.4	
3e. Study to also cover prevalent trends and developments in other regulated infrastructure intensive industries like Power, Roads, etc.	2.5	Discusses InVITs

Subject	Section(s) of the Report	Comments/Caveats
4a. Capital Employed Structure: Study the components of capital employed, suitability to the airport project, its feasibility and sustainability	2.2.1	
4b. Share-holding pattern: Study the composition of shareholders, their holding period, their prevalent divestment scenario and opportunities and possible impact on Cost of Equity	2.2.1	Refer to Table 2.7 - Table 2.10
4c. Cost of Equity: Impact of the cost of equity determined for the previous control periods, suggestions for improvement, impact on the passenger feel aeronautical charges. Study of the scenario must also cover expectations on return or cost of equity, risk-free return, equity market risk premium, equity beta, asset beta, taxation, etc.	3.2.6 and 3.3.8	
4d. Dividend distribution policy: Study on the specific airport's dividend distribution policy, application of Dividend relevance theory in determination of Cost of capital	2.2.3	Fig. 2.7 and Table 2.11 and Table 2.12
4 (Others) a. Cost of debt: Impact of actual cost of debt for previous control periods, variance to projections, suggestions for improvement, impact on passenger fee/aero charges	3.3.7	
4 (Others) b. Debt Structure, Leverage level: Assessment of the efforts of the airport in raising Debt via different avenues, Debt service cost reduction and negotiation efforts	3.3.4	Table 3.4
4 (Others) c. Debt standing and Market perception of the Airport/Major shareholder: Risk profile of the airport operator and/or its largest shareholder and consequent impact on cost of debt	3.3.7	Table 3.7

Subject	Section(s) of the Report	Comments/Caveats
5a. Recommendation 1: Cost of Equity - risk-free return, risk premium and beta levels	3.4 and Excel Utility provided along with this document.	Excel utility manual is provided in section 3.4.1.
5b. Recommendation 2: Feasibility of adopting a normative approach with regards to the optimum capital structure and debt-equity gearing		
5c. Recommendation 3: Alternative models for determination of cost of equity		
6a. Assist in drafting of consultation paper for determination of cost of equity and undertaking stakeholder consultations and consolidating comments received from various stakeholders, preparing clarifications on comments thereof.	Consultations based on one-on-one interactions with AERA	
6b. Assist in drafting the order on determination of cost of equity		