ROUTE TRAFFIC FORECASTING DATA, TOOLS AND TECHNIQUES

LONG TERM FORECASTING

MODULE 4

ASM GLOBAL ROUTE DEVELOPMENT

UBM

Long Term Forecasting

“Forecasting is the process of making predictions of the future based on past and present data and analysis of trends.”

Source : Wikipedia

Long Term Forecasting

OBJECTIVES

- Identify and understand the different types of long term forecasting techniques.
- Selecting the most appropriate and appreciating the benefits of that particular method.
- Understand long term forecast limitations and application of the information.

Long Term Forecasting

WHAT MAKES A GOOD FORECAST

- The forecast should be timely
- The forecast should be as accurate as possible
- The forecast should be reliable
- The forecast should be in meaningful units
- The forecast should be presented in writing
- The methodology should be easy to understand.

Long Term Forecasting – Core Elements

- **Long term growth rates (Subjective & Objective)**
  - Delphi
  - Market Research
  - Time series
  - Regression Analysis

- **Bottom-up forecast**
  - Future scenarios
  - Market changes assessment and feasibility
  - Based on aircraft types, movements, load factor assumptions for each market

Bottom Up Forecast – Short term

A short term forecast is often based on “bottom-up” forecast that comprises:

Route Forecast
Airport Network Forecast

- 3 to 5 years based on current schedule, developed in detail with planned and known growth.

- Anticipated growth in aircraft size and frequencies
  - Aircraft orders, fleet mix, demand by route, load factor growth
  - Markets factors, bilateral agreements, additional runway slots, global changes

Bottom Up Forecast – Short term

A short term forecast is often based on “bottom-up” forecast that comprises:

- New routes based on airline relationships, market strategy, business targets
  - Based airlines adding more destinations
  - Short term targets based on Indirect traffic demand, competition and market share
- Aspirational growth
  - Driven by commercial relationships, revenue guarantees, corporate demands
  - Investment in facilities delivering growth to new markets

Bottom Up Forecast – Short term

Passengers, Seats and Movements

	2016 Passengers	2016 Seats	2016 Movements
Route 1	3,000	4,000	80
Route 2	3,500	5,000	100
Route 3	2,700	3,600	72
Route 4	5,400	7,200	144
Route 5	12,000	16,000	320
Route 6	5,600	7,500	150
Route 7	4,500	6,000	120
Route 8	7,800	10,400	208
Route 9	6,000	8,000	160
Route 10	12,000	16,000	320
Route 11			
Route 12			
Totals	62,500	83,700	1,674

Bottom up Forecast for 2017

	2017 Passengers	2017 Seats	2017 Movements	
Route 1	3,150	4,200	84	5% Increase in Movements
Route 2	5,625	7,500	100	Increase from 50 to 75 seats
Route 3	2,700	3,600	72	
Route 4	5,400	7,200	144	
Route 5	12,000	16,000	320	
Route 6	6,000	7,500	150	Target 80% load factor (was 75%)
Route 7	4,500	6,000	120	
Route 8	7,800	10,400	208	
Route 9	6,000	8,000	160	
Route 10	12,000	16,000	320	
Route 11	1,800	2,400	32	New Route (Summer only)
Route 12	675	900	12	New Route (Winter Start)
Totals	67,650	89,700	1,722	
	8.2%	7.2%	2.9%	

Long Term Forecasting – Core Elements

- **Subjective forecasting**
  - Personnel estimates
  - Market Research / Customer Surveys
  - Jury of Executive Opinion
  - The Delphi Method

Long Term Forecasting – Core Elements

- **Objective forecasting**

  There are two primary methods, causal and time series.

  – A causal model is an abstract model that describes the causal mechanisms of a system. The model must express more than correlation because correlation does not imply causation.

  – A time series is just collection of past values of the variable being predicted. Also known as the “naïve” method. The goal is to isolate patterns in past data such as Trend, Seasonality, Cycles and Randomness

Subjective Growth Rates

LONG TERM GROWTH RATES – **DELPHI**

- Delphi – Consensus trend forecasting, using range of relevant inputs. Individual opinions are compiled, considered and shared among group. Then the groups opinion is requested, the process repeated until an overall group consensus is (hopefully) reached.

- This is the ready made medium term forecast on a country to country level, which could be useful of traffic growth for your airport. However, it lacks reliability as its has no GDP correlation, Economic indicators or Travel trends.

		Passenger Vol	Forecast Annual Percent Changes					Forecast Traffic Volume					CAGR
Base location	Other Location	2011 (000)	2012	2013	2014	2015	2016	2012(000)	2013(000)	2014(000)	2015(000)	2016(000)	2012-2016
Canada	Caribbean	2,379	5.9%	6.7%	6.8%	6.5%	6.1%	2,520	2,689	2,871	3,057	3,245	6.4%
Canada	Central America	1,491	6.3%	8.9%	9.7%	8.5%	8.1%	1,584	1,725	1,892	2,052	2,219	8.3%
Canada	Eastern/Central Europe	168	2.9%	4.4%	4.9%	4.9%	4.8%	173	181	190	199	208	4.3%
Canada	Lower South America	315	6.3%	6.4%	6.8%	6.6%	6.5%	335	356	380	405	431	6.5%
Canada	Middle East	407	5.6%	6.5%	6.9%	6.7%	6.2%	430	458	489	522	554	6.4%
Canada	North America	20,972	1.8%	3.4%	3.3%	3.2%	3.2%	21,352	22,084	22,810	23,546	24,294	3.0%
Canada	Northeast Asia	3,734	5.8%	5.1%	5.4%	5.4%	5.1%	3,952	4,153	4,377	4,611	4,845	5.3%
Canada	Northern Africa	196	4.9%	5.3%	5.4%	5.2%	5.0%	206	217	228	240	252	5.2%
Canada	South Asia	295	6.8%	7.9%	7.7%	7.6%	7.8%	315	340	366	393	424	7.5%
Canada	Southeast Asia	156	3.5%	4.6%	5.1%	5.0%	4.9%	161	169	177	186	195	4.6%
Canada	Southwest Pacific	814	3.5%	4.0%	4.0%	4.1%	3.9%	843	877	911	949	986	3.9%
Canada	Upper South America	157	6.3%	6.5%	6.5%	6.2%	6.1%	166	177	189	200	213	6.3%
Canada	Western Europe	9,547	2.1%	4.2%	4.5%	4.4%	4.3%	9,744	10,152	10,609	11,078	11,555	3.9%
Canada	**Total**	**40,631**	**2.8%**	**4.3%**	**4.4%**	**4.3%**	**4.2%**	**41,781**	**43,576**	**45,490**	**47,439**	**49,422**	**4.0%**

Source : IATA

Subjective Growth Rates

LONG TERM GROWTH – **MARKET RESEARCH**

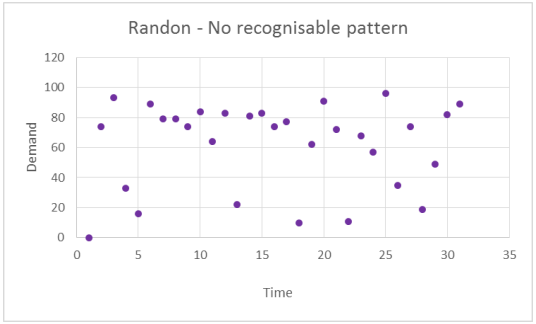
- Market research, which includes social and opinion research, is the systematic gathering and interpretation of information about individuals or organisations using statistical and analytical methods and techniques of the applied social sciences to gain insight or support decision making. (Source : ICC/ESOMAR 2008)

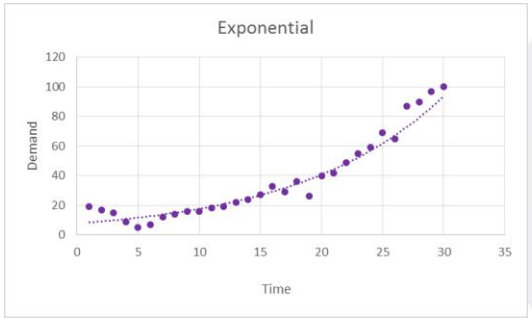
- Research has shown that social media applications help generate the B2B e-commerce market and develop electronic business process efficiency. This application being a highly effective vehicle for market research. While many B2B business models are being updated, the various advantages and benefits offered by Social Media platforms are being integrated within them.
(Source : The UK Market Research Society)

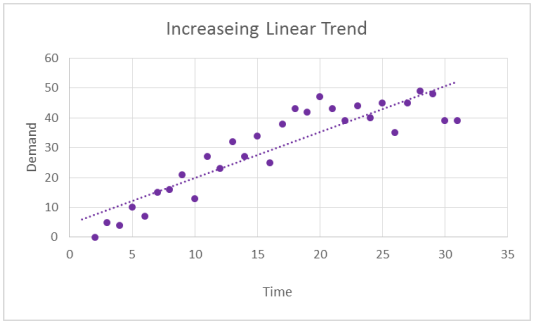
Source : IATA

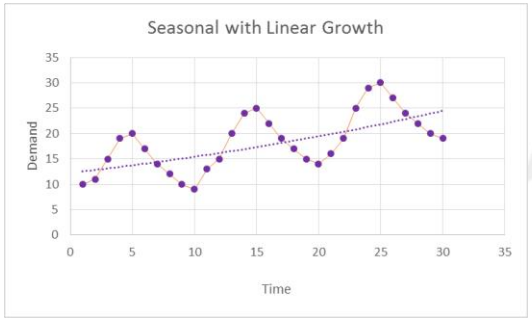
Objective Growth Rates

LONG TERM GROWTH RATES – **TIME SERIES**





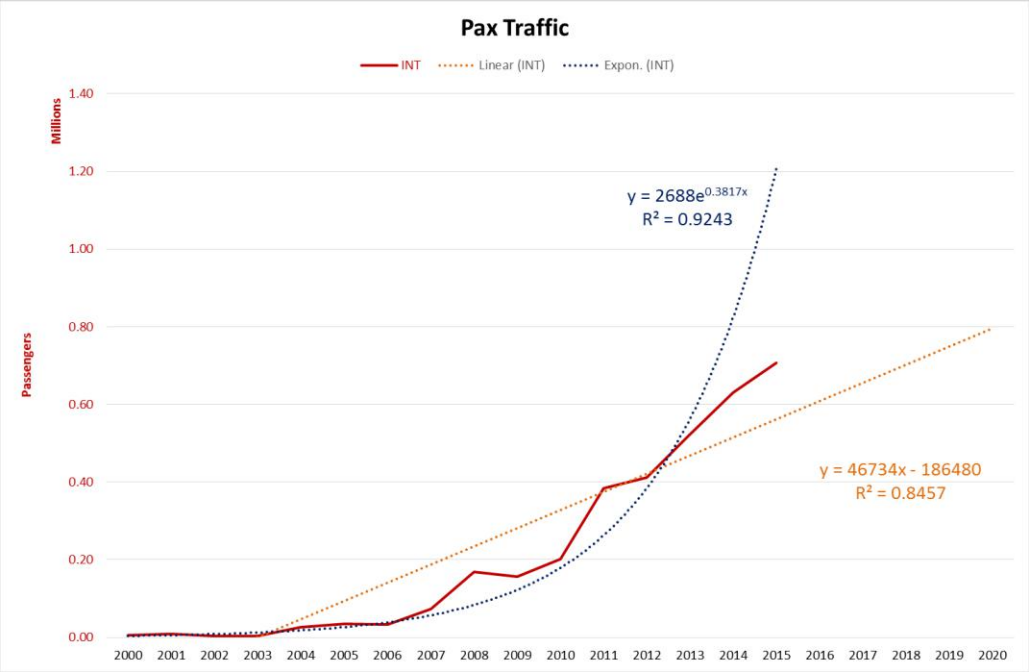




- A time series is just collection of past values of the variable being predicted. Also known as the “naïve” method.
- The goal is to isolate patterns in past data such as Trend, Seasonality, Cycles and Randomness

Objective Growth Rates

LONG TERM GROWTH RATES – **TIME SERIES**



Time Series Linear and Exponential growth estimation techniques

- Based on past performance
- Not linked to economic trends
- Country/country, country/region, route specific

How realistic is the exponential trend in this example?

Long Term Forecasting – Linear Regression

Linear Regression

“In statistics, linear regression is an approach for modelling the relationship between a scalar dependent variable y and one or more explanatory variables (or independent variables) denoted X.

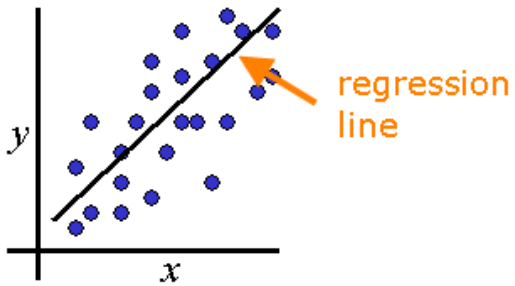
The case of one explanatory variable is called simple linear regression.”

LINEAR REGRESSION ANALYSIS

- Linear regression is the most basic and commonly used predictive analysis.
- Regression estimates are used to describe data and to explain the relationship between one dependent variable and one or more independent variables.
- Linear regression is the most basic and commonly used predictive analysis.
- Regression estimates are used to describe data and to explain the relationship between one dependent variable and one independent variable.
- At the centre of the regression analysis is the task of fitting a single line through a scatter plot. The simplest form with one dependent and one independent variable is defined by the formula

$$y = c + b*x$$

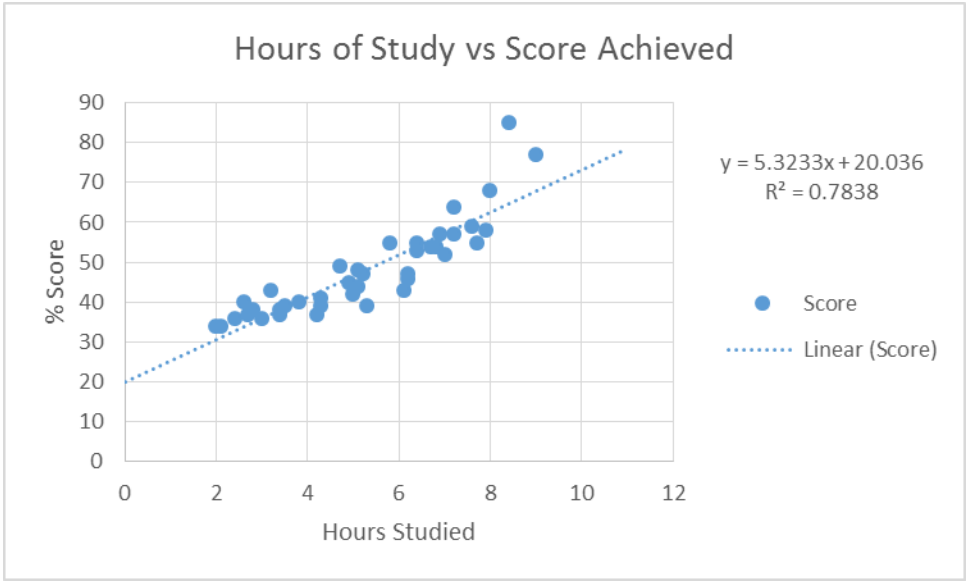
where y = estimated dependent, c = constant, b = regression coefficients, and x = independent variable.



Long Term Forecasting – Linear Regression

LINEAR REGRESSION ANALYSIS – AN EXAMPLE

- Hours Studied vs Grade Achieved



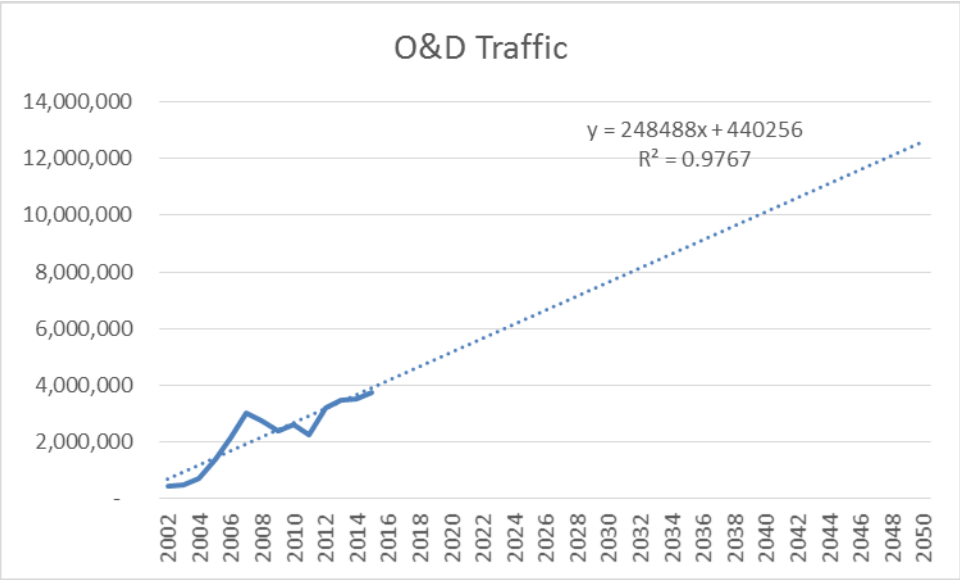
- Plotting the number of hours studied by individual students against the score achieved in a test can be represented in a scatter chart.
- The line of best fit shows the linear path that relates the score achieved to the time spent studying.
- The formula generated describes the relationship between the time and score.
- The R square value denotes the level of variation.

Linear Regression

Practical Exercise

Long Term Forecasting – Linear Regression

LINEAR REGRESSION ANALYSIS – PRACTICAL EXERCISE



- Generate a graph from the sample historical passenger data.
- Apply a line of best fit and extend to 2050.
- Display for formula and R-Squared value
- Calculate the anticipate passenger number in 2050.

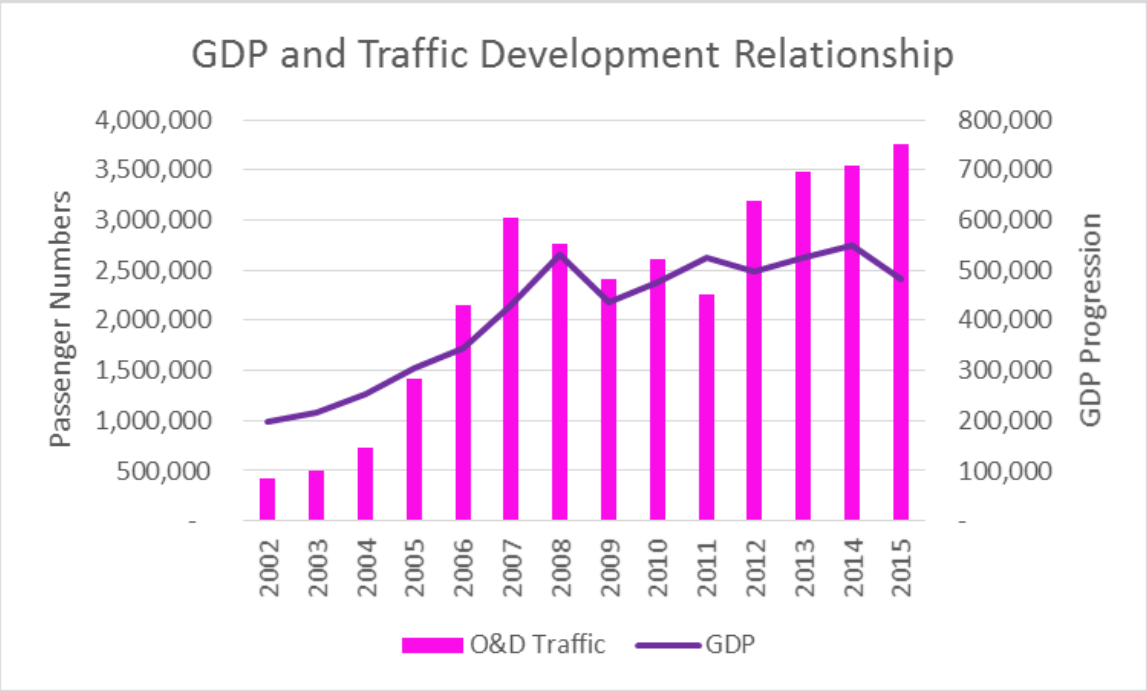
Long Term Forecasting – Regression Analysis

Regression Analysis

“In statistical modelling, regression analysis is a statistical process for estimating the relationships among multiple variables. It includes many techniques for modelling and analysing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables (or 'predictors')”

Long Term Forecasting – Regression Analysis

LINKING PASSENGER GROWTH TO MACRO-ECONOMIC FACTORS:



Long Term Forecasting – Regression Analysis

- The challenge is to find a truly independent variable.
- **Can you name any?**

POPULATION

TRADES (EXPORTS / IMPORTS)

NATIONAL OR LOCAL GDP

UNEMPLOYMENT

PROPENSITY TO TRAVEL

OIL PRICE

HOUSEHOLD DISPOSABLE INCOME

REVENUES

REGRESSION ANALYSIS

- Regression analysis is a statistical tool for the investigation of relationships between variables.
- In undertaking a Regression Analysis we look to ascertain the causal effect of one variable upon another, for example
  - the effect of a price increase upon demand
  - the effect of changes in the money supply upon the inflation rate.

REGRESSION ANALYSIS

- To explore such issues, it is necessary to assemble data on the underlying variables of interest and undertake a regression to estimate the quantitative effect of the causal variables upon the variable that they influence.

- In doing this, we also need to test the “statistical significance” of the estimated relationships, that is, the degree of confidence that the true relationship is close to the estimated relationship.

Long Term Forecasting – Regression Analysis

KEY MEASURES OF STATISTICAL SIGNIFICANCE

- The accuracy of the regression analysis is determined by the R-squared value.
- R-squared represents the percentage variance of the output variable Y, that is explained by the input variable X.
- R-squared = Explained variation / Total variation
- Always between 0 and 100%
- 100% indicates that the model explains all the variability of the response data around its mean

Long Term Forecasting – Regression Analysis

KEY MEASURES OF STATISTICAL SIGNIFICANCE

- To check the regression is not by chance, which it could be, the Significance-f is assessed. The smaller the number, the lower the chance the regression is by chance. The number is represented as a percentage of chance between 0 and 100.

- The reliability of the regression line coefficients and the Y intercepts are defined by the p-value. The lower the p-value the greater the probability that those outputs were not obtained by chance. The number is represented as a percentage of chance between 0 and 100.

Long Term Forecasting – Regression Analysis

KEY MEASURES OF STATISTICAL SIGNIFICANCE

- The Residuals are the difference between the Actual input index and the predicted values. There should be no pattern to these outputs which should also be normally distributed. These can be checked visually on a scatter graph.

Regression Analysis

Practical Exercise

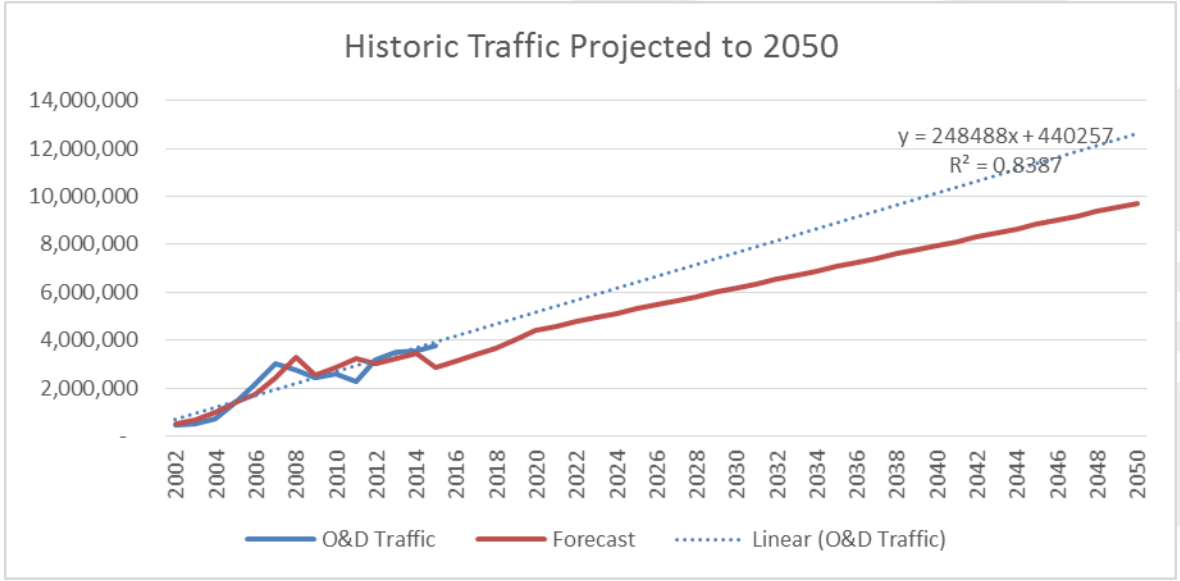
Long Term Forecasting

- **FORECASTING**

From the model, we are interested only in **Growth Factors**, not absolute values

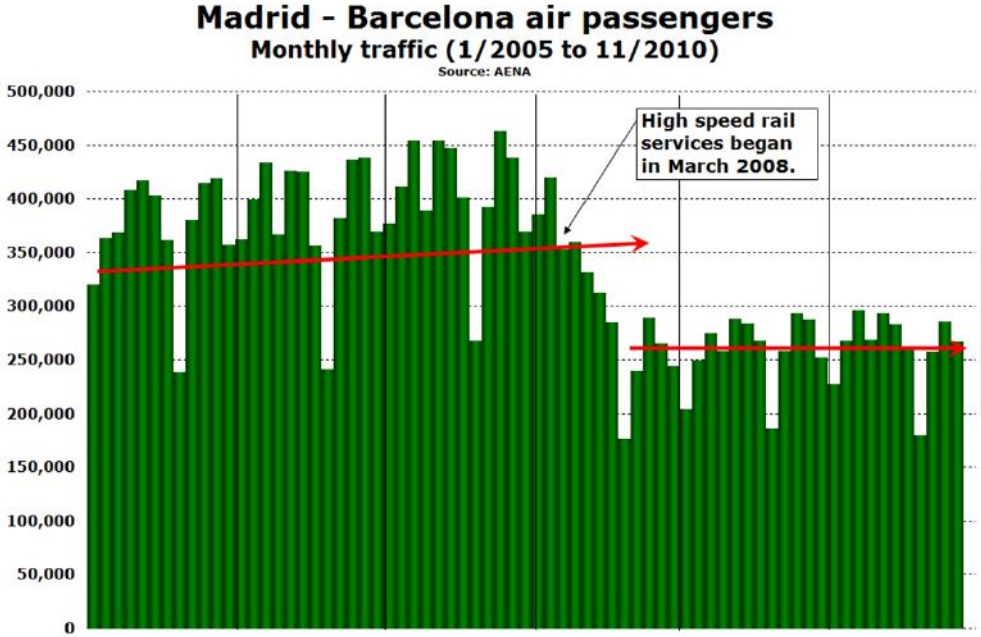
With Regression Analysis, you need a **reliable long-term forecast** for the explanatory variables used

Ex: IMF long-term GDP forecast up to 2060



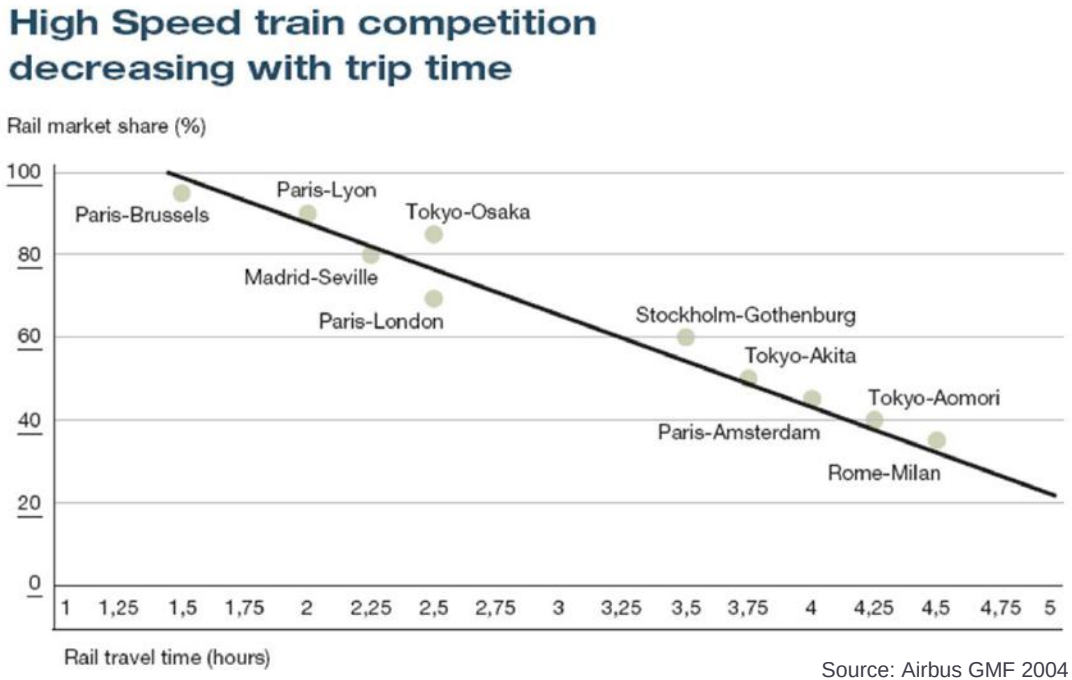
Warning! – Un-modeled external factors

EXAMPLE OF RAIL COMPETITION



Warning! – Un-modeled external factors

EXAMPLE OF EXTERNAL SHOCKS - IMPACT OF HIGH-SPEED RAIL ON AIR TRAVEL DEMAND



Source: Airbus GMF 2004

Long Term Forecasting - Summary

- Understand short term airport potential and possible new routes/capacity growth.
- Identify the suitable techniques for long term forecasting.
- Identify external variables, if applicable and the relationship they have with the researched variable.
- Assume the impact of external shocks, if applicable.
- State assumptions.
- Perform sensitivity analysis (scenario building).

Future Peak Hour & Busy Day Forecast

MODULE 4

- Understand the relationship between long term Passenger Forecasts and future facilities requirements.
- Identify the different mechanisms developed to derive this relationship.
- Establish the mechanisms to define the coefficients required.
- Apply the coefficients to the long term forecast to define the busy day demand.

Future Peak Hour & Busy Day Forecast

- Passenger and aircraft movement are required to measure size and Financial Forecasts
- Annual passenger forecasts do NOT lend themselves to short term “hourly” and “daily” traffic variations required for the planning and design of airport facilities.
- It is the short term demand variation and peaking characteristics that are the primary factor for facilities planning and design.
- These demand measures are used for;
  - Landside - Terminal and Passenger Facilities
  - Airside - Apron, Taxiways and Stands
- The relationship between Peak Hour flows and Annual Passenger Volumes are normally given in conjunction with other estimates used for peak period planning.

Future Peak Hour & Busy Day Forecast

Typical Peak Hour Passenger (TPHP)

- Developed by the FAA, it provides empirical criteria to convert to annual passenger demand to Typical Peak Hour Passenger demand based on the size and peaking pattern of the airport.
- Certain ratios of Peak Passenger demand to annual passenger demand are provided to estimate the peak hour passenger traffic at the airport and assumes estimated 85th percentile use of ultimate capacity.

Standard Busy Rate (SBR)

- Devised by the British Airports Authority (BAA), it takes the 30th Highest Hour.
- This concept is more widely used worldwide than TPHP

Airport Busy Day

- Developed by IATA and defined as the 2nd busiest day in an average week during the busiest month.
- For the peak month, an average weekly pattern of passenger traffic is calculated for that month with any peaks associated with special events removed.
- This method assesses relevant factors far deeper than the TPHP method.

Future Peak Hour & Busy Day Forecast

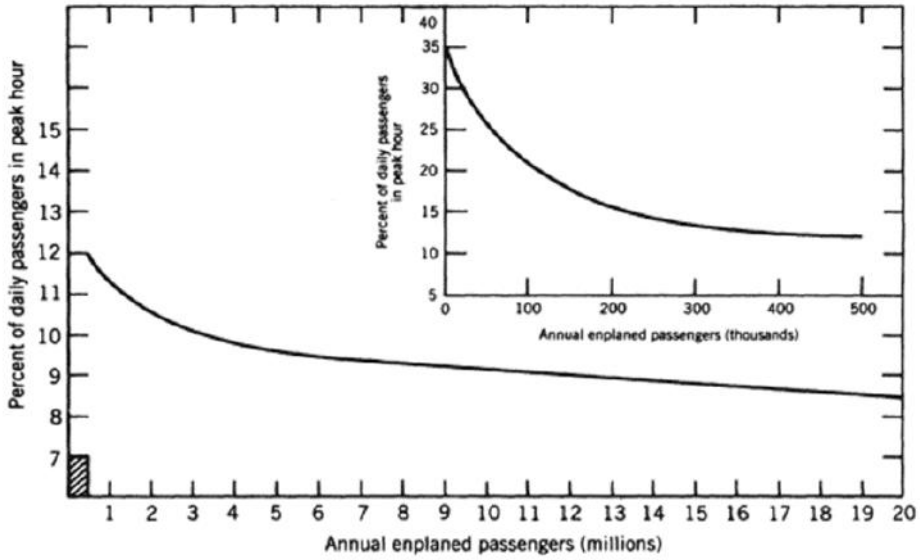


Figure 2.9 Percent of daily passengers in peak hours versus annual enplaned passengers. (*Source*: FAA.)

- The graphs show the relationships recommended for preplanning purposes which relate peak hour passenger flow and peak hour operations to annual passenger enplanement throughput.

Future Peak Hour & Busy Day Forecast

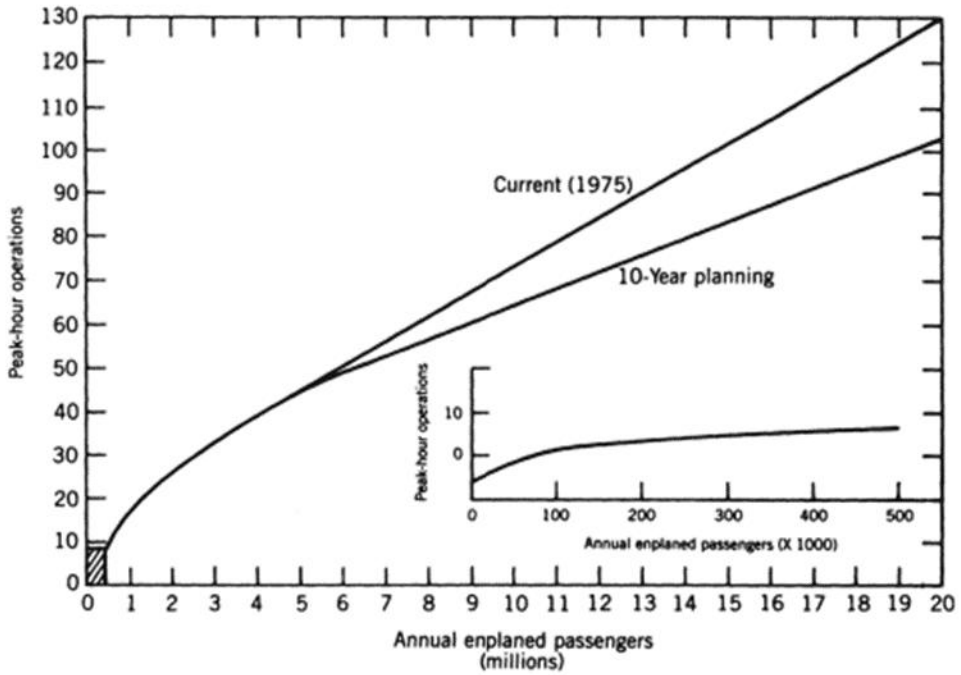


Figure 2.10 Estimated peak-hour aircraft operations versus annual enplaned passengers. (*Source*: FAA.).

Module 4 Summary

- The Long Term Forecast output is very dependant on the methodology adopted
- We are really only interested in Growth Factors, not absolute values
- The long Term Forecast really requires an equal duration of Regression Analysis
- Positive Correlation is not necessarily significant, review the factor of chance and be prepared to dismiss the analysis.
- The longer Term outputs can be used for other purposes
  - Operational Planning
  - Investment planning