Forecasting long-term trends in O-D passenger markets

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www.iata.org/pax-forecast www.iata.org/economics
7th January 2015, Cranfield

To represent, lead and serve the airline industry
My previous lecture was rather sceptical

‘I used to be an economic forecaster but it was all so hit and miss’

Source: The Daily Telegraph
As short-term forecasts fail just when needed

Actual and forecast US GDP growth - Fair Model

Source: Fair Model, Datastream
But decisions about the future still required

New forecast service:
- 4,000 O-D country-pairs
- JV with IATA and Tourism Economics
- Global, country reports, web-tool

For more information:
- [www.iata.org/pax-forecast](http://www.iata.org/pax-forecast)
- David Oxley, IATA, oxleyd@iata.org
- David Goodger, Tourism Economics, dgoodger@tourismeconomics.com
So how should we model air travel demand?

World scheduled air travel, freight and world real GDP

Indexed to equal 1 in 1950

Source: IATA, ICAO, Haver
Is \( \text{RPK}=\text{GDP}^{1.5} \) the best modelling approach?

Ratio of RPK growth to GDP growth

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
But real travel share does not rise with income

Source: This slide is borrowed from Bill Swan [http://cyberswans.com/Airline_Industry_Publications.html](http://cyberswans.com/Airline_Industry_Publications.html)
And nominal share does not rise over time

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
Bill Swan’s conclusions

Cross-sectional data: Travel Share not rising with incomes:
- Travel Share of GDP measured as ASK/GDP ratio
- Data shows small negative correlation with per-capita income
- No acceleration of travel share after joining middle class

Time-series data confirmed pattern:
- Growth of Travel Share was independent of growth of GDP
- Based on Country-by-Country data

Conclusion:
- Travel grows linearly with GDP growth
- Remaining 1/3 of travel growth is “something else”

Useful question: “What Else?”

Source: This slide is borrowed from Bill Swan [http://cyberswans.com/Airline_Industry_Publications.html]
Falling transport costs part of ‘what else’

Unit cost and the price of air transport

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
Improving technology is a major cost driver

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
And constraints on competition are also key

Distribution of countries by level of air market liberalization

- Air markets are less liberal
- Air markets are more liberal

Median WALI scores
- 2005: 9.9
- 2011: 10.2

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
Scope for lower fares on a number of markets

Passenger yields and average trip length

- Within Africa
- Within South America
- Within East Asia
- Within ASEAN
- Within Europe
- ASEAN - Middle East - rest of world
- ASEAN - East Asia
- North-South America
- Pacific
- China - North America
- ASEAN - Africa
- ASEAN - North America
- ASEAN - Europe
- Europe - Australia

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
Travel costs could fall 30-50% on liberalization

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
And price elasticities vary significantly

David Gillen's air travel own-price demand elasticities (selected measures)

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
### Living standards matter (not aggregate GDP)

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Trips/year/person</th>
<th>Months before next trip</th>
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</thead>
<tbody>
<tr>
<td>Low-income</td>
<td>0.04</td>
<td>300</td>
</tr>
<tr>
<td>Middle-income</td>
<td>0.29</td>
<td>41</td>
</tr>
<tr>
<td>High-income</td>
<td>1.48</td>
<td>8</td>
</tr>
<tr>
<td>Below US$20K per person</td>
<td>0.27</td>
<td>44</td>
</tr>
<tr>
<td>Above US$20K per person</td>
<td>1.80</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
There is a relationship but not the usual one

Flights per capita* (2013, logarithmic scale) vs. GDP per capita (2013, US$ '000s)

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
They are certainly key for emerging markets

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
Countries becoming ‘middle’ or ‘high’ income

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
Demographics are important to get right

Demographic change, 2014-2034

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’

IATA Economics  www.iata.org/pax-forecast
Emerging market population much younger

Old-age dependency ratio, %
(65+/15-64)

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
Working-age population makes more trips

Source: UK CAA

* Note: the Eurostat data shown in the 36 to 45 age group are actually for the wider 25-44 age group

N/A*
Looking at the example of Japan

Year 1990  Total population = 122.2m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 1990  Total population = 122.2m

Source: UN
Looking at the example of Japan

Year 1991  Total population = 122.7m

Source: UN
Looking at the example of Japan

Year 1992
Total population = 123.2m

Source: UN
Looking at the example of Japan

Year 1993  Total population = 123.7m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 1994  Total population = 124.1m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 1995  Total population = 124.5m

Source: UN
## Looking at the example of Japan

Year 1996  
Total population = 124.8m

### Population by age group (million)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>6</td>
</tr>
<tr>
<td>5-9</td>
<td>7</td>
</tr>
<tr>
<td>10-14</td>
<td>7</td>
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<tr>
<td>15-19</td>
<td>8</td>
</tr>
<tr>
<td>20-24</td>
<td>9</td>
</tr>
<tr>
<td>25-29</td>
<td>9</td>
</tr>
<tr>
<td>30-34</td>
<td>8</td>
</tr>
<tr>
<td>35-39</td>
<td>7</td>
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<tr>
<td>40-44</td>
<td>6</td>
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<tr>
<td>45-49</td>
<td>5</td>
</tr>
<tr>
<td>50-54</td>
<td>4</td>
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<tr>
<td>55-59</td>
<td>3</td>
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<td>60-64</td>
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<td>65-69</td>
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<td>70-74</td>
<td>1</td>
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<tr>
<td>75-79</td>
<td>1</td>
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<tr>
<td>80-84</td>
<td>1</td>
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<tr>
<td>85-89</td>
<td>1</td>
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<tr>
<td>90-94</td>
<td>1</td>
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<tr>
<td>95-99</td>
<td>1</td>
</tr>
<tr>
<td>100+</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: UN
Looking at the example of Japan

Year 1997  Total population = 125m

Source: UN
Looking at the example of Japan

Year 1998  Total population = 125.3m

Source: UN
Looking at the example of Japan

Year 1999   Total population = 125.5m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2000  Total population = 125.7m

Source: UN
Looking at the example of Japan

Source: UN
Looking at the example of Japan

Year 2002  Total population = 126.2m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2003  Total population = 126.5m

Population by age group (million)

Source: UN
Looking at the example of Japan

Source: UN
Looking at the example of Japan

Year 2005  Total population = 127m

Source: UN
Looking at the example of Japan

Year 2006  Total population = 127.1m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2007  Total population = 127.2m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2008  Total population = 127.3m

Source: UN
Looking at the example of Japan

Source: UN
Looking at the example of Japan

Source: UN
Looking at the example of Japan

Year 2011  Total population = 127.3m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2012  Total population = 127.2m

Source: UN
Looking at the example of Japan

Year 2013  Total population = 127.1m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2014  Total population = 127m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2015  Total population = 126.8m

Population by age group (million)

0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90-94
95-99
100+

Source: UN
Looking at the example of Japan

Year 2016  Total population = 126.6m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2017  Total population = 126.3m

Population by age group (million)

Source: UN
Looking at the example of Japan

Source: UN
Looking at the example of Japan

Year 2019

Total population = 125.7m

Population by age group (million)

Source: UN
Looking at the example of Japan

Source: UN

IATA Economics  www.iata.org/economics
Looking at the example of Japan

Source: UN
Looking at the example of Japan

Source: UN
Looking at the example of Japan

Year 2023

Population by age group (million)

Total population = 124.2m

Source: UN
Looking at the example of Japan

Source: UN
Looking at the example of Japan

Year 2025  Total population = 123.3m

Population by age group (million)


Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2026  Total population = 122.8m

Population by age group (million)

Source: UN

IATA Economics  www.iata.org/economics
Looking at the example of Japan

Year 2027  Total population = 122.3m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2028
Total population = 121.7m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2029  Total population = 121.2m

Population by age group (million)

- 100+
- 95-99
- 90-94
- 85-89
- 80-84
- 75-79
- 70-74
- 65-69
- 60-64
- 55-59
- 50-54
- 45-49
- 40-44
- 35-39
- 30-34
- 25-29
- 20-24
- 15-19
- 10-14
- 5-9
- 0-4

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2030  Total population = 120.6m

Source: UN
Looking at the example of Japan

Year 2031 Total population = 120.1m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2032

Total population = 119.5m

Source: UN

IATA Economics  www.iata.org/economics
Looking at the example of Japan

Source: UN
Looking at the example of Japan

Year 2034 Total population = 118.3m

Population by age group (million)

Source: UN
Looking at the example of Japan

Year 2035
Total population = 117.7m

Source: UN
Trade ‘openness’ also matters for air travel

### The top 20

<table>
<thead>
<tr>
<th>Country</th>
<th>Trade intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong</td>
<td>437.6</td>
</tr>
<tr>
<td>Singapore</td>
<td>352.9</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>326.6</td>
</tr>
<tr>
<td>Seychelles</td>
<td>209.4</td>
</tr>
<tr>
<td>Hungary</td>
<td>197.4</td>
</tr>
<tr>
<td>Ireland</td>
<td>196.9</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>189.7</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>187.9</td>
</tr>
<tr>
<td>Swaziland</td>
<td>184.4</td>
</tr>
<tr>
<td>Estonia</td>
<td>179.2</td>
</tr>
<tr>
<td>Malta</td>
<td>178.2</td>
</tr>
<tr>
<td>Belgium</td>
<td>171.6</td>
</tr>
<tr>
<td>Maldives</td>
<td>167.7</td>
</tr>
<tr>
<td>Lithuania</td>
<td>166.6</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>162.1</td>
</tr>
<tr>
<td>Vietnam</td>
<td>157.0</td>
</tr>
<tr>
<td>Netherlands</td>
<td>155.5</td>
</tr>
<tr>
<td>Slovenia</td>
<td>152.2</td>
</tr>
<tr>
<td>Malaysia</td>
<td>151.3</td>
</tr>
<tr>
<td>Thailand</td>
<td>147.2</td>
</tr>
</tbody>
</table>

### The bottom 20

<table>
<thead>
<tr>
<th>Country</th>
<th>Trade intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>27.9</td>
</tr>
<tr>
<td>United States</td>
<td>30.2</td>
</tr>
<tr>
<td>Pakistan</td>
<td>31.2</td>
</tr>
<tr>
<td>Central African Rep.</td>
<td>33.1</td>
</tr>
<tr>
<td>Nigeria</td>
<td>33.1</td>
</tr>
<tr>
<td>Sudan</td>
<td>33.2</td>
</tr>
<tr>
<td>Venezuela</td>
<td>33.4</td>
</tr>
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<td>Argentina</td>
<td>33.4</td>
</tr>
<tr>
<td>Colombia</td>
<td>37.7</td>
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<tr>
<td>Japan</td>
<td>37.8</td>
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<tr>
<td>Myanmar</td>
<td>38.4</td>
</tr>
<tr>
<td>Benin</td>
<td>39.1</td>
</tr>
<tr>
<td>Cuba</td>
<td>39.9</td>
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<tr>
<td>Martinique</td>
<td>41.2</td>
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<td>Egypt</td>
<td>41.2</td>
</tr>
<tr>
<td>Cameroon</td>
<td>42.0</td>
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<tr>
<td>Australia</td>
<td>42.2</td>
</tr>
<tr>
<td>Burundi</td>
<td>43.4</td>
</tr>
<tr>
<td>Peru</td>
<td>45.4</td>
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<tr>
<td>Iran</td>
<td>47.5</td>
</tr>
</tbody>
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### The G7 and selected emerging markets

<table>
<thead>
<tr>
<th>Rank*</th>
<th>Country</th>
<th>Trade intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>71</td>
<td>Germany</td>
<td>85.8</td>
</tr>
<tr>
<td>97</td>
<td>Mexico</td>
<td>64.5</td>
</tr>
<tr>
<td>98</td>
<td>Canada</td>
<td>64.1</td>
</tr>
<tr>
<td>104</td>
<td>Turkey</td>
<td>60.6</td>
</tr>
<tr>
<td>106</td>
<td>United Kingdom</td>
<td>60.3</td>
</tr>
<tr>
<td>109</td>
<td>Italy</td>
<td>58.3</td>
</tr>
<tr>
<td>110</td>
<td>France</td>
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<tr>
<td>116</td>
<td>India</td>
<td>55.5</td>
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<tr>
<td>121</td>
<td>Russia</td>
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<tr>
<td>122</td>
<td>Indonesia</td>
<td>50.5</td>
</tr>
<tr>
<td>125</td>
<td>China</td>
<td>48.6</td>
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<tr>
<td>137</td>
<td>Japan</td>
<td>37.8</td>
</tr>
<tr>
<td>145</td>
<td>United States</td>
<td>30.2</td>
</tr>
<tr>
<td>146</td>
<td>Brazil</td>
<td>27.9</td>
</tr>
</tbody>
</table>

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’

IATA Economics  [www.iata.org/economics](http://www.iata.org/economics)
Natural and cultural assets matter too

<table>
<thead>
<tr>
<th>Country</th>
<th>Index level</th>
<th>Country</th>
<th>Index level</th>
<th>Rank*</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>141.5</td>
<td>Haiti</td>
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<tr>
<td>Switzerland</td>
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<td>Lesotho</td>
<td>65.6</td>
<td>3</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>139.5</td>
<td>Burundi</td>
<td>68.4</td>
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</tr>
<tr>
<td>Canada</td>
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<td>Sierra Leone</td>
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<td>Australia</td>
<td>135.0</td>
<td>Chad</td>
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<td>Spain</td>
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<td>Guinea</td>
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<td>Moldova</td>
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<td>Austria</td>
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<td>Kuwait</td>
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<td>Japan</td>
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<td>Korea, Republic Of</td>
<td>118.7</td>
<td>Kazakhstan</td>
<td>82.6</td>
<td></td>
</tr>
</tbody>
</table>

Source: WEF Travel and Tourism Competitiveness Index – human, cultural and natural resources sub-index
The TE-IATA econometric model

- Equations follow a standard Error Correction Mechanism (ECM) structure involving both short-run growth dynamics and convergence to longer-run level terms

- The levels relationships are crucial to the twenty-year outlook

- Short-run dynamics follow the current expected economic cycle and largely include economic drivers

- A primary driver of long-run levels is income and the share of population able to afford travel

- Other structural factors will also be accommodated within the long-run equation
Short-run equation

Passengers between country AA and country BB

\[
D(\ln(PAXAABB)) = x \cdot D(\ln(GDP,AA)) + (1-x) \cdot D(\ln(GDP,BB)) \\
+ y \cdot (x \cdot \ln(UP,AA/UPAVE,BB) + (1-x) \cdot \ln(UP,BB/UPAVE,BB)) \\
+ z \cdot (x \cdot D(LN(RXAABB)) - (1-x) \cdot D(LN(RXAABB)) ) \\
+ z_1 \cdot D(LN(RXTOUR,AA)) + z_2 \cdot D(LN(RXTOUR,BB)) \\
+ a \cdot D(LN(PRAABB)) \\
-0.5 \cdot (\ln(PAXAABB(-1)) - \ln(LRAAABB(-1)) )
\]

Assumed GDP elasticity = 1

\(x\) – share of travel from country AA on AABB flow (from TDM)

\(y\) – elasticity of unemployment (0.1)

\(z\) – elasticity of own nominal exchange rate (0.3)

\(z_1, z_2\) – elasticity of cross exchange rate (nominal)

ECM coefficient of 0.5 ensures rapid convergence to long-run (90% in 3 years)

LRAAABB = long-run relationship
Long-run equation components

Air passenger volumes are modelled according to the following, split overall travel population factors and bilateral route factors

**Overall travel population factors**

- GDP per capita / wealth effects
- Population and demographics
- Trade linkages

**Bilateral route factors**

- Exchange rates
- Air fares (includes dynamics of greater access)
- Destination attractiveness (share of rising outbound)
- Visa facilitation measures
Adding up to differing outlooks for 2014-2034

Drivers of additional passenger numbers, million

Living standards  Demographics  Price and other

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
Resulting in much change over next 20 years

Rank by size of O-D passenger flows in, out & within country

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
Uncertainty can also be explored

Outlook for worldwide O-D passenger trips, million

Source: IATA/Tourism Economics ‘Air Passenger Forecasts’
New forecast service:
- 4,000 O-D country-pairs
- JV with IATA and Tourism Economics
- Global, country reports, web-tool

For more information:
- [www.iata.org/pax-forecast](http://www.iata.org/pax-forecast)
- David Oxley, IATA, oxleyd@iata.org
- David Goodger, Tourism Economics, dgoodger@tourismeconomics.com