



## Air Travel Forecasting Problem

### Your Role

Assume that you are an executive of the U.S. Federal Aviation Agency (FAA). The FAA is concerned about the *accuracy* of the long-term forecasts of “revenue passenger miles” (RPMs).<sup>1</sup> As a result, they have solicited proposals from various consultants on improved methods of forecasting. You are meeting today with other executives of the FAA in order to reach a decision on whether it is advisable to change the long-term (1 to 5 years) forecasting methods now being used. Summaries of the proposals have been prepared for each consulting firm along with a summary of the current method, unaided judgment.

### How to Conduct This Meeting

A version of Delphi known as “mini-Delphi” will be used in this meeting. This involves having each of you read the various proposals and then making an independent estimate *before any discussion* takes place (these estimates will be recorded by paper ballot). The estimates should be treated as *anonymous*. A summary will then be provided of the *group* responses. After this summary has been examined, the groups will discuss the various proposals for a period of 25 minutes using the consensus rules. Then, each person will again make an independent, anonymous estimate, and a group summary will be prepared. (Note, this process can also be done without having a meeting by using the Delphi Freeware, located on [forecastingprinciples.com](http://forecastingprinciples.com).)

### Class Session

1. Each group will briefly summarize its ranking and the reasons for this ranking.
2. Evidence-based findings will be presented.
3. Discussion of Delphi.
4. Review

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<sup>1</sup> RPMs are calculated by multiplying the number of paying passengers per trip by the trip length and then summing over all passenger trips.

## Use of Delphi to Select a Forecasting Method

<b>Small Group Task</b>			Minutes
Round 1	Estimate	Study consultants' reports (pp. 3-5) and rate the methods on the round 1 sheet (p. 6). Do not talk to anyone as you read these reports. Rely on your own interpretation. If you have questions, record them on p. 7.	10
Round 1	Summary	Done by 2 of the group members (with anonymous responses). Report <i>group results</i> using the summary sheet on p. 10.	3
Talk		Discuss the advantages and disadvantages of each method. Do not argue for your own position. Instead, seek information from others and contribute your expertise. Discuss facts, not opinions. (Follow the rules for "consensus seeking" on p. 8 and record your questions on p. 7.)	25
Round II	Estimate	Make a second estimate. Do this individually and anonymously. Use p. 9.	5
Round II	Summary	Summarize the group's response for Round II. (Use p. 10.)	2
Total Time for Small Group			45
<b>Large Group Discussion</b>			Minutes
Conclusions from evidence-based studies			10
Calculation of Error scores			5
Discussions			10
Review			5
Slack time			5
Total Time for Large Group			35

## Unaided Judgment: The Current Forecasting Method

Some people at the FAA think that the current forecasting method is the best way to proceed. It uses *unaided judgment*. It involves having a number of people from the FAA (experts on the air travel market) met to reach agreement as to what will be the RPMs over each of the next six years. This group reviews a substantial amount of data in making these forecasts. For example, they review graphs showing trends in RPMs. They examine econometric studies to determine what factors affect RPMs. Finally, they draw upon their experience (most of them have spent many years in this forecasting activity) to reach conclusions based on all of the available evidence. It is felt that this method has much flexibility should changes occur: it utilizes a great deal of information; it can handle complex relationships more easily than a mathematical model; and it can recognize the intangibles. People who have been involved in this forecasting activity have a lot of confidence in their judgment. While accuracy has been a problem, the question is *which method is better than the other methods*. On this basis, many people feel that “unaided judgment,” along with much good information, is best.

### Judgmental Bootstrappers, Inc.

Judgmental Bootstrappers, Inc. plans to develop a model of how the FAA currently makes its forecasts. They will develop a regression model of the following nature:

$$\bar{R} = a + b_1x_1 + b_2x_2 \dots + b_nx_n$$

where R is RPMs as forecast by the FAA experts (from the current forecasting method above) and the x's are the variables examined by the FAA experts (e.g., real price of air travel, population, income, safety, speed, availability of service, support surface travel, price of alternative modes of transportation).

*Note that no actual data on RPMs is used in this method – only the forecasts by the FAA experts.* A preliminary examination indicates the forecasts of RPMs are available for a period of 30 years. The FAA experts said they used six key factors (the x's) in making their forecasts over this 30 year period. More important, they can design additional years of data in which they provide large variations in the causal variables, designed in such a way that variations are not correlated with one another.

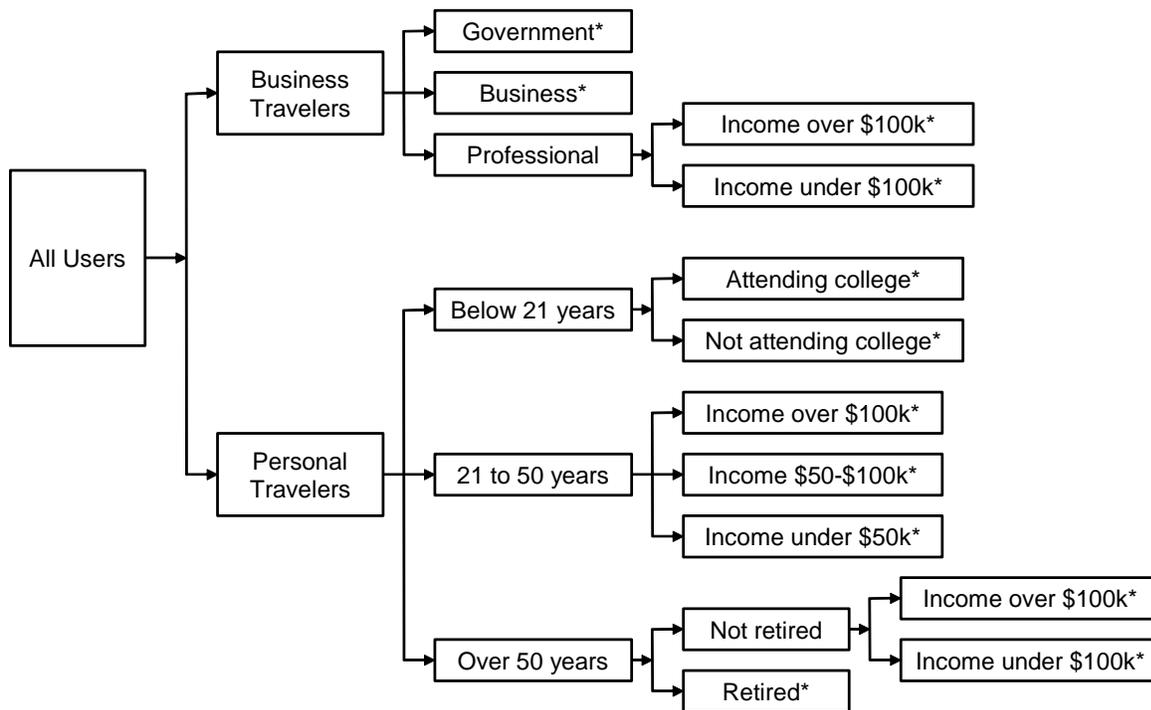
Judgmental Bootstrappers, Inc. claims that the bootstrapping model of the FAA experts should do better than the experts themselves can do. Their basic argument is that the bootstrapping model is more consistent than the experts – i.e., given the same inputs, the same forecast will always be produced when the bootstrapping model is used. This gain in consistency should outweigh both the loss in flexibility and the possibility that experts can take better account of complex relationships.

### Seg-men-ta-tion Co.

Seg-men-ta-tion Co. feels that it is important to identify each of the important users of air travel and then to look at trends within each of these user segments. The identification of segments will be done by using expert opinion and previous studies to identify the key variables. To some extent, one must also consider what data are available. These variables will then be arranged in priority: which ones should be considered earliest? Then decisions are needed on how many branches should be used for each variable.

Demand factors are easier to handle than supply factors (e.g., price of air travel, number of flights, safety). To account for supply factors, estimates in each segment will be modified to reflect the forecasts of supply factors.

For a simplified example, they expect to use something such as the following. The asterisks denote the user segments, 12 in this sample.



Within each final segment, trends in air travel will be observed in terms of average number of RPMs per person per year. A substantial amount of survey data is available that might allow for trend extrapolations in some segments. Forecasts for some segments, especially the smaller ones, will use subjective estimates of the average RPMs.

## **Causal Model Associates**

Causal Model Associates proposes the use of a regression model of the type of model shown here:

$$R = a + b_1x_1 + b_2x_2 \dots + b_nx_n$$

where R is actually RPMs as observed in previous years and the x's are the variables shown to be important from previous research (e.g., price of air travel, population, income, safety, speed).

A preliminary examination shows that annual data for all variables were available for the past 50 years. In addition, studies on related topics can be used to refine the price elasticity estimate.

Causal Model Associates is aware of previous studies of the air travel market. They plan to utilize this knowledge in developing their econometric model. In fact, they believe they can even develop a reasonable econometric model based on judgment and previous studies.

## **Extrapolations, Ltd.**

Extrapolations, Ltd. believes that people often introduce too much complexity into their forecasting methods. This introduction of complexity produces error. Therefore, they advocate the use of simple methods. They propose a model that calculates the annual percentage growth rate for the past ten years and uses this as a basis of extrapolation over the next six years. They will also consider other extrapolation methods such as moving averages and exponential smoothing.

### Round 1 – Rankings of Accuracy Before Discussion

Put a “1” beside the method that you feel would be the most accurate over the next six years, a “2” beside the next most accurate, etc., until the five methods have been ranked.

<b>Method</b>	<b>Rank</b>
Unaided Judgment	_____
Judgmental Bootstrappers, Inc.	_____
Seg-men-ta-tion Co.	_____
Causal Model Associates	_____
Extrapolations, Ltd.	_____

Do not sign this page. Your opinions should be kept anonymous throughout the Delphi procedure. Give this completed form to your facilitator.

**Notes on the Strengths and Weaknesses  
of the Forecasting Methods**

(Use this page to take notes or to record any questions that you would like to examine further.)

## Interactive Skill Technique

### Use of Consensus Techniques in a Group\*

Consensus is a feeling within a group that its conclusion represents a fair summary of the conclusions reached by the individual members of the group. Hall (1971) presents a decision-making process for reaching consensus. I draw heavily upon Hall's description here.

Consensus should make good use of a group's resources, and it should provide for a fair resolution of conflicts within the group. Consensus is difficult to reach, so not every conclusion will meet with everyone's approval. Complete unanimity is not the goal, and it is rarely achieved. However, each individual should be able to accept the group's conclusion on the basis of logic and feasibility. This means, in effect, that a single person can block the group if he thinks it is necessary. Here are some guidelines to use in achieve consensus:

1. Focus on facts rather than opinions.
2. Avoid arguing for your own viewpoint. Present your comments as lucidly and logically as possible, but then listen to the other members' comments and consider them carefully.
3. Do not assume that someone must win and someone must lose when the discussion reaches a stalemate. Instead, consider a restatement of the problem, or another alternative.
4. Do not change your mind simply to avoid conflict and to reach agreement. Be suspicious when agreement seems to come to quickly and easily. Explore the reasons, and be sure that everyone accepts the solution for similar or complementary reasons.
5. Avoid conflict-reducing techniques such as majority votes, averages, coin flips, and bargaining. When a dissenting member finally agrees, don't feel that he must be rewarded by having his own way on some later point.
6. Differences are natural and expected. Seek them out and involve everyone in the decision process. Disagreement can improve the group's decision because a wide range of judgments increases the chance that the group will hit upon better solutions.

To make this approach work, you will have to assign one group member to act as facilitator. The facilitator should help the group to follow these rules. The facilitator should *not* provide opinions during the discussion. The facilitator should also summarize unanswered questions on page 7.

\* Based partly on Hall, Jay, "Decisions, Decisions, Decisions," *Psychology Today*, 5 (November 1971), 51 seq. These guidelines are also available under Educational Materials/Group Process at [jscottarmstrong.com](http://jscottarmstrong.com).

## Round II – Rankings of Accuracy After Discussion

Ranking of the various methods. Put a “1” beside the method that you feel would be the most accurate over the next six years, a “2” beside the next most accurate, etc., until the five methods have been ranked.

<b>Method</b>	<b>Rank</b>
Unaided Judgment	_____
Judgmental Bootstrappers, Inc.	_____
Seg-men-ta-tion Co.	_____
Causal Model Associates	_____
Extrapolations, Ltd.	_____

Do not sign this page. Your opinions should be kept anonymous throughout the Delphi procedure. Give this completed form to your facilitator.

## Group Summary Sheet

### Round I

Method	Individual Rankings	(A) Average Rank	(B)* Evidence-Based Rankings	Error Score  A-B
Unaided Judgment	<input type="checkbox"/>			
Judgmental Bootstrapping	<input type="checkbox"/>			
Segmentation	<input type="checkbox"/>			
Causal Model	<input type="checkbox"/>			
Extrapolation	<input type="checkbox"/>			
Total				

### Round II

Method	Individual Rankings	(A) Average Rank	(B)* Evidence-Based Rankings	Error Score  A-B
Unaided Judgment	<input type="checkbox"/>			
Judgmental Bootstrapping	<input type="checkbox"/>			
Segmentation	<input type="checkbox"/>			
Causal Model	<input type="checkbox"/>			
Extrapolation	<input type="checkbox"/>			
Total				

\_\_\_\_\_  
Today's Date

\_\_\_\_\_  
Group Number/Name

\*Evidence-based opinions will be provided later.