Premium economy class products have gained a secure foothold in the industry, but in many ways the concept remains in a formative stage. Many questions remain: How large a cabin? How many seats per row? How large a fare premium is revenue maximizing? How fragile are the revenue gains?

Getting it right may have never been so important. The current economic environment can be expected to result in continued pressure from a very large share of discretionary travellers for the lowest possible fares. Similarly, the business environment can be expected to force more business travellers to downgrade from business class; the alternatives available to them will determine whether the fares they pay fall all the way to a tourist fare or to a premium economy fare that may be nearly twice as high. At the same time, vacationing baby boomers are increasingly looking for a product that offers good value for money in treating their aging joints more kindly than the tourist product optimized for their more price sensitive (and more lithe) children and grandchildren.

To better understand the key relationships, I undertook a broad study including four airplane models, 24 different cabin layouts, 60 comparative study cases and many dozens of between-case sensitivity analyses. Often such an undertaking only clouds the issues further; happily that was not so in this case, several very clear relationships emerged.

In the end three questions emerged as of central importance:
“How large should the premium economy cabin be?”
“How great is the risk of premium economy cannibalizing business class?”

In the case of the first two questions, there was no runaway favorite. Near maximum revenues occurred over a relatively broad range of premium economy cabin sizes. Similarly, with no attempt to estimate the relative rates of cannibalization of business class by premium economy, “Y+” and “J-” generated very similar revenues.

With regard to cannibalization of business class by premium economy, it was found that only very high portions (e.g. 40% or more) of business class travellers buying down to the premium economy product resulted in the three-class (business / premium economy / tourist economy) configurations generating less total revenue than the corresponding two-class (business / economy) configurations. Any cannibalization reduces total revenue and is to be minimized, but the risk of cannibalization reversing the revenue gains from the addition of a premium economy class seems very manageable.

To many readers the analytical approaches used in this study may be as useful and interesting as the findings themselves. At the same time, the details of the analyses are uninteresting to many to the point that they make a fine sleep aid. Both audiences are important, so I begin with a, hopefully, readable discussion of the study and findings. An appendix describing the analytical approaches in more detail follows the presentation of the “Observations and Conclusions.”

Configurations studied:

Representing a likely reconfiguration choice of an airline with two-class airplanes in service, the study configurations were all based on generic dual-class configurations for the 787-8, 787-9, 777-200 and 777-300. All four-parent configurations had approximately 16% of total seats in business class. The 787 parent configurations used a 6-abreast business class and 9-abreast tourist economy class, while the parent 777 configurations used a 7-abreast business class and 10-abreast tourist economy class. Premium economy classes were configured in both “Y+” (8-abreast in the 787 and 9-abreast in the 777), and “J-” (7-abreast in the 787 and 8-abreast in the 777.)
Without changing monuments, realistic detailed layouts were drawn in which one block of about 7 rows of 32-inch pitch tourist economy was replaced with an identical-length block of 6 rows of 38-inch pitch premium economy in one set of cases for each model. The layout immediately below is an example of one of 10 such layouts, in this case the 3-2-3 “Y+” for the 787-9. The remaining nine include other one block (6-row) “Y+” and “J-” row arrangements for the 787-8, 787-9, 777-200 and 777-300.

In a second set of cases two “blocks” of tourist economy with a total of about 10 rows were replaced with 9 rows of 38-inch pitch premium economy. The layout immediately below is a single example of this, also the 3-2-3 “Y+” for the 787-9.

The unforgiving realities of door and monument locations resulted in a few significant variations from those nominal conversions, but those variations did not present any significant challenges to the analysis.

Fare Premiums & Intercontinental Premium Economy Demand:

The baseline demand for premium economy class is analyzed in this study as buy-up from the existing demand for economy in the parent two-class configuration. As noted earlier, buy-down from business class (cannibalization) was explored through sensitivity analyses.

The demand for intercontinental premium economy class may vary significantly from market to market. Due diligence for any airline considering implementing a premium economy class must include
research exploring the demand for the product at selected price points in its own markets.

For this study I developed the study demand curve plotted below based on the earlier work of my colleague Dr. Ken Fox, coupled with observations of premium economy class sizes and fare premiums currently in service. For the purpose of understanding the sensitivity of the concept to different demand levels, I generated the second “lesser demand” curve delivering about 40% less demand at any given fare premium. These demand curves are discussed in greater detail in the appendix.

Study & “Lesser” Demand Curve

![Graph showing study demand and lesser demand curves.]

I believe the study demand curve and the “lesser demand” curve are adequate for illustrating important key relationships; but, as mentioned earlier, due diligence requires an operator to research the demand characteristics in play in its target market.

Premium that maximized total revenue in each of 40 study cases.

The revenue-maximizing premiums for premium economy over tourist economy proved to be somewhat lower than expected, typically between 65% and 85%. Comparisons cited in this paper are all made at a 75% premium. As would be expected, smaller premium economy cabins favored a higher fare premium and larger cabins a
lower premium, but the range of optimal premiums was remarkably small, typically only 10% for any given model, e.g. from 70% to 80%, or from 65% to 75%. With the “lesser demand” curve the revenue-maximizing premiums were somewhat lower; comparisons under the lesser demand curve are made at a 65% fare premium over tourist economy for premium economy.

Row Arrangements:

There is no universal understanding of the terms “Y+” or “J-”. In this paper the “Y+” product always has wider seats than those in tourist economy. I believe it is critical to differentiate premium economy class from tourist economy with fewer, wider seats per row whenever possible for two key reasons:

First, inflight surveys have long shown that tourists are less sensitive to width than business travellers. While correlations do not prove causality, the causal connection usually drawn, that a large fraction of tourists are travelling seated beside a family member with whom they don’t mind rubbing shoulders, gives confidence in the research finding. Business travellers, by contrast, are typically seated beside someone they do not know, someone with whom they would most likely prefer not to rub shoulders.

Second, the first-glance visual differentiation provided by a different row arrangement is important to reinforcing a sense of value for the premium paid for premium economy class. Pitch differences alone are not so apparent at first glance, and to small statured passengers may not be readily apparent (or particularly meaningful).

The first reason above, the lesser sensitivity to width among tourists, led me to choose the 10-abreast configuration for the 777’s tourist economy class in this study. 10-abreast has found increased acceptance in the 777 in recent years. The availability of a complementary premium economy optimized for business and other “solo” travellers makes the 10-abreast an even more attractive tourist economy product.

As mentioned previously, premium economy class rows were configured in all of the likely candidate configurations: 7-abreast and 8-abreast (both 3-2-3 and 2-4-2) in the 787, and 8-abreast and 9-abreast in the 777. In three of the four 8-abreast 787 cases there was no difference in seat count between 3-2-3 and 2-4-2; in the fourth case, owing to the relatively straight aisle transition between 3-2-3
and the 3-3-3 tourist class, the 3-2-3 configuration had two more seats than the 2-4-2.

Demand differences between premium economy configurations were modeled in a typical 3000 nautical mile competitive environment using values derived from our personal space research. (A further explanation is included in the appendix.)
In the 8-abreast “Y+” 787, the 3-2-3 configuration generated 2.5% more demand than 2-4-2 due to the same adjacent empty seat phenomenon that has turned the industry toward 3-3-3 and away from 2-5-2 for 9-abreast configurations in the 777.

The 3-2-3 premium economy configuration consistently generated more revenue than 2-4-2 in the 787

As a result, as seen in the chart above, the 3-2-3 cases typically generated about 0.4% more total revenue than the 2-4-2 cases.

7-abreast “J-” premium economy seating resulted in 15% more demand in the 787 than the 3-2-3 “Y+” 8-abreast, and the 8-abreast “J-” in the 777 resulted in 11% more demand than the 9-abreast “Y+”. Of course, fewer seats per row means more spilled demand, particularly with greater demand for the lower seat count product. Overall demand determined whether higher total revenues were generated with the more spacious or less spacious row arrangement in premium economy. As would be expected, lower overall demand favored “J-”, while higher overall demand favored “Y+”. The overall demand tipping points at which the different “Y+” and “J-” row arrangements generated equal total revenue were typically around that which would result in a 75% load factor in the parent two-class configuration.

All data plots included in this paper use starting demand levels for each model which result in a 75% total load factor and a 60% paid business class load factor in the parent two-class arrangement for
that same model. That is to say the starting demand levels are
different for each model (lower for smaller capacity models, e.g. 787-
8, and higher for larger capacity models, e.g. 777-300), while all the
various configurations (dual class, “Y-” and “J+”) for each model were
fed the same starting demands. These starting demand levels result
in load factors ranging from 74% to 81% in the configurations
including a premium economy class.
In the 787, 7-abreast and 3-2-3 8-abreast premium economy classes generated similar total revenues with 75% (two-class) starting demand levels.

In the 777, 8-abreast and 9-abreast premium economy classes generated similar total revenues with 75% (two-class) starting demand levels.
Cabin Size:

Under the study conditions, a premium economy cabin size of approximately 25% of total seats emerged. Most reassuring, the premium economy concept was revenue positive over a broad range of cabin sizes. Even the worst performer, a 777-300 with only one block of premium economy seats (less than 10% of total seats), generated 4.5% more total revenue than the parent two-class arrangement.

Sensitivity analyses with the “lesser” demand curve showed lower total revenue increases, of course. Most interesting, the optimum cabin size shifted downward only 5% or so, to about 20% of total seats. Furthermore, the curves are very flat; oversizing or undersizing the cabin by a significant amount to take advantage of a configuration opportunity does not appear likely to meaningfully compromise total revenue.

Lesser demands reduced revenue increases but only resulted in a small downward shift in optimum cabin size.
There is another aspect of these broad optima for premium economy cabin size that merits attention. The broad optima offer an opportunity to provide still greater comfort to premium economy travellers. Comfort is a function of load factor to a very significant degree, and biasing the premium economy cabin size toward the upper end of the optimum will result in the benefit of lower average load factors and higher comfort in premium economy.

I believe there are two good reasons to manage load factors to the benefit of comfort in premium economy. First, as mentioned earlier, business travellers (and other individual travellers who are major target markets for premium economy) are more sensitive to shoulder room such as that provided by adjacent empty seats. Second, of course, premium economy is intended to be a higher comfort product than tourist economy. The risk of spill resulting from the smaller tourist economy cabin is mitigated to a very great degree by upgrading tourist economy passengers into available premium economy seats as necessary; this is, of course, common practice and the analysis was conducted reflecting this practice.

Configuration anomalies are plainly in evidence in the results. The 3-2-3 787 with 19% premium economy, which gained two seats as a result of the relatively straight aisle transition between the 3-2-3
premium economy and the 3-3-3 tourist economy, is made obvious by its upward blip in the revenue curves. Similarly, in the 777s with 34% and 36% premium economy, the 2-4-2 lost two seats due to an aisle transition while the 3-3-3 lost none; with another parent layout their total revenue increases may have been more similar. Most significantly, when a troublesome conversion still generates 8% more revenue, there is little need for tears.

Observations and Conclusions:

Cabin Size:

Optimum cabin size will be a function of the demand curve in play in the target market. That being said, a study demand curve scaled to reflect selected current experience suggests revenue-maximizing premium economy cabins are nearer the top end of the range commonly found in service today. Cabin size appears to be very forgiving of the real-world constraints imposed by conversion of an existing configuration with near maximum revenue increases found in a wide range of percentages of total seats in premium economy.

A wide range of total seats in premium economy - from 20% to 30% - generated near maximum revenue increases
“J-” or “Y+”?  
In this study, which does not attempt to estimate a different likelihood of “J-” or “Y+” cannibalizing business class, the “J-” and “Y+” alternatives generally resulted in very similar total revenue increases. As a result, other factors are likely to lead to a preference for “J-” or “Y+”.

The ability to provide product features on the wider “J-” seat may lead to a preference for “J-”.

On the other hand, the desire to reduce “cannibalization,” the number of business-class fare-paying passengers who find the premium economy product “acceptable” and, as a result, buy down from business class to premium economy, favors a larger comfort gap between the business and premium economy products, i.e. favors “Y+”. In light of the similar revenue increases suggested by this study, with no accounting for different levels of cannibalization by “J-” and “Y+”, I am clearly biased toward “Y+”.

The bottom line:

The revenue gains suggested by this study are far too large to ignore. Understanding market-specific demands for premium economy service, as well as the likelihood of business class cannibalization by various products, are well worth the required research to the intercontinental carrier.

How can the revenue gains be so large? The range of travellers served by economy class today is extremely broad: Many are extremely price sensitive and, as measured by their willingness to pay for it, less sensitive to comfort. At the same time, there are many passengers, willing to pay significantly more for a product that offers more comfort and amenities than an all-purpose economy product optimized for the price sensitivity (and comfort insensitivity) of the majority of tourists. Simply put, the revenue gains come the old fashioned way, from selling a product that better suits the needs of selected customers at a premium price.
The Study Demand Curves:

A former colleague, Dr. Ken Fox, conducted an elaborate discrete choice experiment from which he developed a demand curve for regional business classes based on the premium paid relative to economy class. 15,000 subjects from the U.S. and Europe were involved in the study. To create a demand curve for intercontinental premium economy classes for this study, I simply scaled the Fox curve to fit the premium economy class seats sold at the premiums paid observable in a variety of current intercontinental markets. The resulting scaled demand curve is:

\[ \text{buyup} = 1.6 \times e^{-2.6 \times \text{farepremium}} \]

[in Excel notation: \text{buyup}=1.6*\text{EXP}(-2.6*\text{farepremium}).]

The “lesser” demand curve is simply the study demand curve scaled down so that the curve intercepts the y axis at 100\%, i.e. when there is no price premium everyone buys the product. While this might at first seem intuitively correct, superior products like a spacious premium economy class have been seen to generate additional demand, through reduced trip avoidance among other things. That additional demand leads to a y-intercept greater than 1.

Fox’s experiment actually produced different demand curves (for different markets.) While the y-intercepts of those curves were very similar, they did vary in concavity with the exponent ranging from -2.0*farepremium to -2.6*farepremium. Given my bias toward understating the results in studies such as this, I chose the exponent (-2.6*farepremium) providing the lowest buy up and total revenue increases. I did do sensitivity analyses with the flatter (-2.0*farepremium) curve; as expected, total revenue did increase significantly, but the revenue maximizing surcharges increased only modestly and the other relationships presented in this paper held together.

Whitefish:

Whitefish is our current model for estimating differences in passenger demand in each class of service resulting from differing competing products, and estimating the changes in loads and revenues resulting from those different demands and/or simply from
differences in seat counts. The model is named for the Montana ski resort where the original version was written.

Estimating differences in passenger demand with Whitefish

The passenger demand modules in Whitefish were used to estimate the differences in demand for the various “Y+” and “J-” products. The model replicates a sequential passenger choice process separately for passengers in each fare bucket.

The model assumes that schedule convenience always trumps differences in comfort. As a result, it first uses a schedule coverage model to estimate the portion of total passengers who find both the study airline and a competitor convenient from a scheduling standpoint. In the present study, modeled with two competitors each offering two daily flights for a 3,000 nm flight, the model estimates that 75% of total passengers have a convenient schedule alternative and could be influenced by the relative attractiveness each competitor’s product.

The model further assumes that comfort represents only one of several factors considered by those passengers who face a choice between carriers. Other factors such as service, schedule reliability and frequent flyer membership can override comfort differences for many passengers. The relative importance of comfort factors, categorized as “seating and cabin environment,” is estimated as a well established function of flight length. For the 3,000 nm flight of the current study, seating and cabin environment represented 32% of the choice criteria.

Finally, Whitefish uses a simple random utility model to estimate the portion of passengers who will prefer one product over another. Several “seating and cabin environment” variables are available in Whitefish, but only one is varied in this study: “effective width per seat”. “Effective width per seat” is a function of cabin width per seat measured 50 inches above the floor (where the highest correlation to preference is found) and the impact of adjacent empty seats (which is, in turn, a function of row arrangement and load factor distribution). “Effective width per seat,” as formulated in Whitefish, has shown a correlation to inflight survey responses to a well-proven overall preference question from more than 100,000 inflight survey responses with an $R^2$ consistently greater than .9 .

Estimating revenues using “Whitefish”:
Whitefish, emulates revenue management behavior by sequentially spilling the demand for each fare bucket in the seating capacity available, starting with the highest fare bucket. Passengers seated in successive fare buckets are calculated by spilling the total demand for that and all higher buckets from the seats available for that and all higher classes of service and then subtracting the total passengers boarded in higher fare buckets. That is to say capacity for each class is nested into the higher class of service, e.g. tourist economy demand would be “seated” in the premium economy cabin to avoid spill if capacity was available in the premium cabin.

For this study two fare buckets were used for each class of service. Based on current experience, in each class of service the average of paid restricted fares was set to equal 75% of the average of paid unrestricted fares in the same class of service. Mean business class fares were set to equal 400% of the mean economy fare with the corresponding level of restriction/discount. Similarly, while the revenue maximizing premium economy fares were being sought, the restricted premium economy fare was always set to equal 75% of the unrestricted premium economy fare.

As described earlier in the paper, the revenue maximizing premium economy fares were found in a narrow range centered on a 75% premium over the tourist economy fare with the corresponding level of restriction/discount. It is by pure coincidence that the optimal premium and chosen ratio of unrestricted to restricted fares are both 75%. It is a further coincidence that the tipping point at which the “Y+” and “J-” configurations generated equal revenues occurred in the region of a 75% starting load factor.