Pricing Challenges: ePODS and Reality

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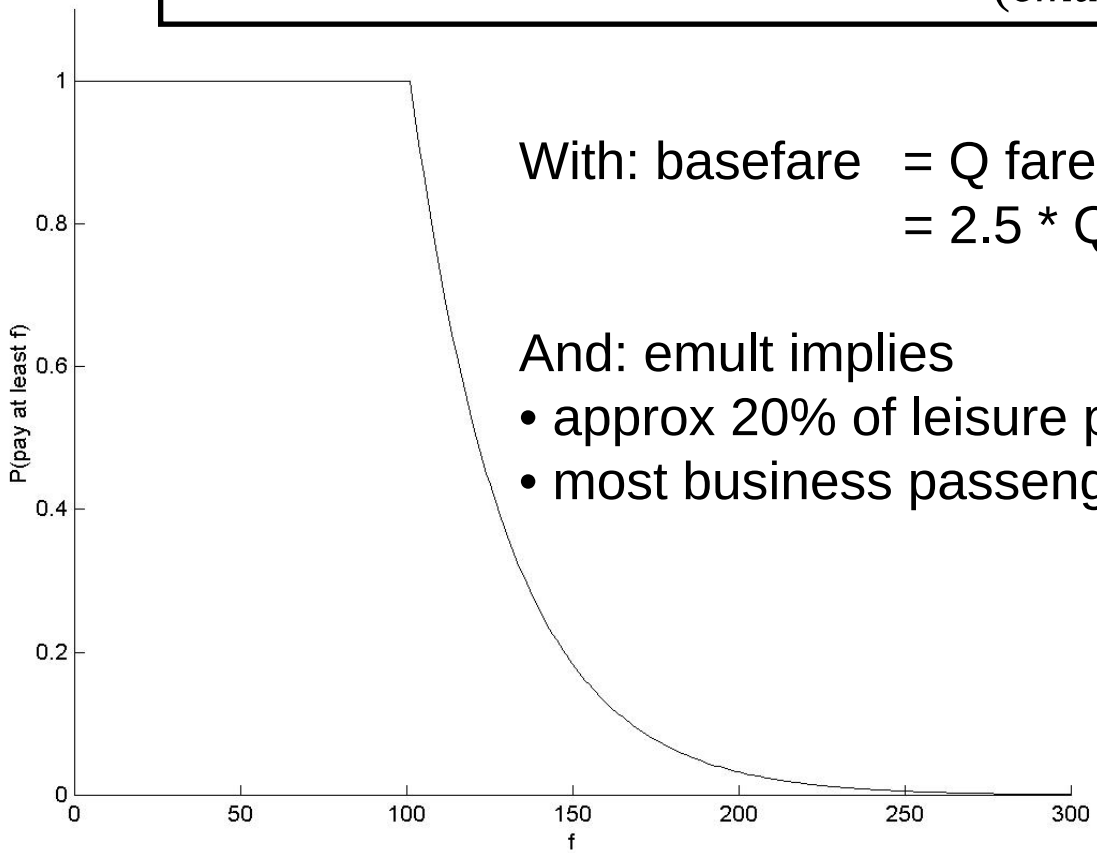
PODS: Passenger Choice of Path/Fare

- **Given passenger type, randomly pick for each passenger generated:**
  - Maximum “out-of-pocket” willingness to pay
  - Disutility costs of fare restrictions
  - Additional disutility costs associated with “re-planning” and path quality (stop/connect) costs
- **Screen out paths with fares greater than this passenger’s WTP.**
- **Assign passenger to feasible (remaining) path/fare with lowest total cost.**

Willingness to Pay (WTP)

$$\text{Probability (pay at least } f) = \min[1, e^{\frac{-\log(2) * (f - basefare)}{(emult - 1) * basefare}}]$$



With: basefare = Q fare for leisure passengers
= 2.5 * Q fare for business passengers

And: emult implies
- approx 20% of leisure passengers will pay higher fare
- most business passengers will pay Y fare if necessary

E-PODS Baseline Fare Structure

Fare Code	Price Level	Advance Purchase	Sat. Night Min. Stay	Non-Refundable	Change Fee
Y	$350	--	--	--	--
M	$200	7 day	Yes	--	--
B	$150	14 day	Yes	Yes	--
Q	$100	21 day	Yes	Yes	Yes

Fare Class Restriction Disutilities

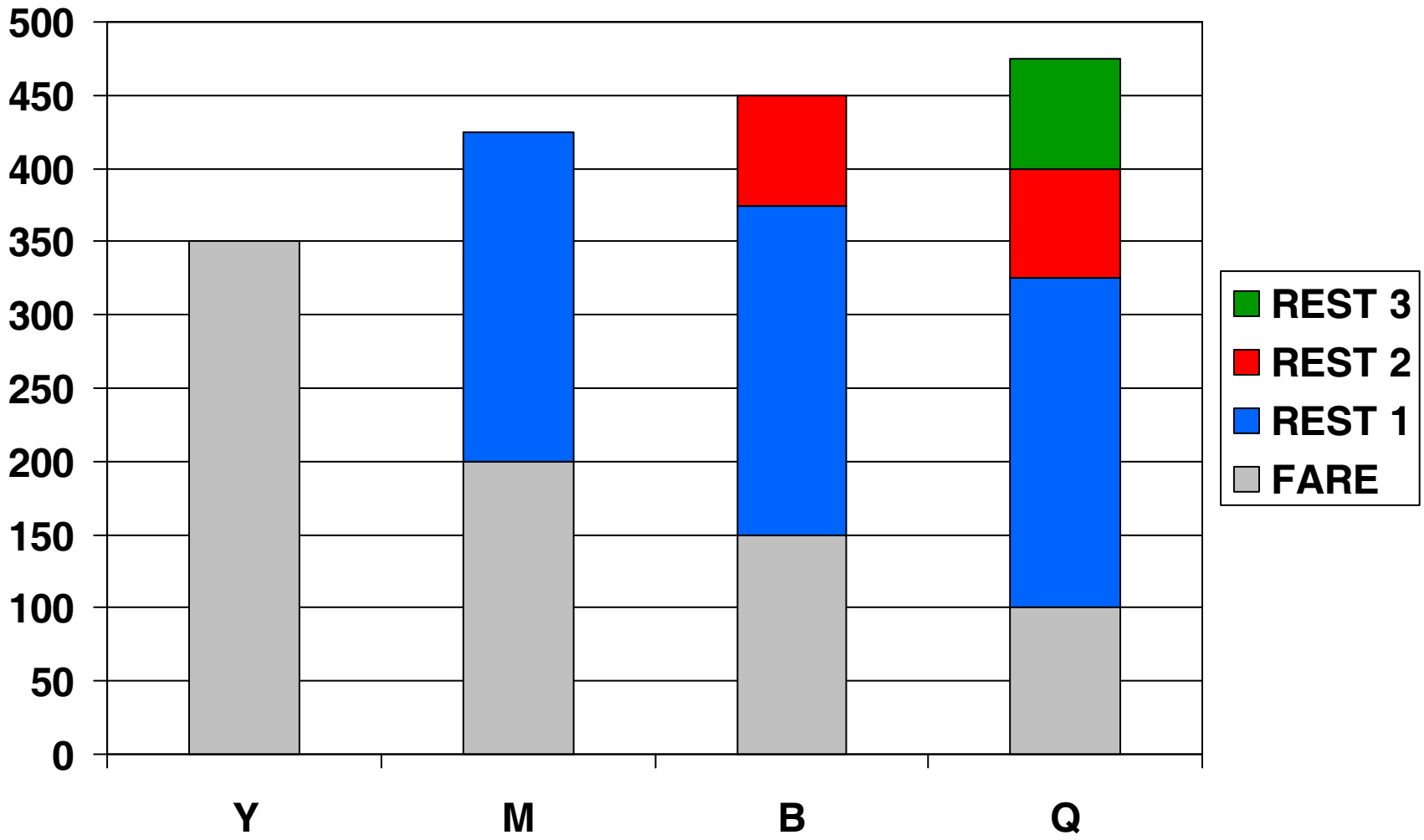
- Disutility costs associated with the restrictions of each fare class are added to the fare value to determine the choice sequence of a given passenger among the classes with fare values less than his/her WTP.
- The restrictions are:
  - **R1: Saturday night stay (for M, B and Q classes),**
  - **R2: cancellation/change penalty (for B and Q classes),**
  - **R3: non-refundability (for Q class).**

Fare Restriction Disutilities

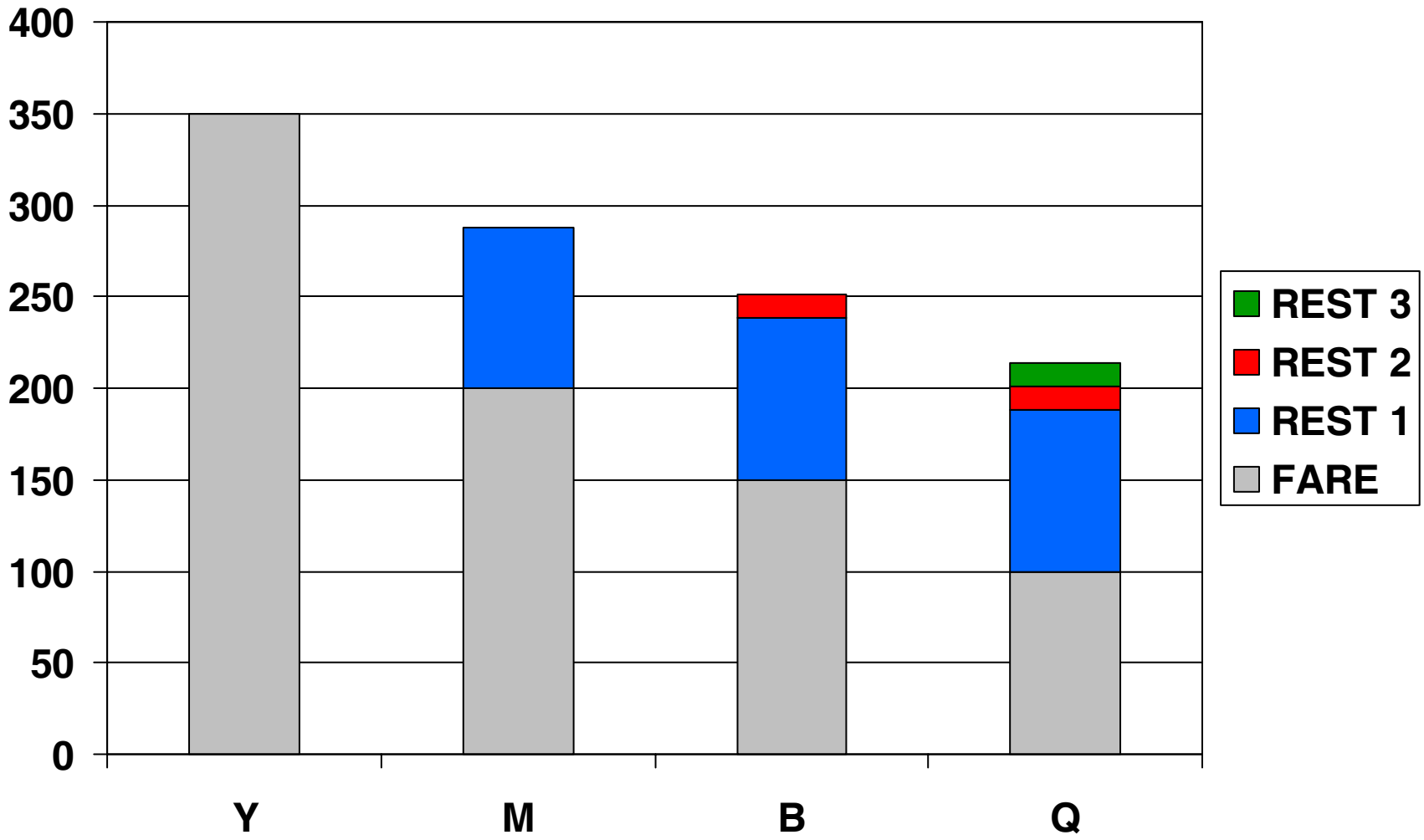
- These coefficients have been “tuned” with structured fares so that on average* business and leisure passengers have respectively a Y/M/B/Q and a Q/B/M/Y choice sequence, as shown on the next two slides.

- *The following slides represent the mean disutilities for an average passenger. The actual disutility value for an individual passenger is a random number taken from a normal distribution centered on the mean disutility value.

Business Passenger Generalized Costs



Leisure Passenger Generalized Costs



Interpretation of Cost Parameters

- **Assumed MAX PAY values:**
  - Virtually all business passengers will pay Y fare if necessary
  - Most leisure passengers will not buy B, very few will buy M
- **Assumed relative restriction disutility costs:**
  - Average business passenger finds fares with more restrictions less attractive
  - Even with restrictions, most leisure passengers prefer Q fare

Fare Simplification: Less Restricted and Lower Fares

- **Recent trend toward "simplified" fares – compressed fare structures with fewer restrictions**
  - Initiated by some LFAs and America West, followed by Alaska
  - Most recently, implemented in all US domestic markets by Delta, matched selectively by legacy competitors
- **Simplified fare structures characterized by:**
  - No Saturday night stay restrictions, but advance purchase and non-refundable/change fees
  - Lower fare ratios from highest to lowest available fares, typically no higher than 4:1 in affected US domestic markets
  - Revenue management systems still control number of seats sold at each fare level

Example: BOS-ATL Simplified Fares
Delta Air Lines, April 2005

One Way Fare ($)	Bkg Cls	Advance Purchase	Minimum Stay	Change Fee?	Comment
$124	T	21 days	0	$50	Non-refundable
$139	U	14 days	0	$50	Non-refundable
$184	L	7 days	0	$50	Non-refundable
$209	K	3 days	0	$50	Non-refundable
$354	B	3 days	0	$50	Non-refundable
$404	Y	0	0	No	Full Fare
$254	A	0	0	No	First Class
$499	F	0	0	No	First Class

Traditional Leg-Based RM Approach

- **Leg RM: EMSRb Seat Protection**
  - Unconstraining and forecasting of bookings to come by flight leg and fare class, based on historical bookings
  - Leg-based Expected Marginal Seat Revenue protection algorithm for nested booking limits applied to fare classes
  - Re-optimization of booking limits 16 times before departure
- **Concerns about traditional leg-based RM models**
  - As restrictions are removed, more passengers buy lower fares and fewer bookings are recorded in higher classes
  - Inadequate protection leads to “spiral-down” in unrestricted fares
- **Is this a concern in semi-restricted fare structures?**
  - Very few examples of fully unrestricted fares in practice

LEG RM SIMULATIONS: Impacts of Fare Restriction Removal

- 2 carriers, single market, both use EMSRb leg RM controls
- 6 fare classes, 3.4:1 fare ratio:

Class	1	2	3	4	5	6
Fare	**425.00**	**310.00**	**200.00**	**175.00**	**150.00**	**125.00**

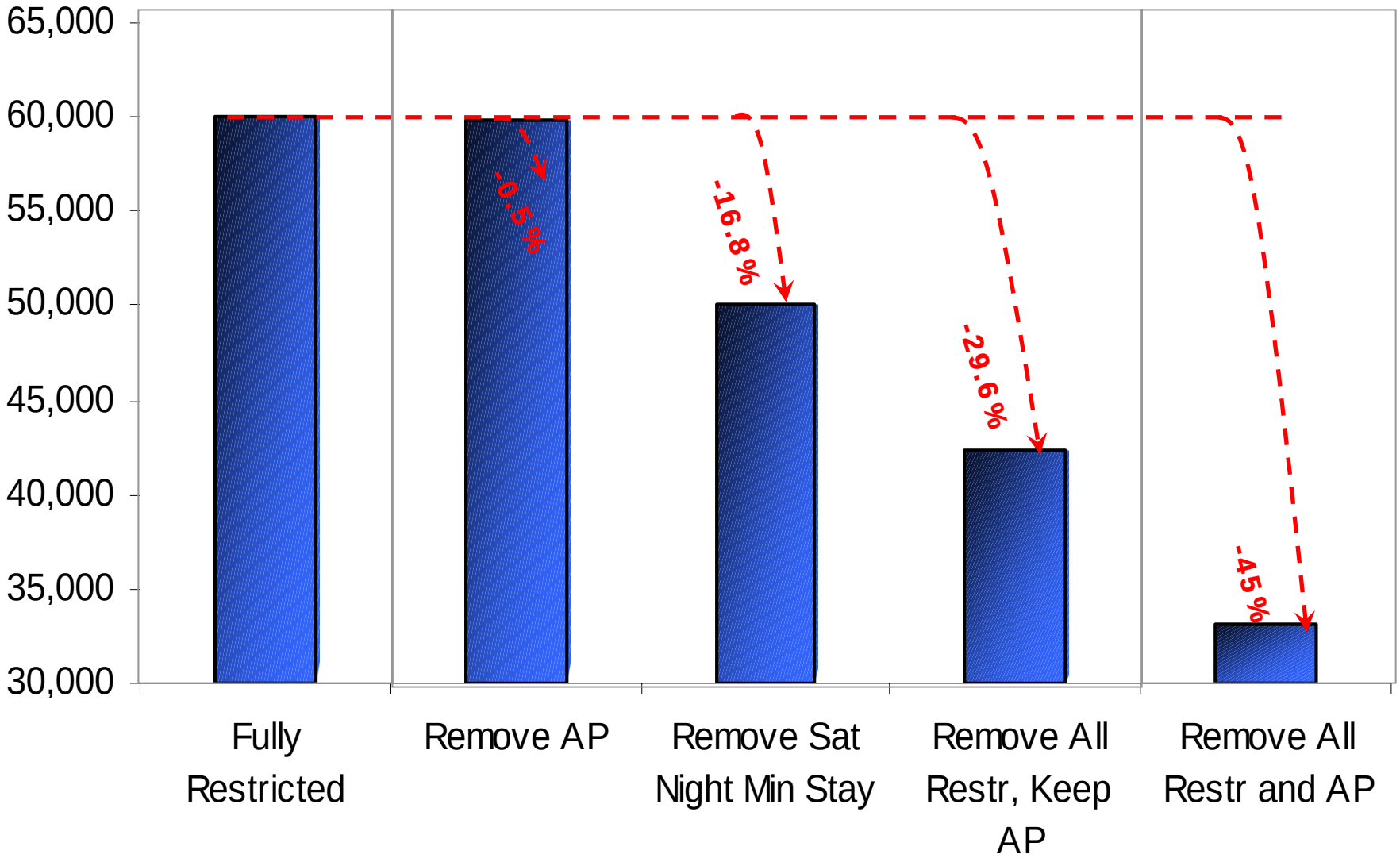
- BASE CASE: Fully Restricted Fares

Fare Class	AP	MIN Sat Night	Chg Fee	Non-Refund
1	**0**	**0**	**0**	**0**
2	**3**	**0**	**1**	**0**
3	**7**	**1**	**0**	**0**
4	**10**	**1**	**1**	**0**
5	**14**	**1**	**1**	**1**
6	**21**	**1**	**1**	**1**

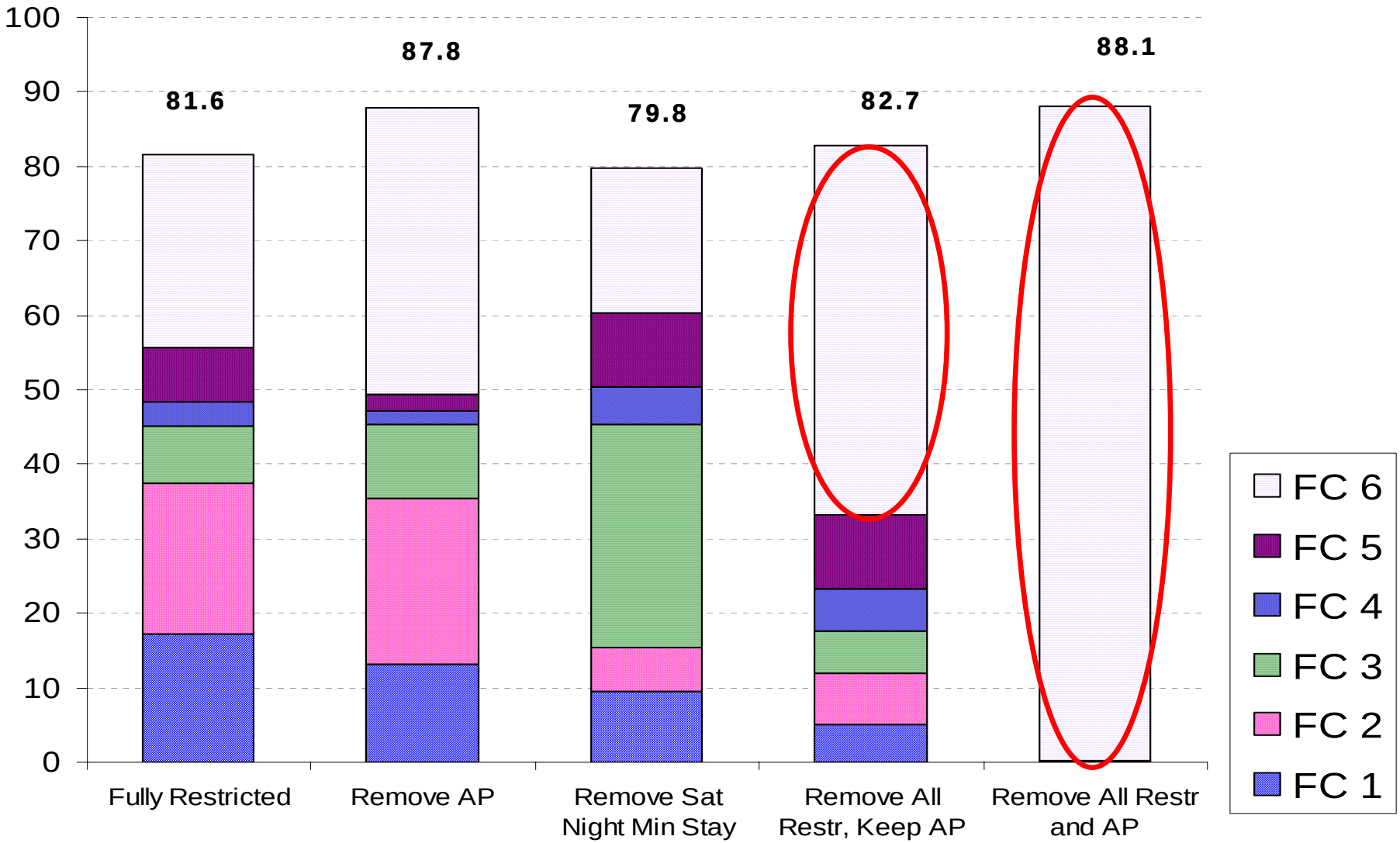
Steps Toward Fare Simplification

- **From fully restricted BASE, simulate impacts of simplified restrictions and/or AP rules (separately):**
  - Remove Advance Purchase Rules (only)
  - Remove Saturday Night Min Stay restriction (only)
  - Remove ALL restrictions but keep AP Rules
  - Remove ALL restrictions and AP Rules
- **Assess impacts of each simplification on:**
  - Total flight revenues
  - Fare class mix
  - Revenue gain performance of Leg-Based RM (EMSRb)
- **When does "spiral down" make traditional Leg RM controls ineffective?**

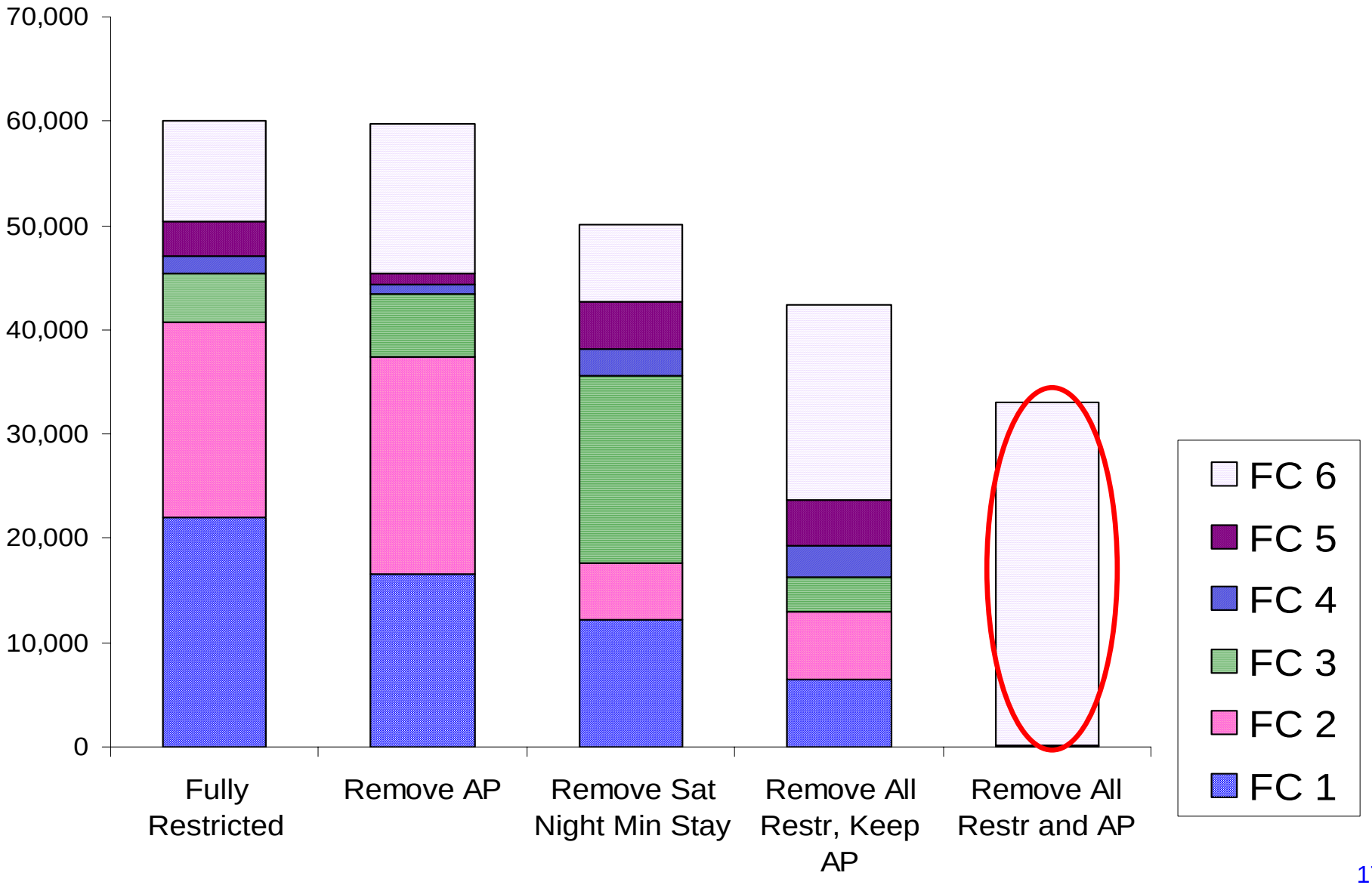
Revenue Impact of Each "Simplification"



Loads by Fare Class

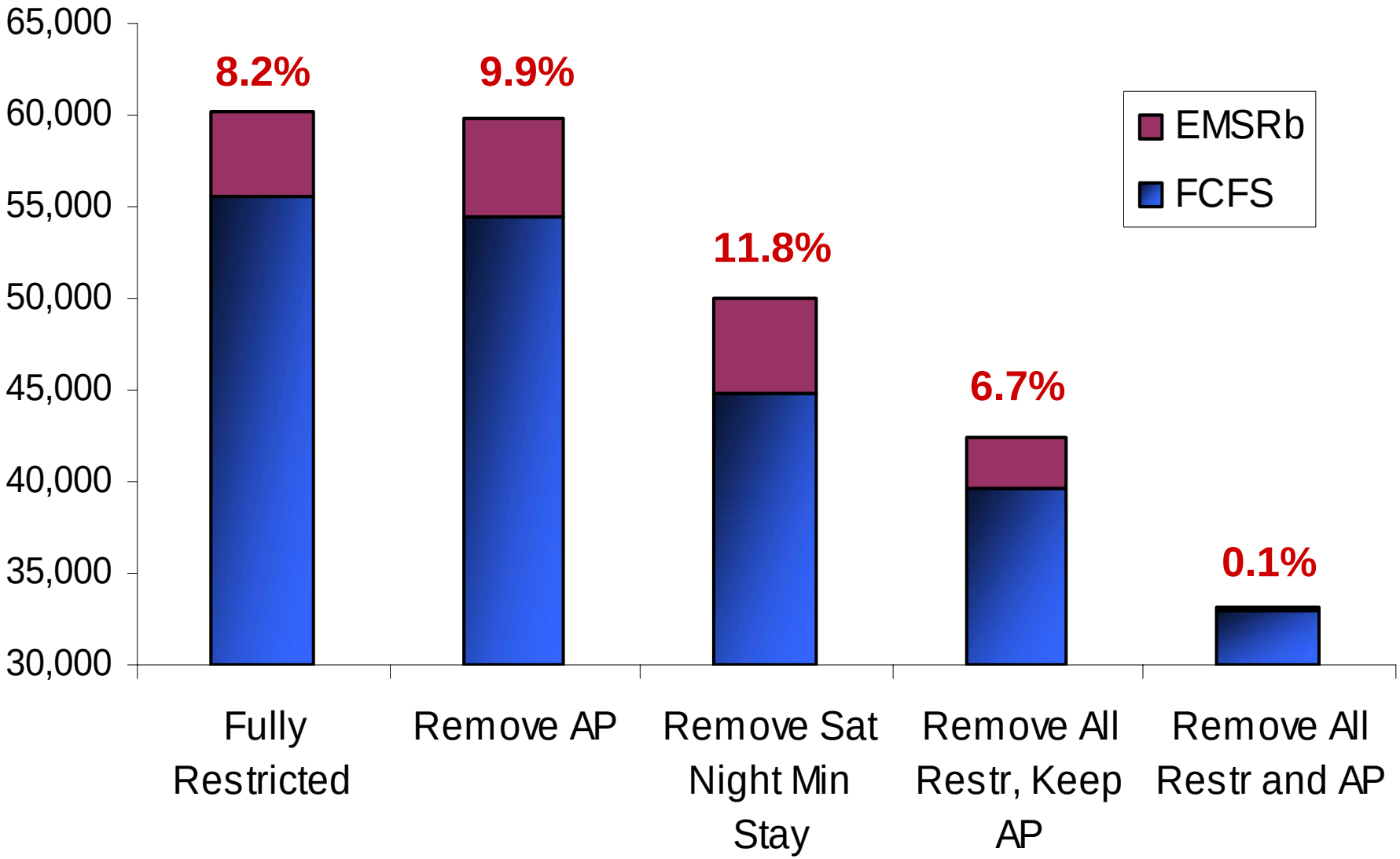


Revenues by Fare Class



Effectiveness of Traditional Leg RM

Percentage improvement of EMSRb over FCFS



Existing Airline RM Systems Need to be Modified for This New Environment

- **RM systems were developed for restricted fares**
  - Assumed independent fare class demands, because restrictions kept full-fare passengers from buying lower fares
  - With unrestricted fares, passengers buy lowest available fare
- **Without modification, these RM systems do not perform well in less restricted fare structures**
  - Unless demand forecasts are adjusted to reflect potential sell-up, high-fare demand will be consistently under-forecast
  - Optimizer then under-protects, allowing more "spiral down"
- **RM system limitations are affecting airline revenues**
  - Existing systems, left unadjusted, generate high load factors but do not maximize revenues
  - Many airlines are currently using manual overrides

Current RM Challenge is To Find New Forecasting and Optimization Models

- **Less restricted fare structures require forecasting of passenger choice and "willingness to pay"**
  - Instead of forecasts by product/restriction
- **The new RM problem is much more complicated than independent class demand RM environment:**
  - Affected by passengers' actual willingness to pay, and ability of airline to estimate this willingness to pay
- **Existing Network RM systems also need to be modified for multiple fare structures**
  - How to control seat availability in unrestricted fare domestic markets while managing seats in more traditional fare markets
  - Seats shared by passengers in both types of markets

MEM Proposed Structure

Fare Code	Price Level	Advance Purchase	Sat. Night Min. Stay	Non-Refundable	Change Fee
Y	$350	--	--	--	--
M	$200	7 day	--	Yes	Yes
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- **COMPETING AIRLINES MAY DECIDE TO MATCH CONDITIONS OF**
  - **M class ONLY or B class only (partial match)**
  - **BOTH M and B classes (complete match of MEM fare structure)**
  - **NEITHER M nor B classes (initial fare structure remains intact)**