MIT International Center for Air Transportation

WILLINGNESS TO PAY AND COMPETITIVE REVENUE MANAGEMENT

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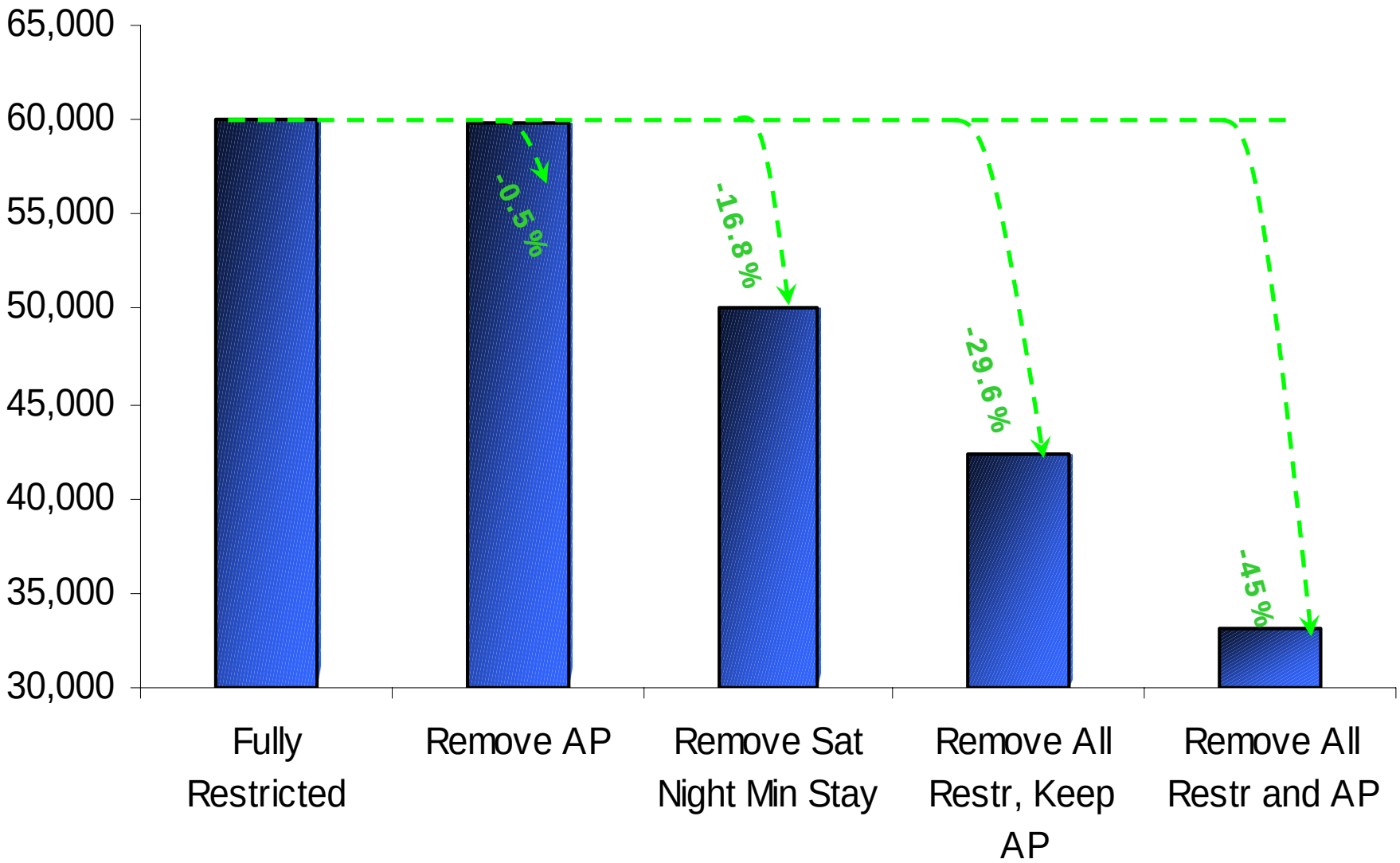
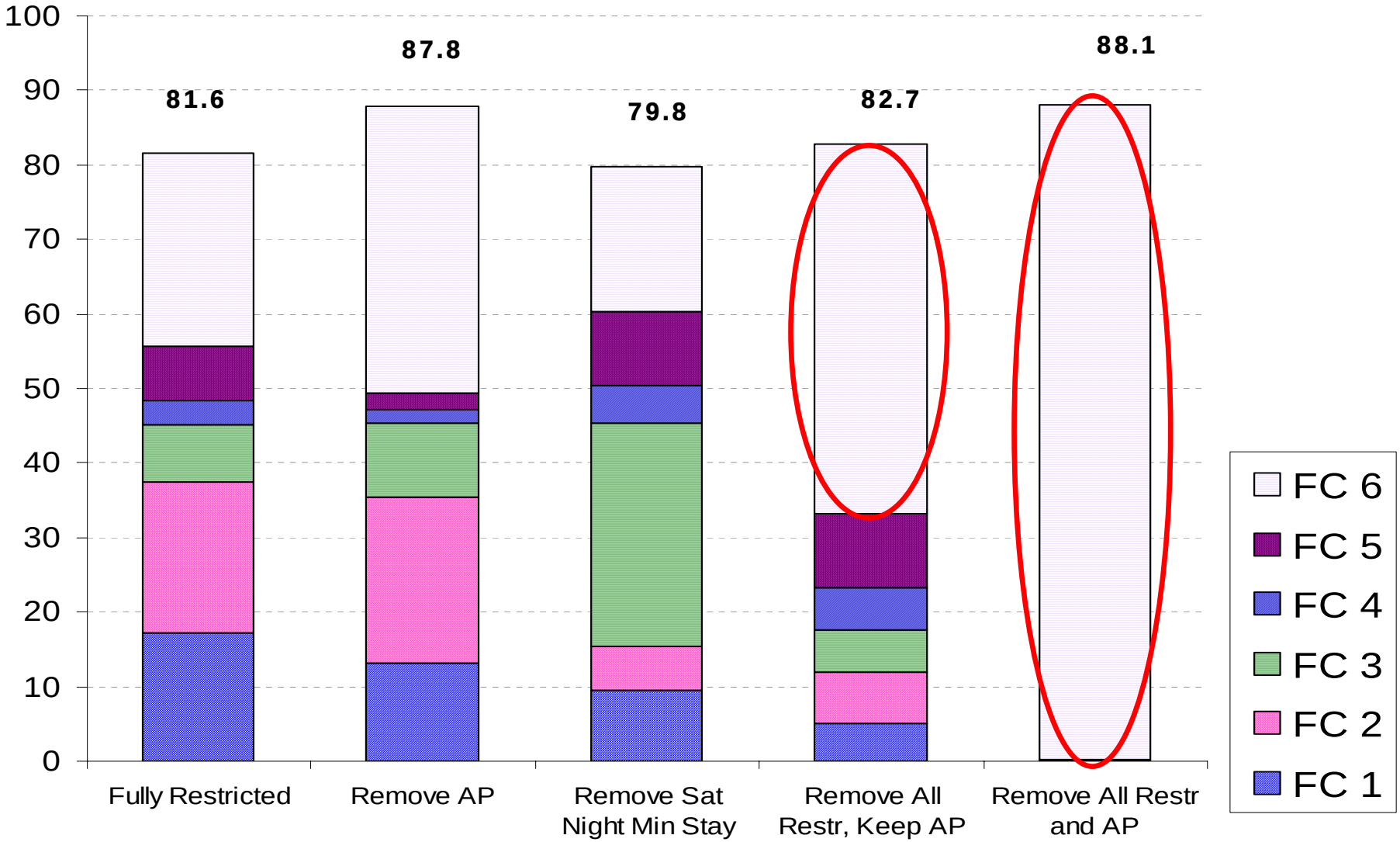
Traditional RM Systems Are Struggling Under Fare Simplification

- **Simplified fare structures characterized by**
  - One-way fares with little or no product differentiation, priced at different fare levels
  - Existing RM systems employed to control number of seats sold at each fare level
- **But RM systems were developed for restricted fares**
  - Assumed independent fare class demands, because restrictions kept full-fare passengers from buying lower fares
  - Time series forecasting models used to predict future demand based on historical bookings in each fare class
  - Given independent demand forecasts, top-down protection for highest classes, extra seats made available to lowest class

Revenue Impacts of Fare Simplification with Traditional RM Models



Traditional RM Models "Spiral Down" without Product Differentiation



Existing Airline RM Systems Need to be Modified for Changing Fare Structures

- **Without modification, these RM systems will not maximize revenues 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"
- **Current RM system limitations are negatively affecting airline revenues**
  - Existing systems, left unadjusted, generate high load factors but do not increase yields
  - Many legacy carriers are using "rule-based" RM practices
- **RM forecasting models must be changed to reflect passenger willingness to pay (WTP)**

Forecasting by Willingness to Pay

- **With undifferentiated fares, forecasting must focus on demand by willingness to pay higher fares**
  - Approach is to “transform” all historical bookings at different fares to maximum demand potential at lowest fare
- **Total demand potential at lowest fare converted to demand forecasts by fare level for future flights**
  - Based on estimates of sell-up potential/WTP
- **But, most simplified fare structures still retain some product differentiation**
  - Lowest fares can have more several cancel/change restrictions
  - Higher fares can offer full flexibility and additional amenities

Hybrid Forecasting For Partially Differentiated Fare Structures

- **Generate separate forecasts for price ("priceable") and product ("yieldable") oriented demand**
  - A passenger is ***price-oriented*** if the next lower class from the one booked is closed
  - A passenger is ***product-oriented*** if the next lower class from the one booked was open.
- **Combine standard forecasts and WTP forecasts for input to RM optimizers**
  - For product-oriented demand, bookings are treated as a historical data for the given class, and standard time series forecasting applied.
  - For price-oriented demand, forecasts by WTP based on expected sell-up behavior

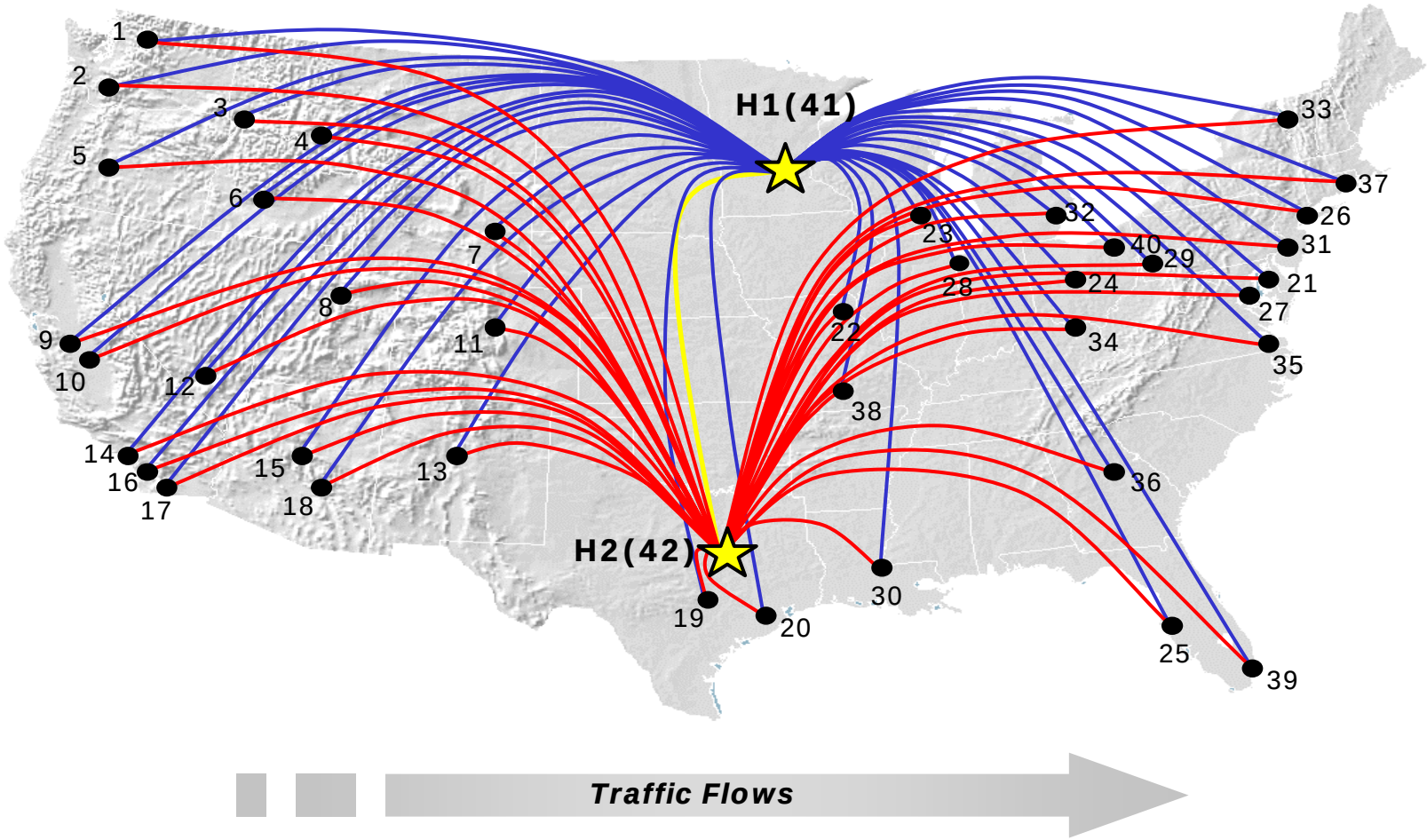
PODS Simulations in Network D

- **Simplified Fare Structure**
  - 6 fare classes
  - Compressed fare ratio of 4.1
- **2 competing hub airlines**
  - 40 Spoke Cities
  - 252 legs
  - 482 OD markets

Class	AP	Min Stay	Chg Fee	Non Ref
1	0	0	0	0
2	3	0	1	0
3	7	0	1	1
4	14	0	1	1
5	14	0	1	1
6	21	0	1	1

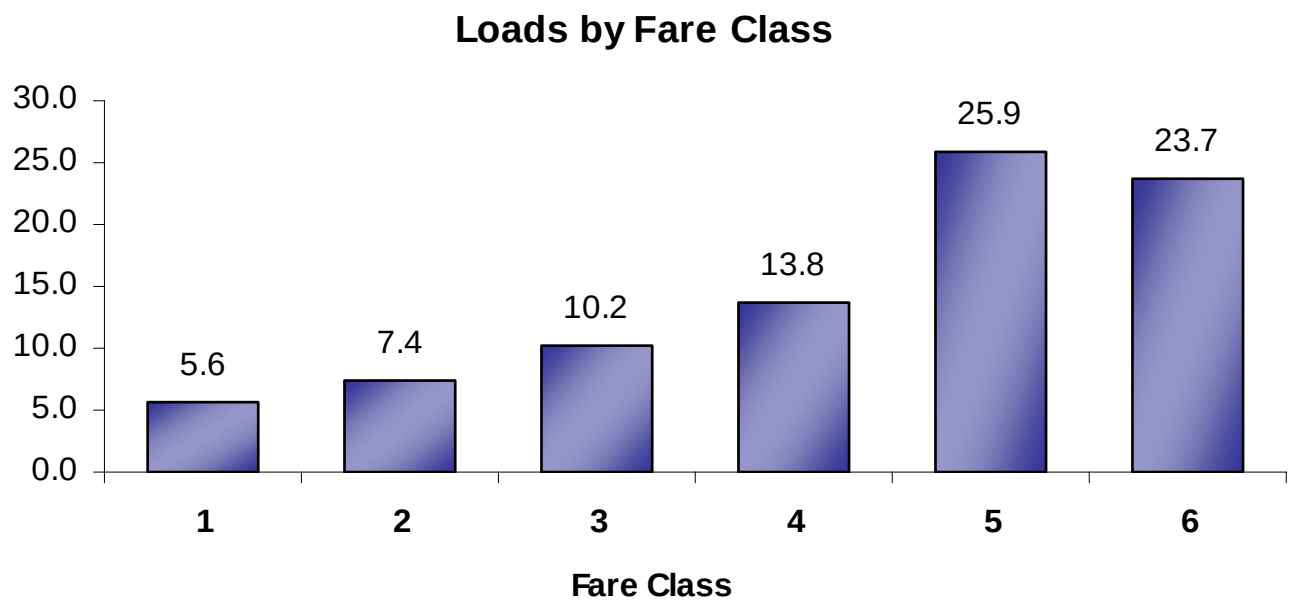
Class	1	2	3	4	5	6
Average Fare	412.85	293.34	179.01	153.03	127.05	101.06

PODS "Network D"

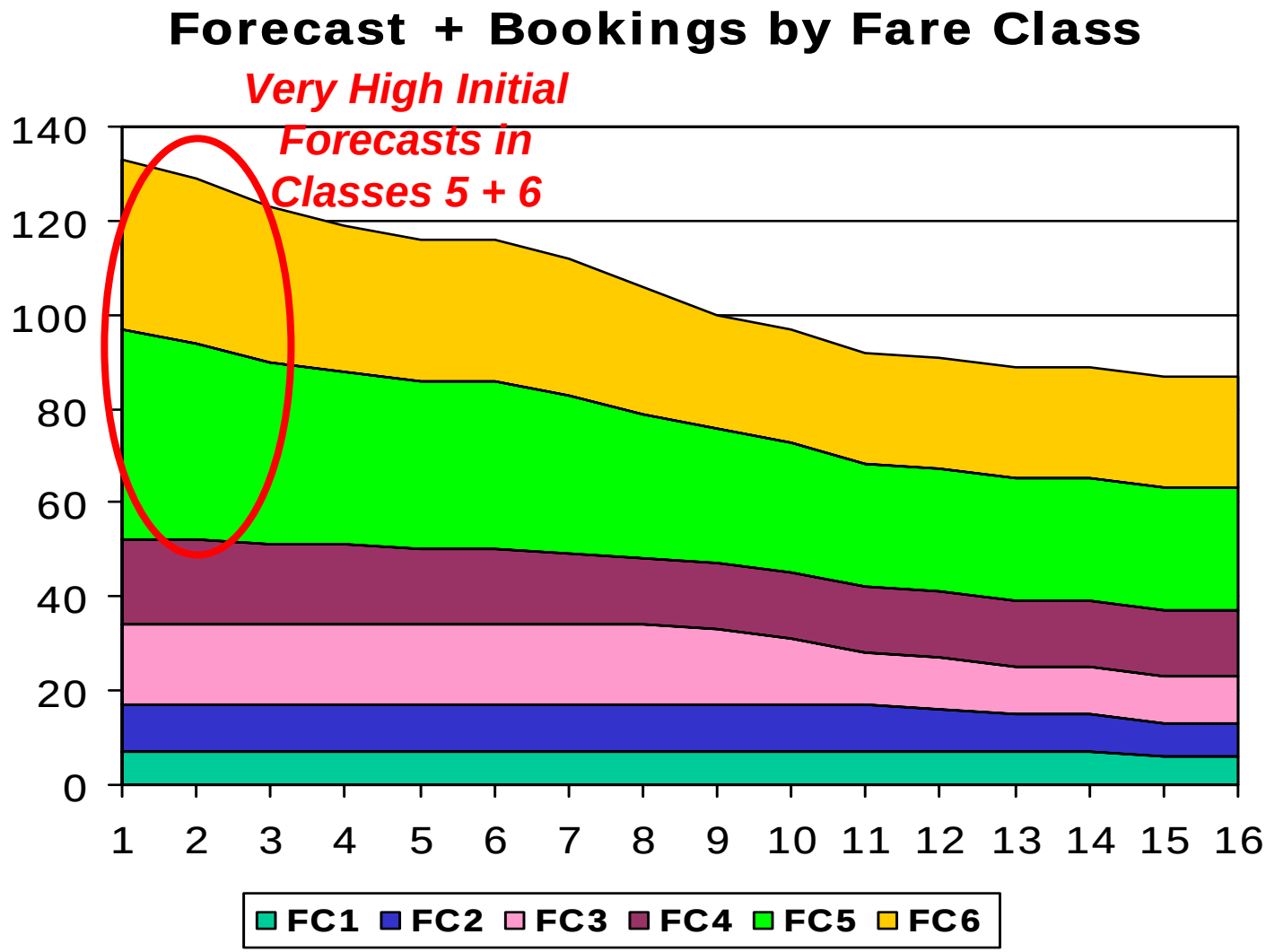


Baseline Results: Standard RM Models

- Standard pickup (moving average) forecaster, booking curve unconstraining and EMSRb optimizer
- Revenue is $1,124,782 ; Yield is $0.1061
- Load factor is 86.45%

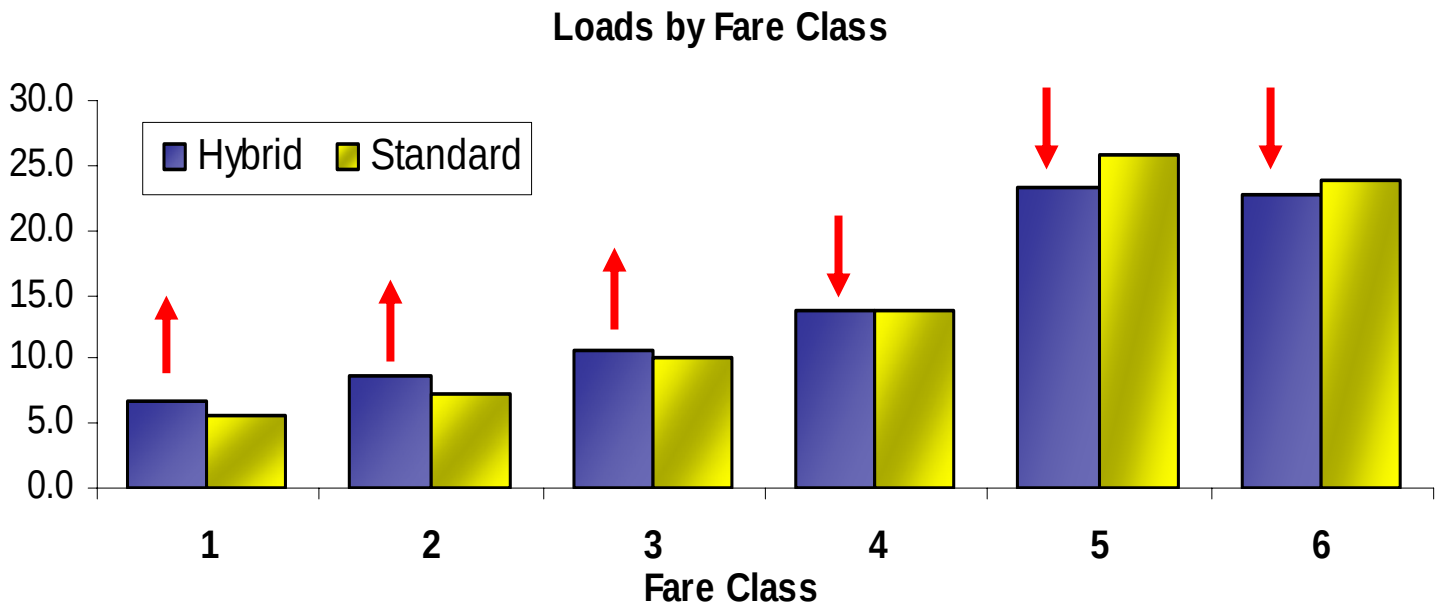


Spiral Down is Evident in Standard Forecasts



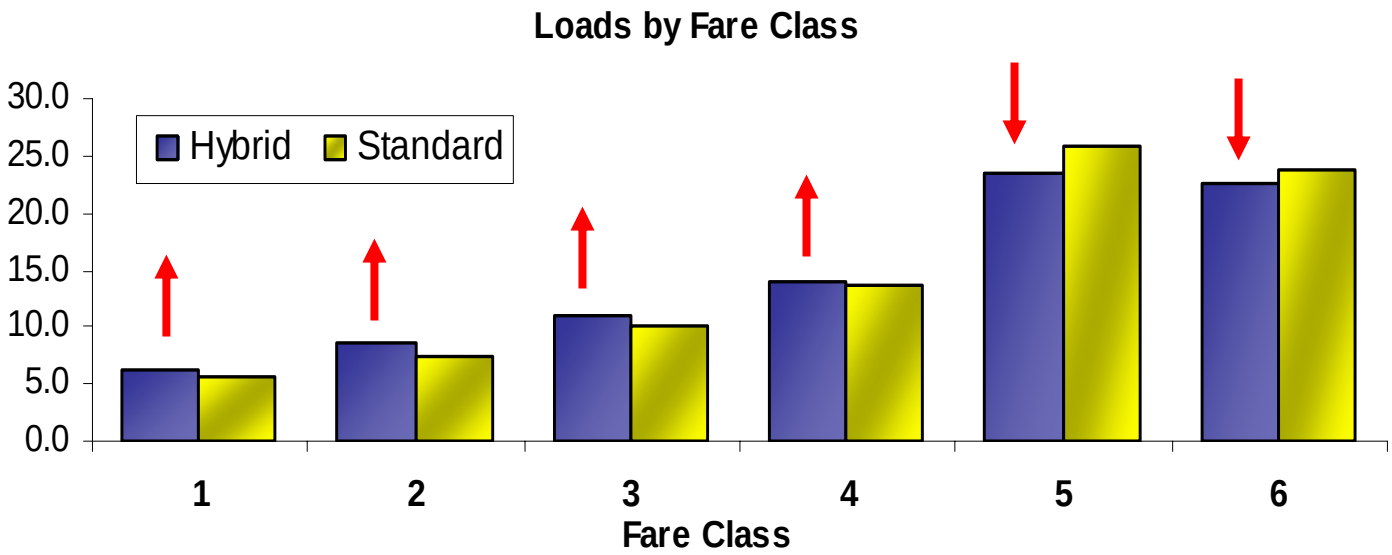
Airline 1 Implements Hybrid Forecasting

	Airline 1		Δ from Trad RM	Airline 2		Δ from Trad RM
Revenue	$1,163,408		+ 3.4%	$1,118,299		- 0.2%
Yield	$0.1107		+ $0.005	$0.1016		- $0.001
Loads	85.70%		- 0.75	86.40%		+ 0.26

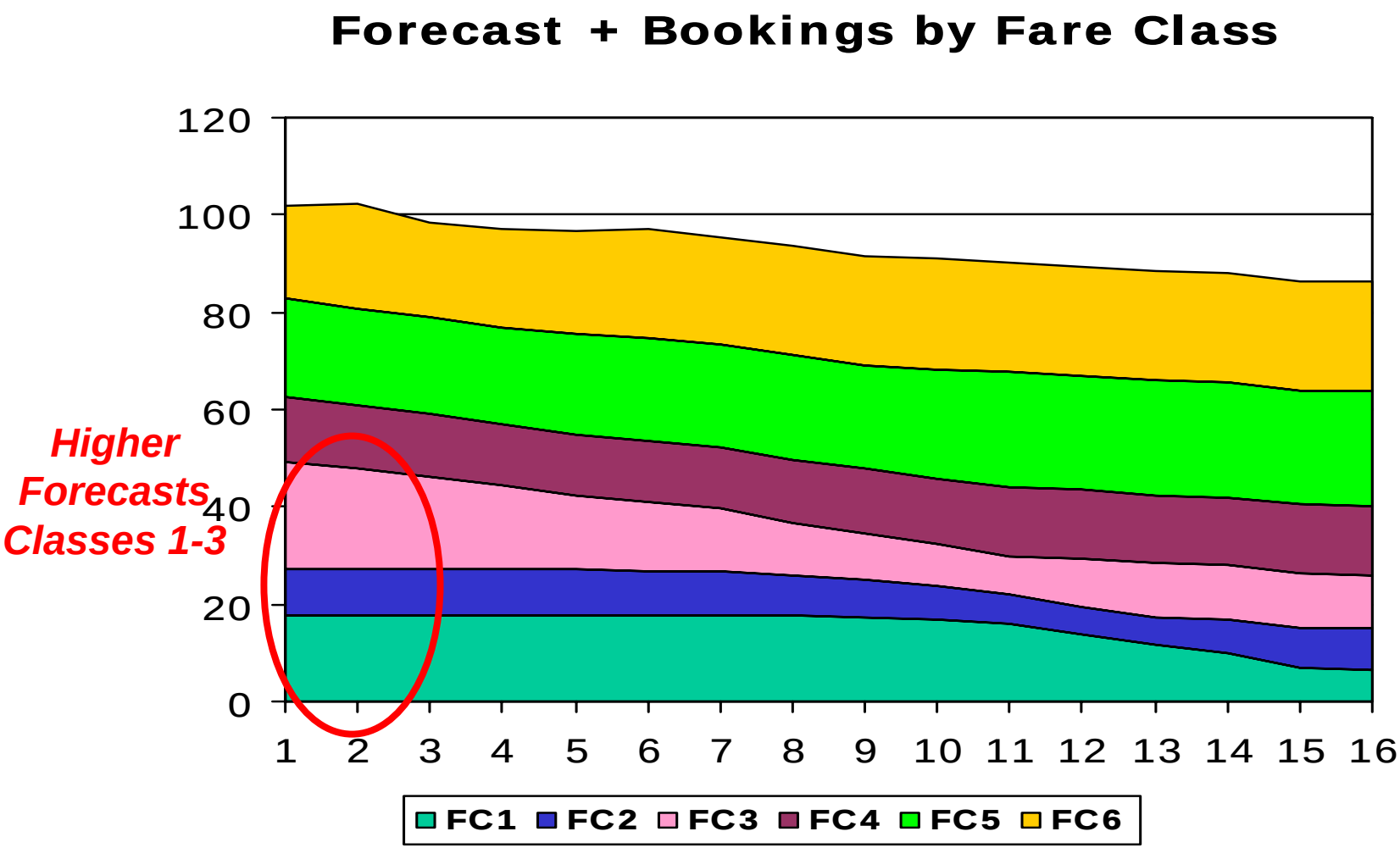


Both Competitors Use Hybrid Forecasting

	Airline 1		Δ from Trad RM	Airline 2		Δ from Trad RM
Revenue	$1,158,167		+ 2.97%	$1,152,222		+ 3.03%
Yield	$0.1098		+ $0.004	$0.1055		+ $0.004
Loads	85.95%		- 0.5	85.72%		- 0.68



WTP Approach Brings Forecasts Back into Line

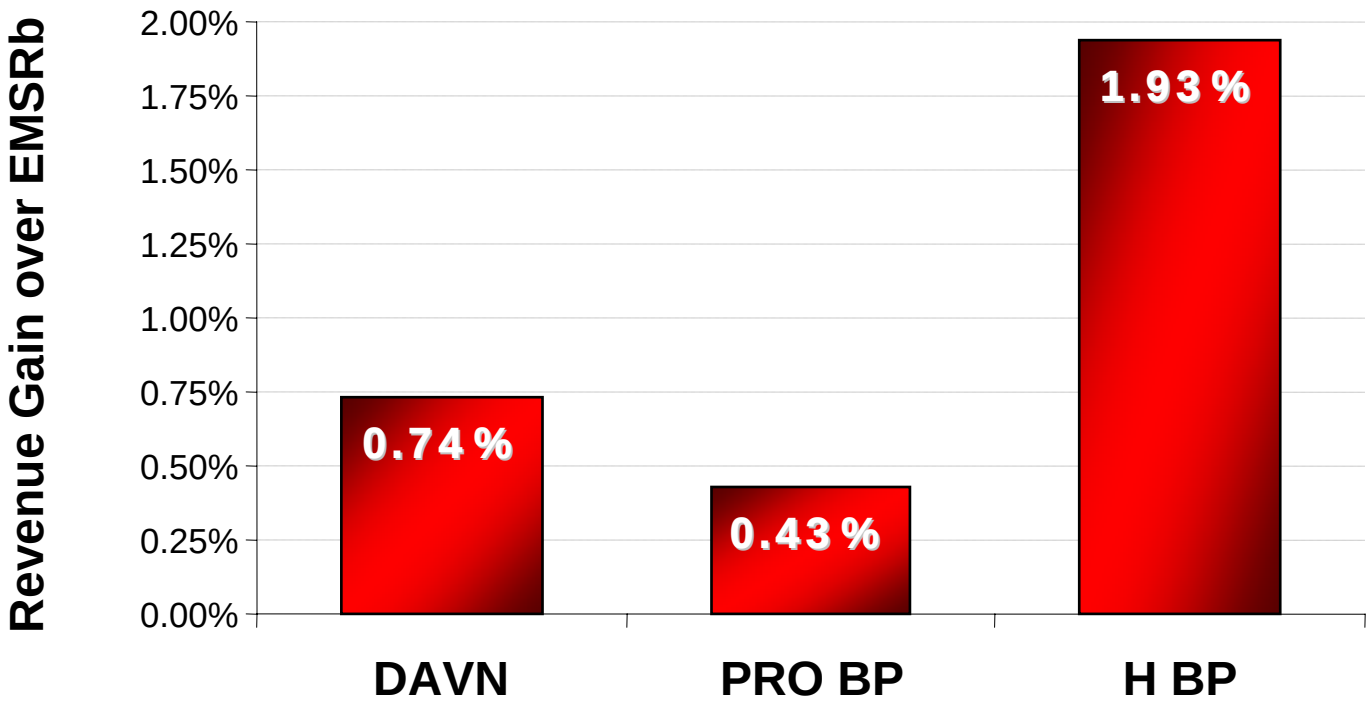


Distorted Forecasts Affect RM Performance

- **Spiral-down leads to high forecasts in lower classes**
  - And, in turn, forecasts that are too low in higher classes
- **In EMSR-based leg RM, at least the lowest class demand is rejected when demand is high**
  - Not revenue maximizing, but some benefit from booking limits
- **Recent PODS simulations illustrate impacts of distorted forecasts on O+D method performance:**
  - Mismatch between independent path/class demands assumed by network optimizer and reality of passenger sell-up
  - Network optimizers over-protect for forecast low-class connecting traffic, leading to distorted bid prices or displacement costs

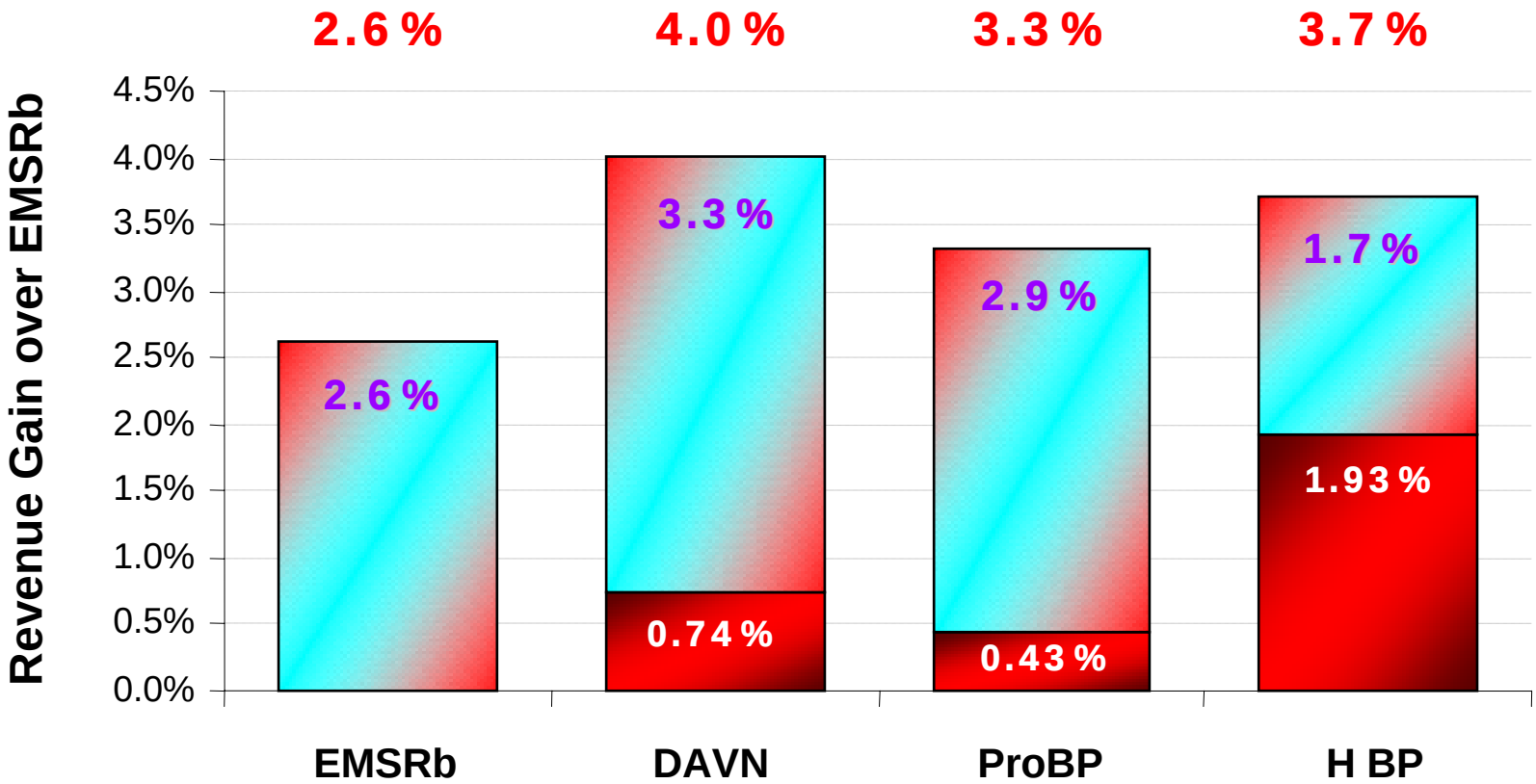
Impacts on O+D Revenue Gains Under Simplified Fare Structure

- **Revenue performance of O+D methods is affected:**
  - Standard forecasting assumes path/class independence
  - Incorrect forecasts fed into network optimizers (LP, ProBP)
  - Network optimization methods more affected than Heuristic BP



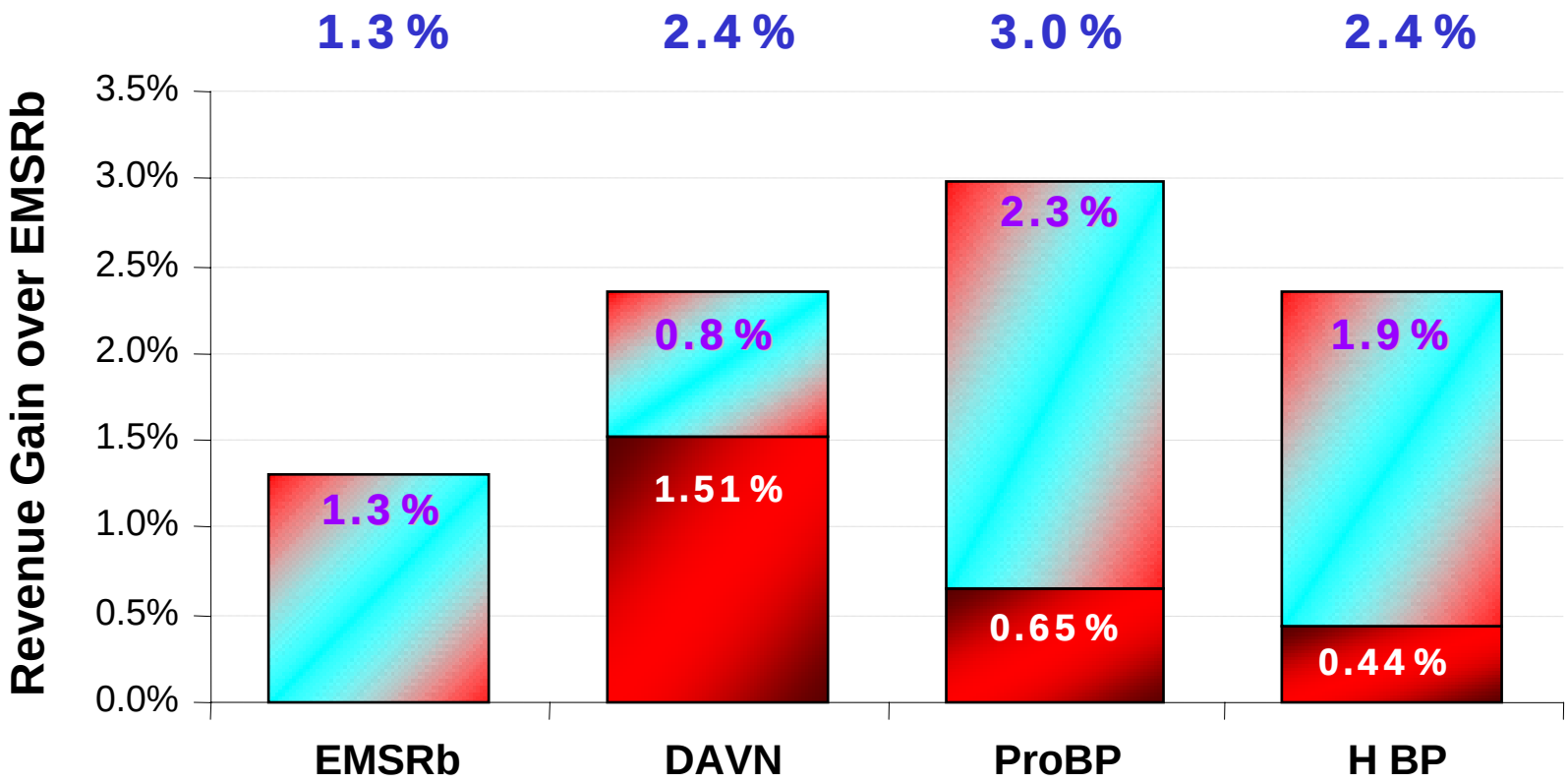
All RM Methods Benefit From Hybrid Forecasting

- Use of Hybrid Forecasting with WTP component improves RM revenue gains by 2-4%
- O+D RM Methods once again outperform EMSRb leg controls by 1% or more



Simulations in Larger Network R
4 Competitors with 4 Hubs

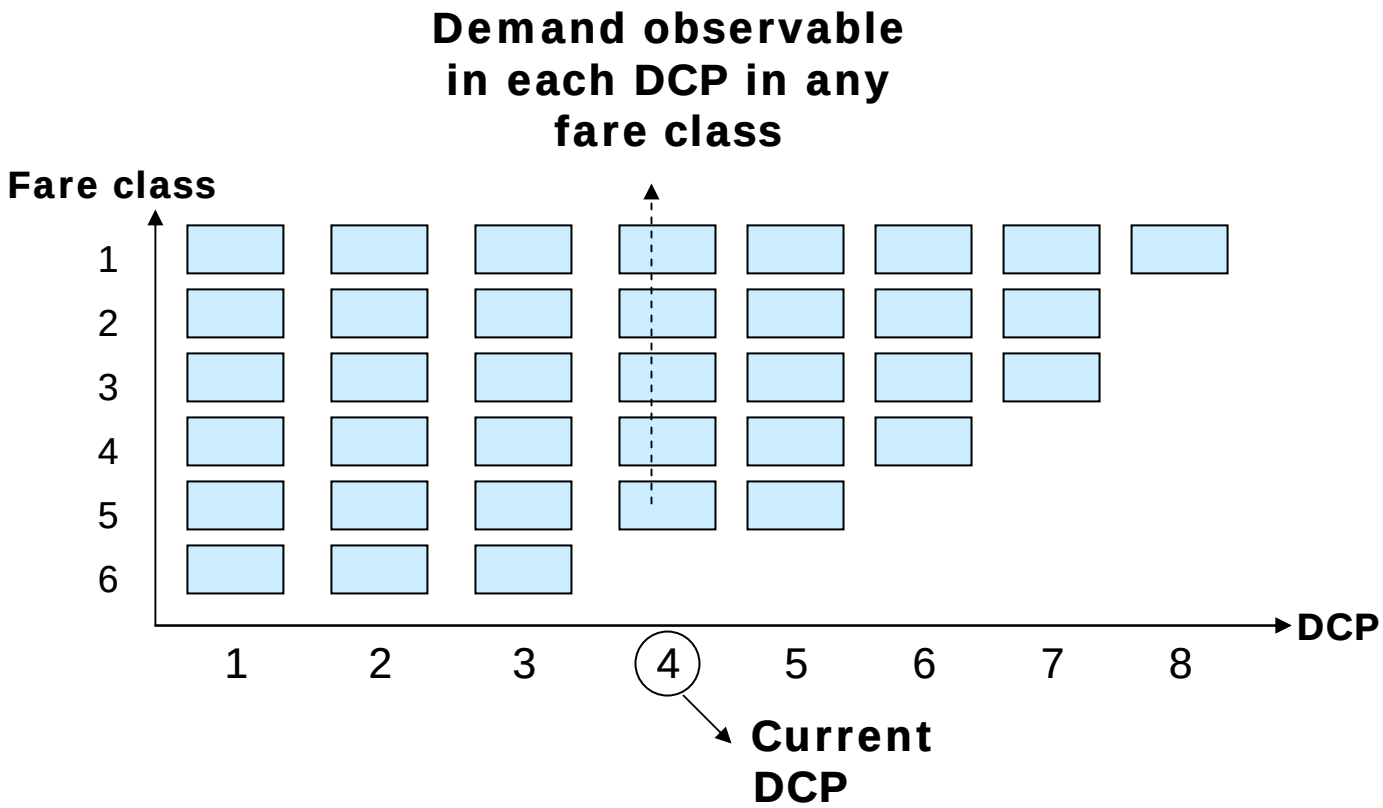
- **All methods benefit from Hybrid Forecasting**
  - ProBP again is most affected by simplified fare structure, but benefits most from use of Hybrid Forecasts based on WTP



Existing RM Forecasts Are Inadequate for Simplified Fare Structures

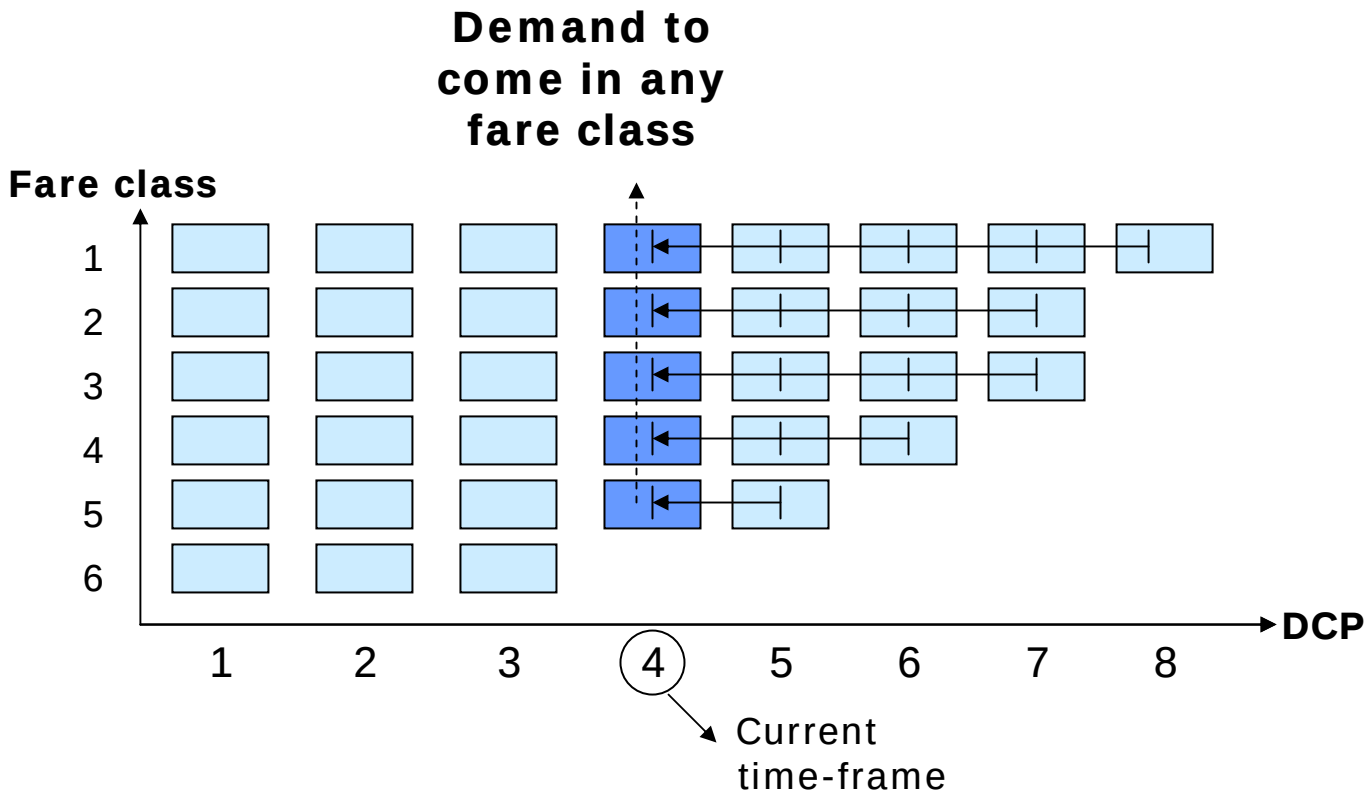
- **Existing RM systems need to be modified**
  - Mismatch between RM model assumptions and fare structures
- **Price/product hybrid forecasting increases revenues**
  - Compared to use of standard RM forecasting methods
  - Gains come from higher forecasts in upper/middle classes, increasing protection and helping to reduce “spiral down”
- **Modified forecasters require estimates of passenger WTP by time to departure for each flight**
  - Approach is to forecast maximum demand potential at lowest fare, and convert into “partitioned” forecasts for each fare class
- **But, WTP forecasting is much more difficult…**

Standard RM Forecasts Assume Independent Demands by Class



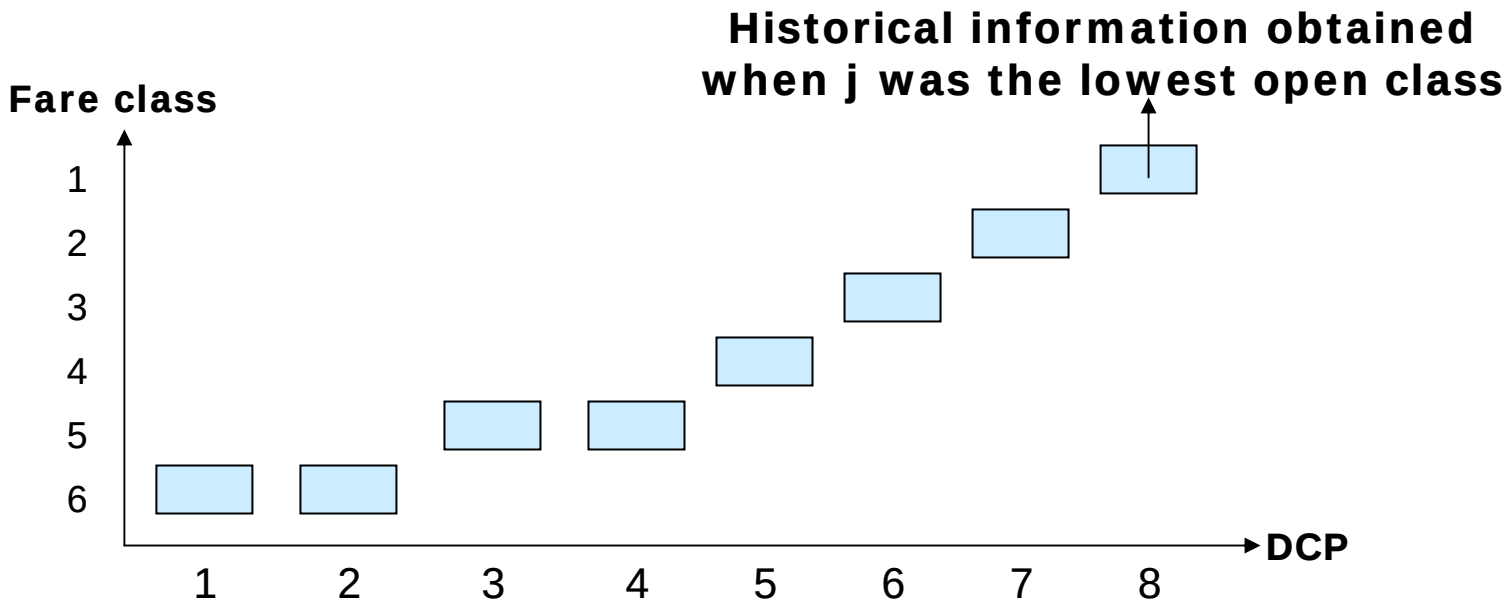
- Product-oriented demand observed for any open class by DCP

Forecasts of Demand to Come by Class Used as Inputs by Optimizer



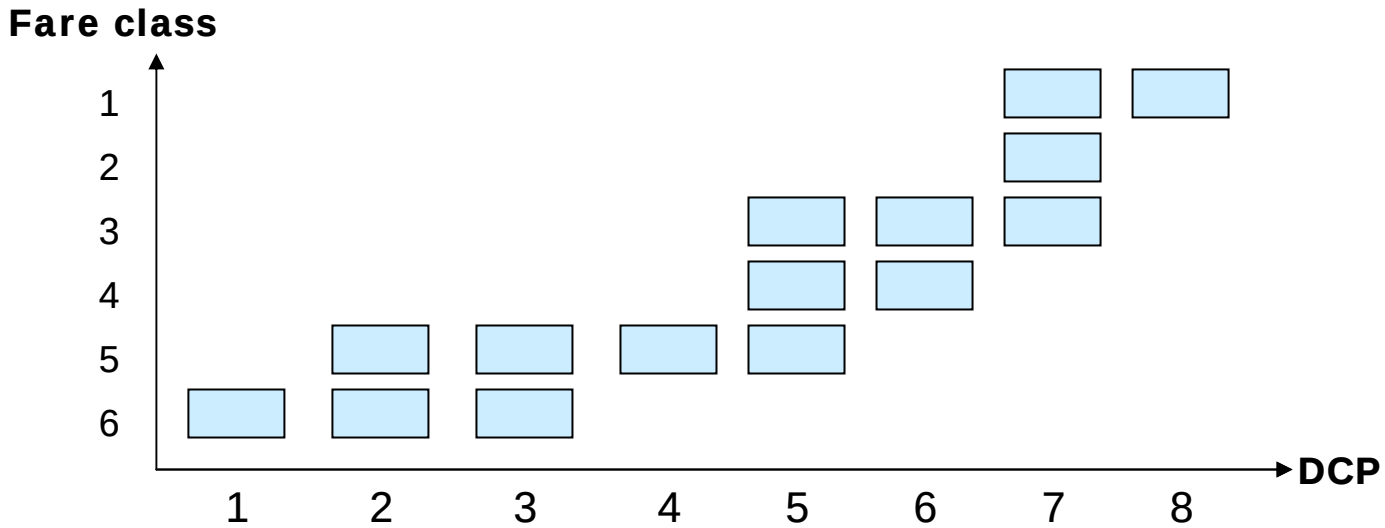
- Demand to come by class assumed to be independent of what classes are open or closed.

Price-Oriented Demand for Undifferentiated Fares



- On a single flight departure, bookings in each class observed only when lower class was closed down.

Sample of Price-Oriented Demand over Multiple Departures

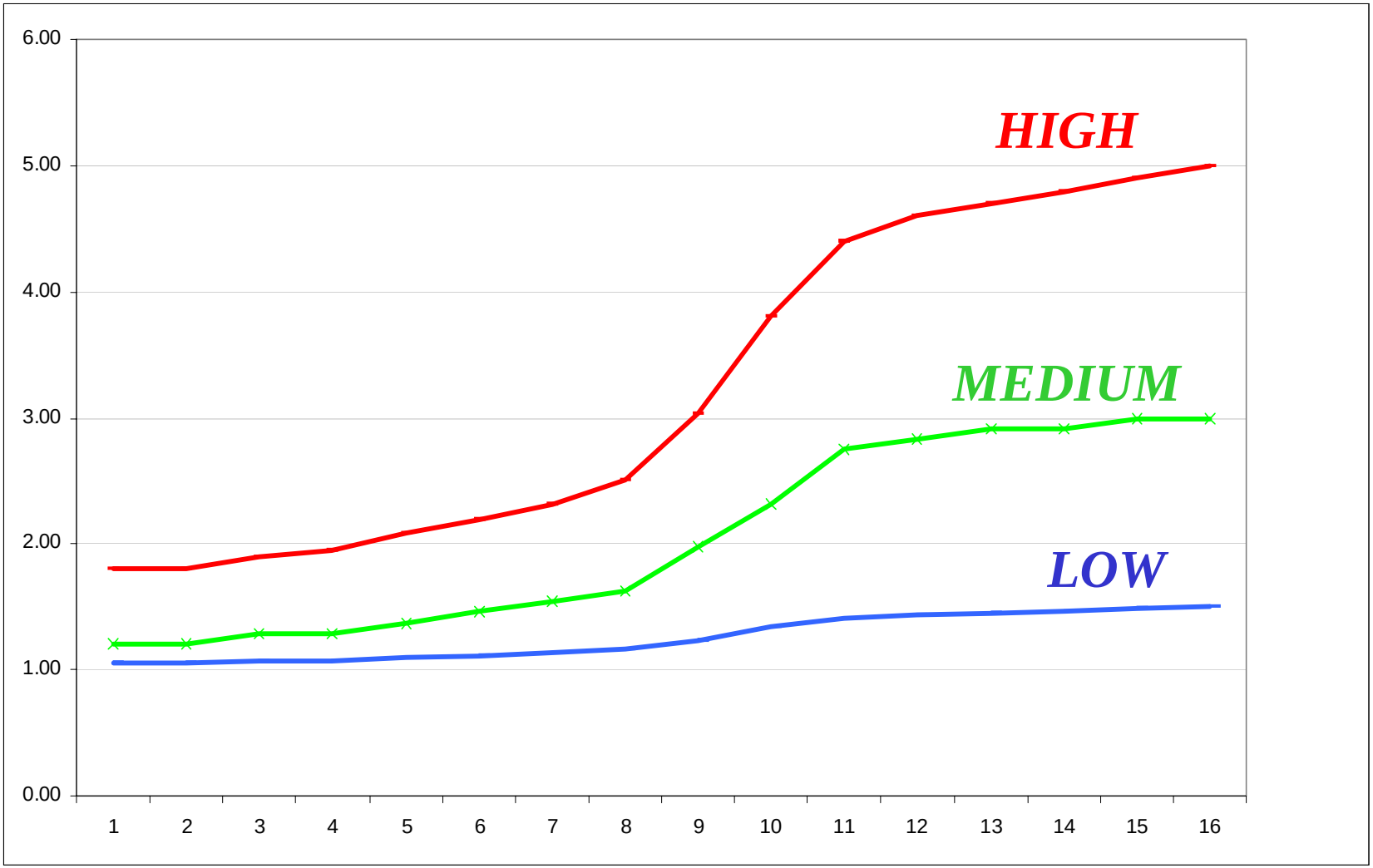


- With information about class closures and observed bookings, we can estimate WTP and sell-up
- But we can't estimate what we've never seen!

Factors Affecting WTP Estimates

- **Time to departure**
  - Business travelers with higher WTP book closer to departure date
- **Peak vs. off-peak periods**
  - Higher demand periods tend to have higher WTP
- **Market characteristics**
  - Limited competition and low capacity (relative to demand) means a higher WTP among consumers
- **RM seat availability – your own and your competitors'**
  - Weak RM controls on previous flights mean historical bookings don't reflect higher WTP of consumers
  - High availability of low-fare seats on competitor makes it difficult (impossible) to observe high-fare bookings

Willingness to Pay Relative to Lowest Fare Changes over the Booking Process



WTP Estimates are Critical to Effective RM under Simplified Fares

- **Nothing simple about RM models required by these simplified fare structures**
  - Traditional RM methods do not maximize revenues
  - Without forecasting modifications, even O+D control gains are affected
- **New approaches to "hybrid" forecasting of price- vs. product-oriented demand show good potential**
  - Significant revenue gains over standard forecasting methods
- **Recent PODS research shows potential for conditional WTP estimates:**
  - Requires separate estimation of WTP for each scenario of class closure, for own airline and potentially competitor(s)