

Competition in Passenger Railways in Central and Eastern European Countries



Prague – June 19, 2014



The Dynamics of Transport Fares: Welfare Analysis

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Joint with

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Going to Lyon from Paris by Train

Thu 19 Jun.

Leaving at	<u>07h38</u>	<u>07h53</u>	<u>09h58</u>
From	64.00 €	130.00 €	Train fully booked
Journey time	05h08 Direct	02h04 Direct	01h58 Direct
Travel with	TER	TGV	TGV

07h38 PARIS BERCY

2nd class

TER 17753



12h44 LYON PART DIEU

White period

- No seat reservation required



64.00 €

TARIF NORMAL : Ticket exchangeable and refundable. Terms and conditions apply.

07h53 PARIS GARE DE LYON

09h57 LYON PART DIEU

TGV 6605

1st class



Peak period
- Mandatory seat reservation

ESPACE
PRO 1ÈRE



130.00 €

FULL FARE LOISIR : Can be exchanged and refunded free of charge up until the day before departure, with a 12 euros administrative charge the day of departure.



135.00 €

TGV PRO 1ÈRE : Free exchange and refund service up until departure. Conditions apply after departure.

The train has a Pro Première Area.

Thu 26 Jun.

Leaving at	<u>05h50</u>	<u>06h28</u>	<u>06h58</u>	<u>06h58</u>	<u>07h28</u>	<u>07h38</u>	<u>07h53</u>
From	95.00 €	95.00 €	95.00 €	95.00 €	95.00 €	64.00 €	95.00 €
Journey time	02h08 Direct	01h58 Direct	01h58 Direct	01h58 Direct	01h58 Direct	05h08 Direct	02h04 Direct
Travel with	TGV	TGV	TGV	TGV	TGV	TER	TGV

07h38 PARIS BERCY

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White period

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07h53 PARIS GARE DE LYON

TGV

6605

2nd class



09h57 LYON PART DIEU

Peak period

- Mandatory seat reservation



95.00 €

FULL FARE LOISIR : Can be exchanged and refunded free of charge up until the day before departure, with a 12 euros administrative charge the day of departure.



100.00 €

TGV PRO 2NDE : Free exchange and refund service up until departure. Conditions apply after departure.

TRAVEL IN 1ST CLASS



130.00 €

FULL FARE LOISIR : Can be exchanged and refunded free of charge up until the day before departure, with a 12 euros administrative charge the day of departure.

	Wed 3 Sep.	Thu 4 Sep.					
Leaving at	<u>20h58</u>	<u>05h50</u>	<u>06h28</u>	<u>06h58</u>	<u>07h28</u>	<u>07h38</u>	<u>07h53</u>
From	25.00 €	42.00 €	30.00 €	30.00 €	74.00 €	64.00 €	30.00 €
Journey time	01h58 Direct	02h06 Direct	01h58 Direct	01h58 Direct	01h58 Direct	05h06 Direct	02h04 Direct
Travel with	TGV	TGV	TGV	TGV	TGV	TER	TGV

07h53 PARIS GARE DE LYON

09h57 LYON PART DIEU

TGV 6605

2nd class



Peak period

- Mandatory seat reservation



30.00 €

TGV PREM'S : Ticket cannot be exchanged and is non-refundable.

Hurry, last seats available!



61.00 €

LOISIR REDUCED FARE : Can be exchanged and refunded free of charge up until the day before departure, with a 12 euros administrative charge the day of departure.



100.00 €

TGV PRO 2NDE : Free exchange and refund service up until departure. Conditions apply after departure.

VEL IN 1ST CLASS



58.00 €

TGV PREM'S : Ticket cannot be exchanged and is non-refundable.

Hurry, last seats available!

Going to Lyon from Paris

- Paris – Lyon
 - 4 hours 21 minutes by car
- Different trains
- Different service conditions
 - First and second classes
- Outcome
 - Wide range of fares depending on the buying date
 - Availability of seats is changing

Revenue Management

- A form of intertemporal price discrimination
 - Transport industry: Airlines, railroads
 - Other industries: Movie theaters, hotels
- Policy debate on the outcome
 - For the same product, large range of prices among purchasers
 - Fairness versus Efficiency
- Research
 - Welfare analysis
 - Impact on producer profit, consumer surplus, total welfare
 - Monopoly
 - Competition

Contribution

- Limited number of articles and studies on RM
- Main results
 - RM increases consumer surplus
 - RM may have a redistribution effect between leisure and business Passengers
 - Competition among operators decreases prices but increases its dispersion
 - Competition does not necessarily yield an optimal capacity and operators tend to exploit at the maximum of the available capacity

Methodology

- No data, no econometric analysis
 - Very complex and heavy
 - Not useful for practitioners
- Simulation
 - Allow to exhibit / to elicitate the business strategies of buyers

Basic ingredients of the basic model

- A product
 - Train ticket
 - Constrained availability
 - Number of days before departure
 - Number of seats left
- A railroad (monopoly)
 - Set of possible prices for the different trains
 - Closing option = put an infinite price
- A traveller
 - Homogenous consumers
 - Random arrival on the website or at the ticket window
 - Myopic expectations
 - Decision: buy the ticket or take the outside option

The revenue manager's problem

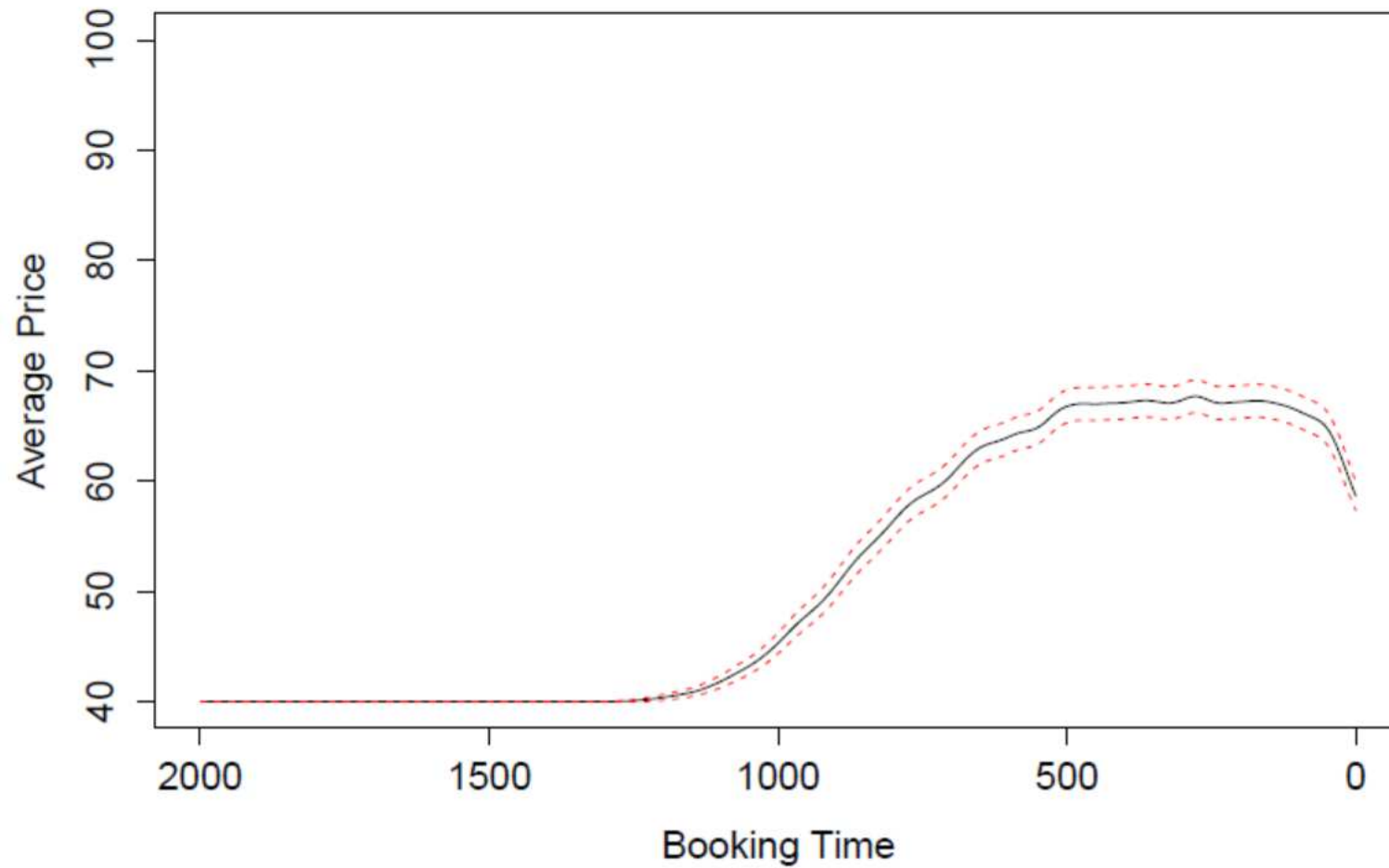
- Objective
 - Choose the sequence of prices in order to maximize expected revenue at each period
- Expected revenue

$$V_t(X) = \max_{\tilde{p} \in \Pi_{i,k} P_{ik}} \sum_{i,k} \lambda_t Pr(d_{ik} = 1 | \tilde{p}) [\tilde{p}_{ik} + V_{t-1}(X_i - 1, X_{-i})] \\ + [1 - \lambda_t + \lambda_t Pr(d_0 = 1 | \tilde{p})] V_{t-1}(X)$$

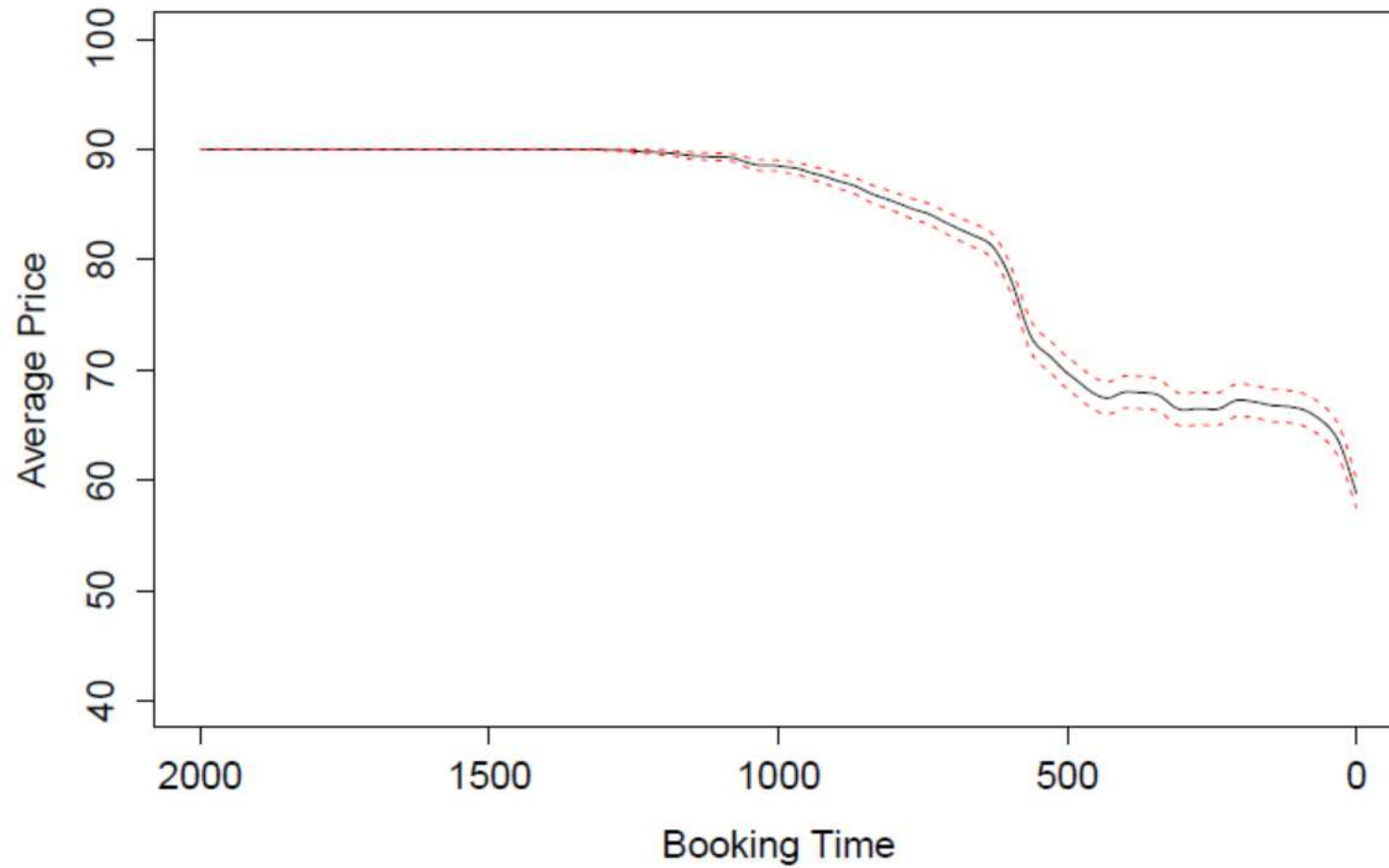
Computation

- Supply
 - Train capacity is fixed = 400 seats
 - 2 prices (low = 40, high = 90)
- Demand
 - Choice (buying) probability based on a multinomial logit specification
 - Calibrate the parameters to yield realistic estimate of demand elasticities
- Market size
 - No more than one consumer per period
 - Function of the arrival rate from 0.2 to 0.9 (step 0.1)
 - Time constraint = number of periods before departure
 - Example
 - Medium size = 1000 (arrival rate = 0.4)
 - Large size = 1400 (arrival rate = 0.7)

Standard profile

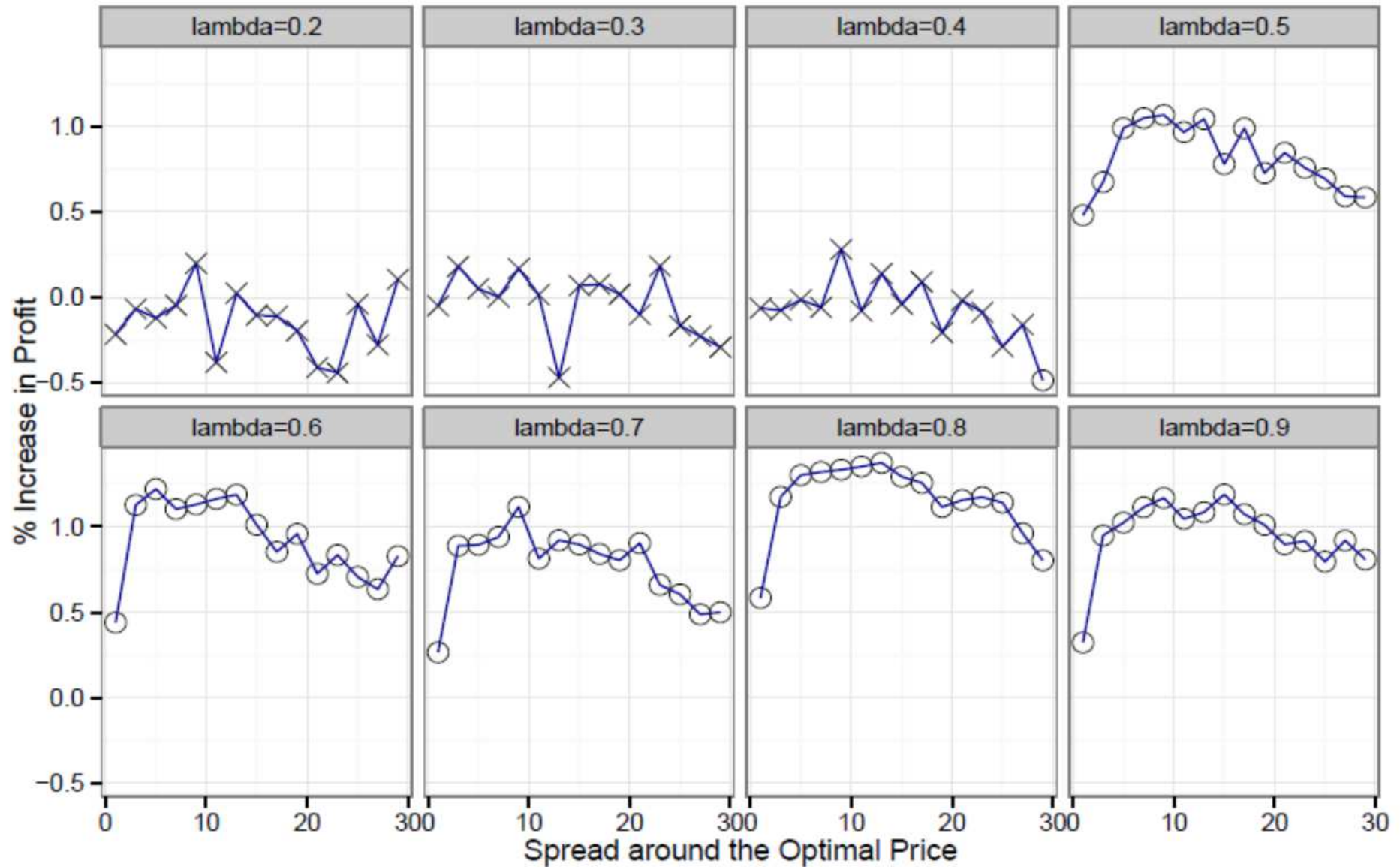


Profile under high demand



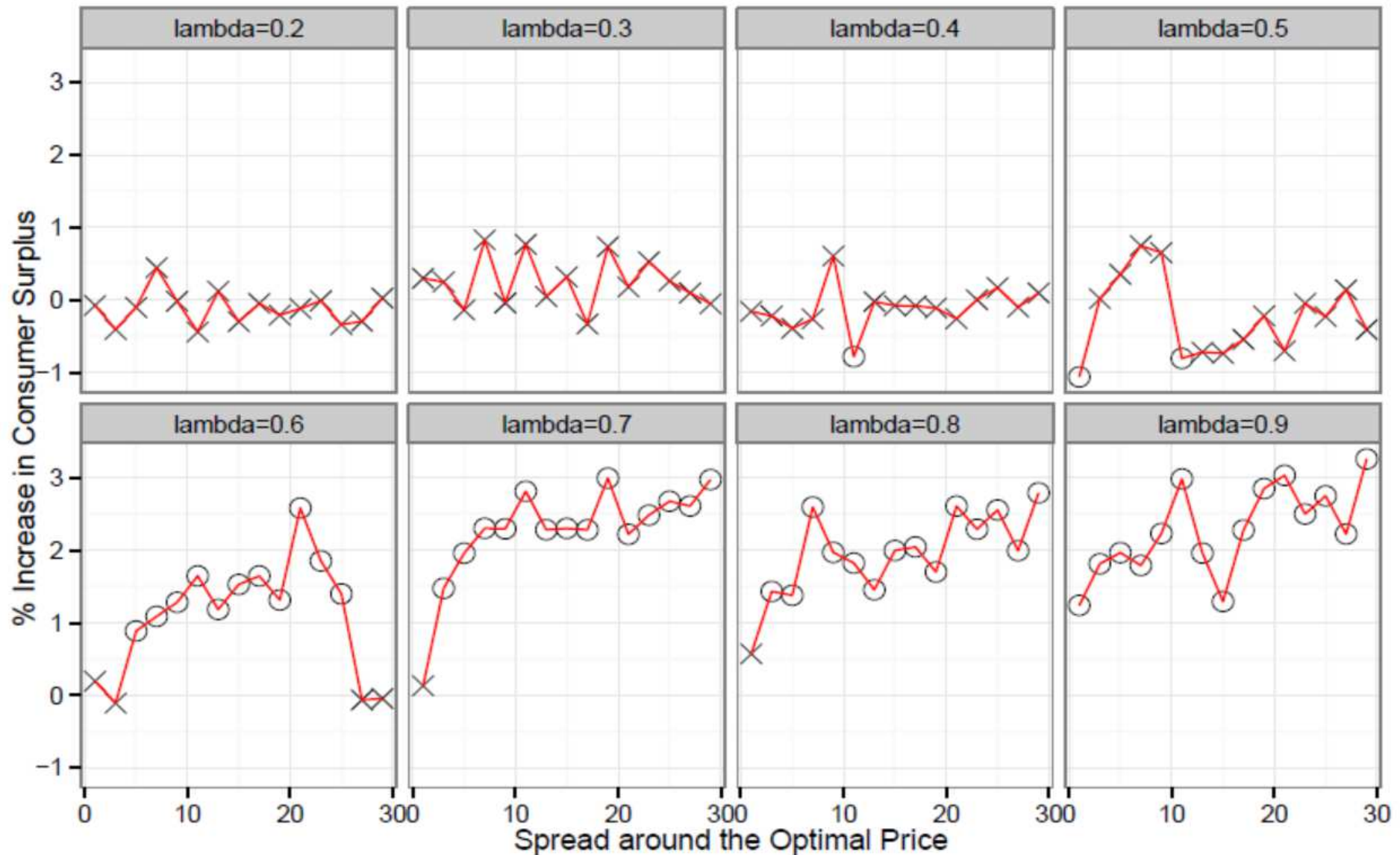
Revenue Management versus Optimal Fixed Price

Change in profit



Revenue Management versus Optimal Fixed Price

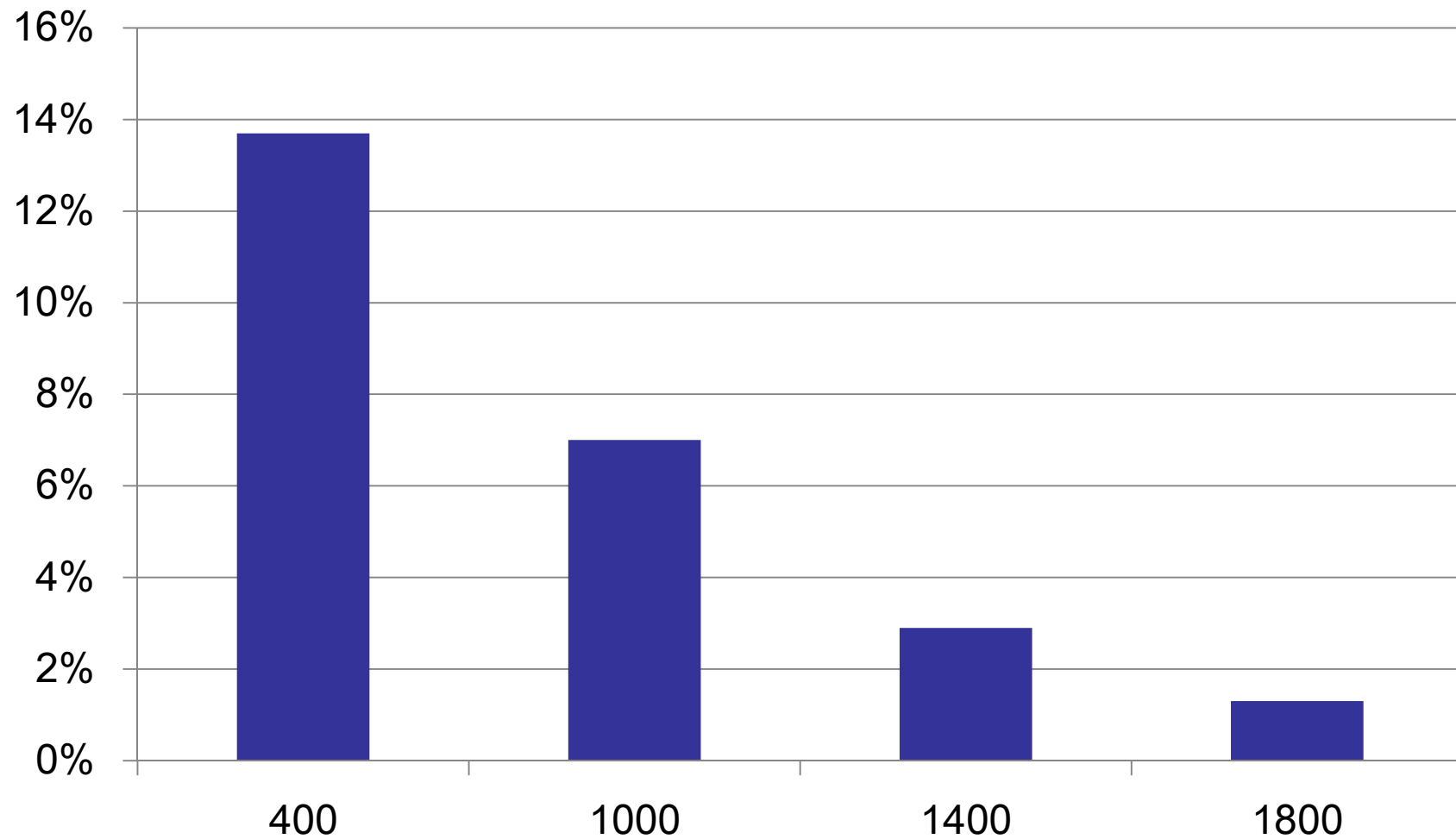
Change in consumer surplus



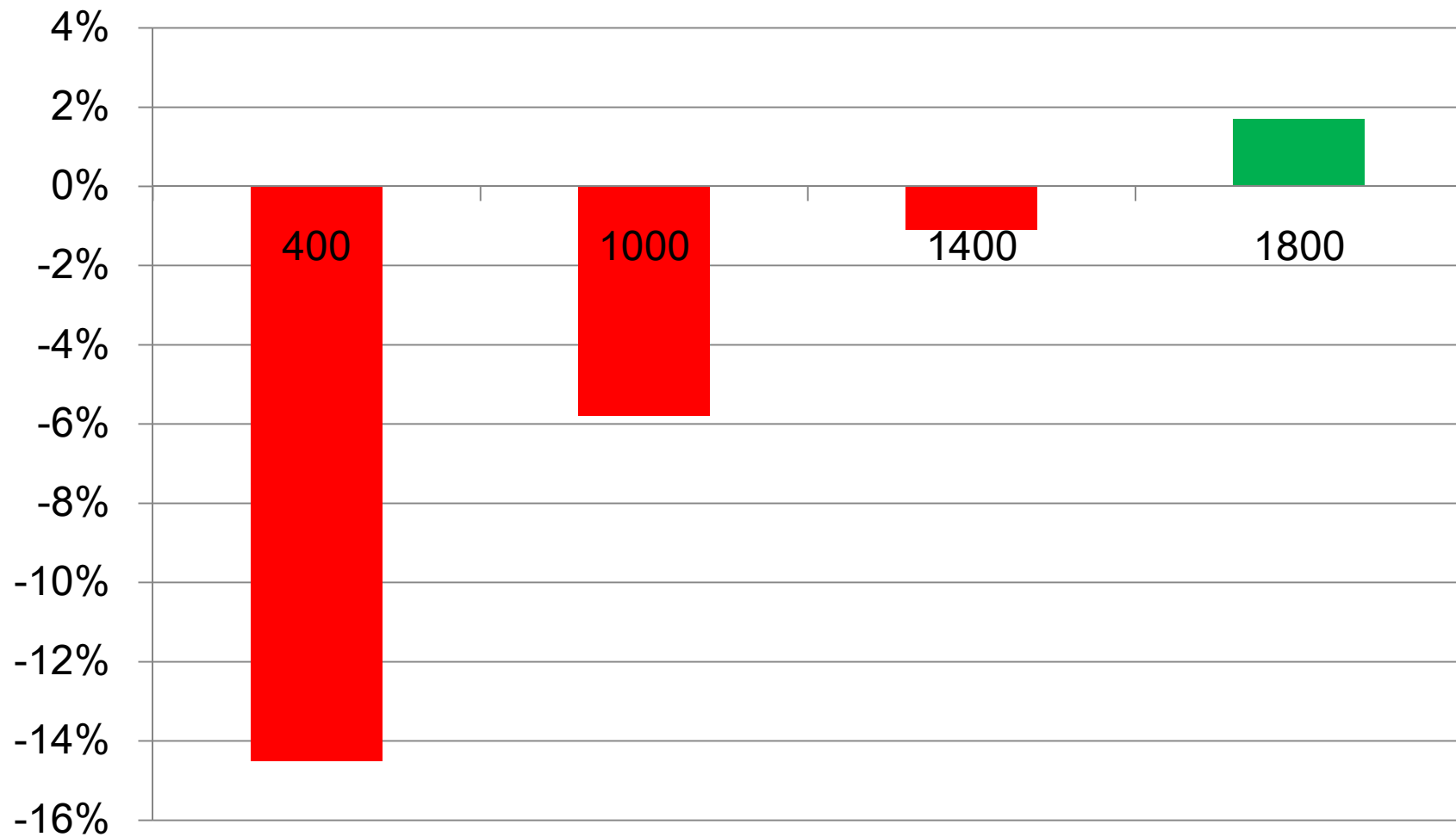
Heterogenous Consumers

- Two types of train:
 - Off peak
 - Rush hour
- Two types of Passengers (i.e., different demand elasticity)
 - Leisure
 - Business
- Two pricing strategies
 - Fixed Price
 - Revenue Management

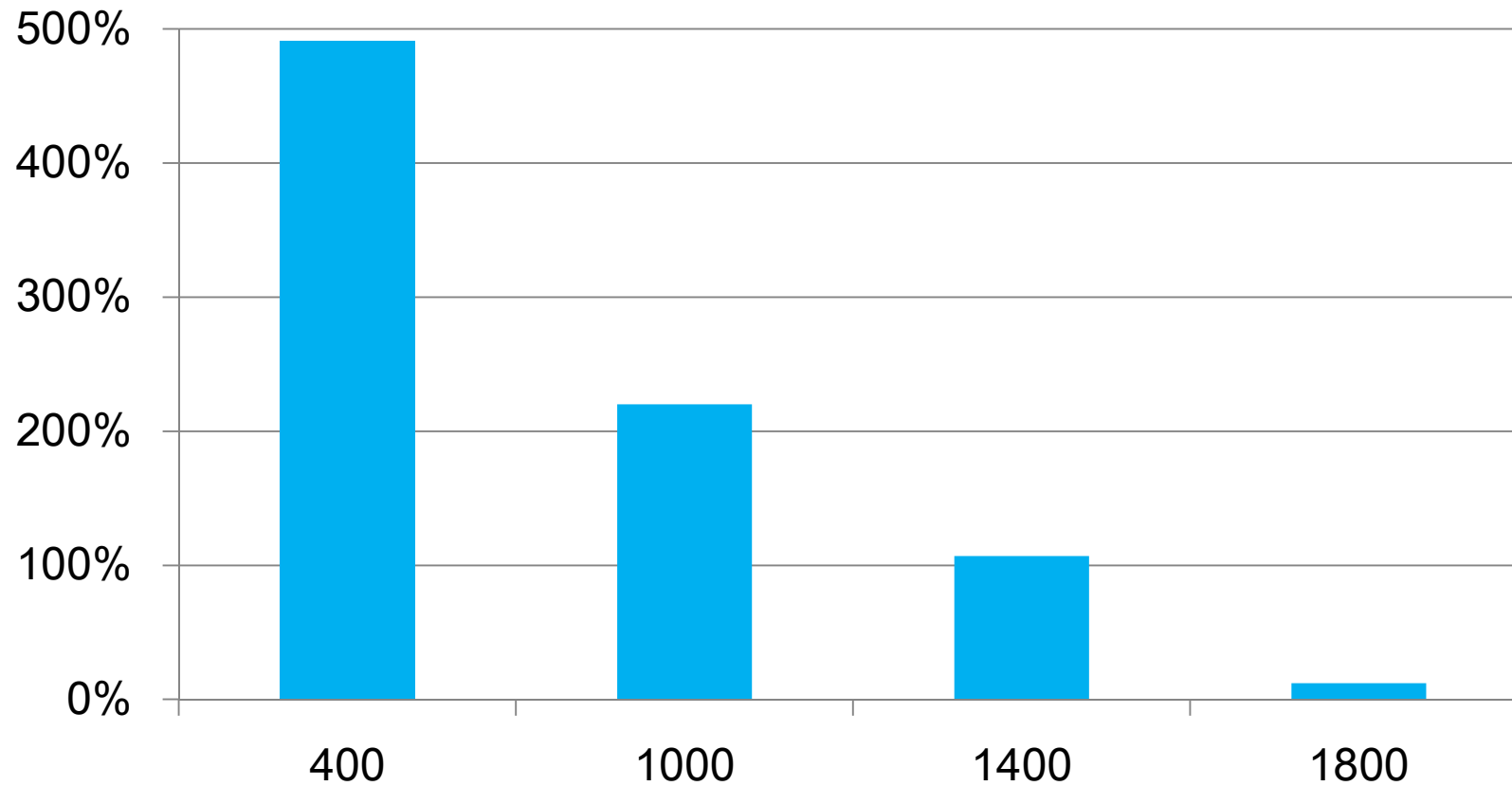
Change in Profit from Fixed Price to Revenue Management



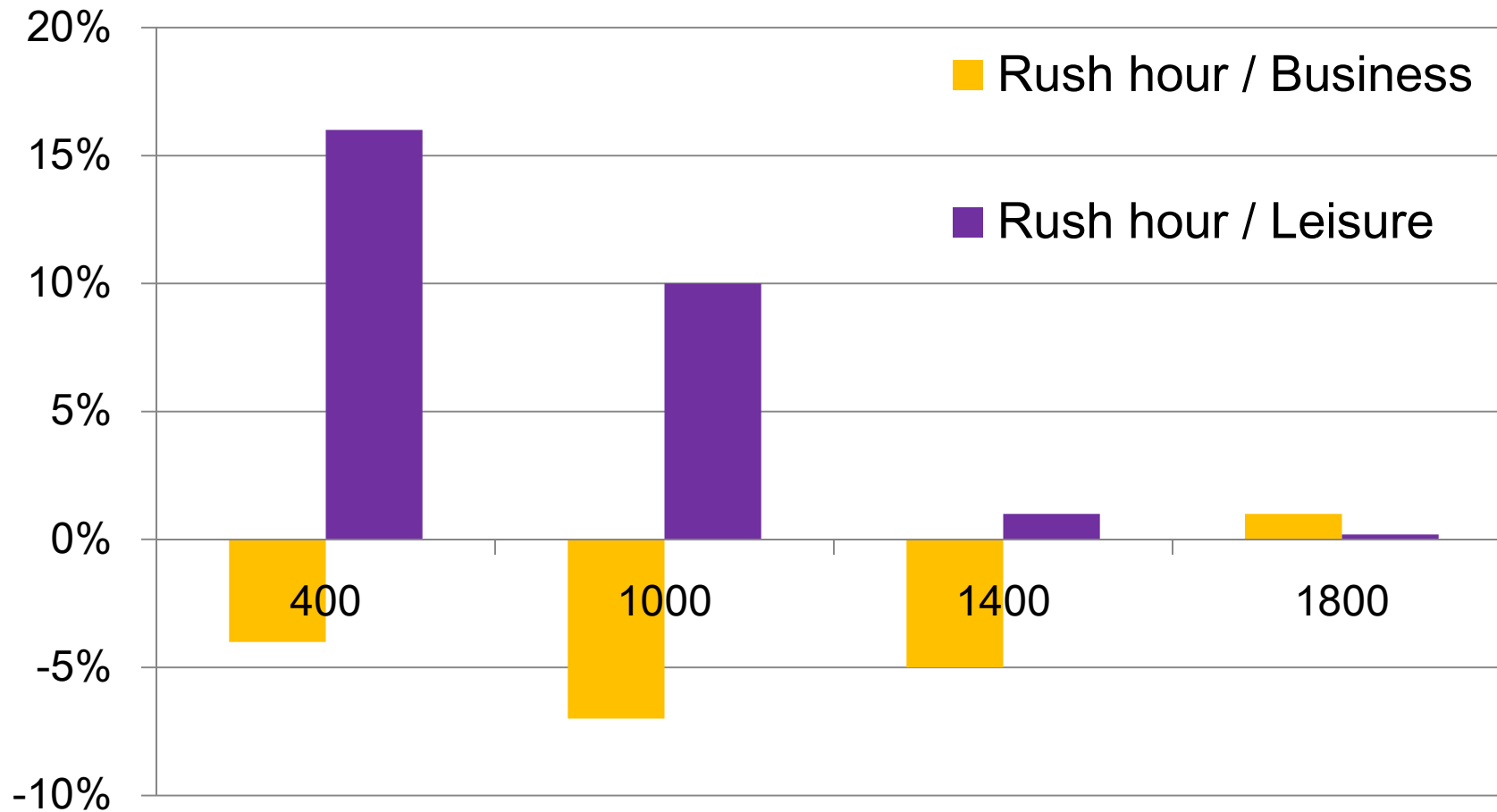
Change in Surplus of Business Passengers from Fixed Price to Revenue Management



Change in Surplus of Leisure Passengers from Fixed Price to Revenue Management



Load rates of Leisure and Business Passengers from Fixed Price to Revenue Management



Competition between revenue managers

- Type of competition
 - Indirect competition: Rail versus Road
 - Direct competition: Rail versus Air
- Two horizontally differentiated products
- Two industrial structure
 - A multiproduct monopoly
 - A duopoly

Results

- Higher profit under monopoly than under duopoly
- Higher surplus under duopoly than under monopoly
- Price dispersion

λ	Mono-Product Duopoly		Multi-Product Monopoly	
	Avg. Price	Dispersion	Avg. Price	Dispersion
0.2	40	0	90	0
0.3	45.5	14.9	90	0
0.4	64.8	24.7	90	0
0.5	84.2	13.7	90	0
0.7	90	0	90	0

Conclusion

- Revenue management
 - A practice in general beneficial to both consumers and firms
- Key variables
 - Market size and capacity constraints
- Further work
 - More strategic behavior of consumers

Thank you!