Institute for Transport Studies
FACULTY OF ENVIRONMENT

UNIVERSITY OF LEEDS

Trends in air travel behaviour research

Stephane Hess

ITS

Outline

UNIVERSITY OF LEEDS

- Why do we do this?
- Revealed or stated?

  - two case studies
- Trends in air travel behaviour
- Approach to joint study
- Modelling Results
- Conclusions

ITS

Air-travel behaviour research

UNIVERSITY OF LEEDS

- Need for accurate forecasts
- Understanding of individual passenger behaviour
- High number of studies over recent years
  - focus on US and UK
  - mainly choice of airport, or airline
- Aim is to determine what drives individual choices

ITS

Discrete choice models

UNIVERSITY OF LEEDS

- Choice between finite set of discrete alternatives
  - Alternatives mutually exclusive
  - Choice-set exhaustive
- Alternatives have an associated “utility”
- Principle: alternative with highest utility is chosen
- Taste coefficients “calibrated” on RP or SP data

ITS

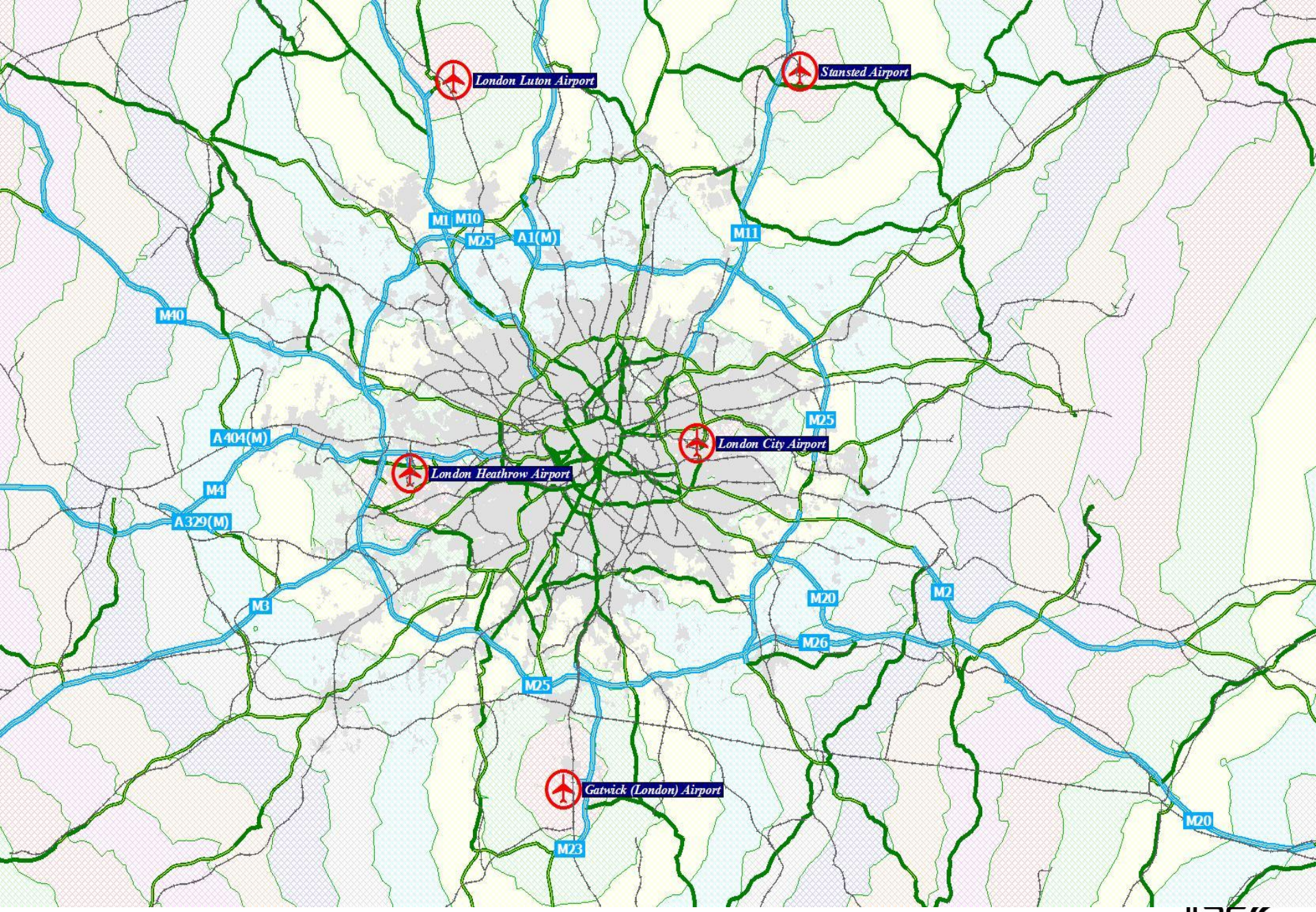
Data

UNIVERSITY OF LEEDS

- Models estimated on data containing information on choices
  - Attributes of alternatives
  - Attributes of decision maker
  - Choice
- Initially, majority of studies based on real world choices, also known as Revealed Preference (RP) data

ITS

Revealed Preference case study: London model


London Luton Airport
Stansted Airport
M1
M10
M25
A1(M)
M11
M40
A404(M)
M4
A329(M)
M3
London Heathrow Airport
London City Airport
M25
M20
M2
M26
M25
Gatwick (London) Airport
M23
M20

Topic and scope of analysis

UNIVERSITY OF LEEDS

- Combined choice of airport, airline and access-mode
- Excludes arriving and connecting passengers
- Passengers on direct flights only
- Ignores unchosen transport modes (car, coach, …)

  ➔ Passengers have already decided to go by air

ITS

Data

UNIVERSITY OF LEEDS

- Survey: 33,612 usable observations (1996)
- Several auxiliary datasets, **highly disaggregate**
- 5 departure airports
- 31 destination airports
- 6 access modes
- 37 airlines
- 54 actual airport-airline combinations

→ 324 alternatives

ITS

Modelling results

UNIVERSITY OF LEEDS

- Potential impacts of:

  → access cost, access time, wait time, changes

  → fare, frequency, flight time, aircraft type, seats

- No information on:

  → Frequent flier programmes (but nationality)

  → Past choices

- Low quality of fare data

ITS

Resident business

UNIVERSITY OF LEEDS

Effects:

→ access time (negative, log-linear)

→ access cost (negative, log-linear)

→ frequency (positive, log-linear)

→ flight time (negative, log-linear)

ITS

Resident leisure

UNIVERSITY OF LEEDS

Effects:

→ access time (negative, log-linear)

→ access cost (negative, log-linear)

→ frequency (positive, log-linear)

→ flight time (negative, log-linear)

ITS

Visitor business

UNIVERSITY OF LEEDS

Effects:

→ access time (negative, log-linear)

→ access cost (negative, log-linear)

→ frequency (positive, log-linear)

→ flight time (negative, log-linear)

→ non-UK airline (positive)

ITS

Visitor leisure

UNIVERSITY OF LEEDS

Effects:

→ fare (negative, linear)

→ access time (negative, log-linear)

→ access cost (negative, log-linear)

→ frequency (positive, log-linear)

→ flight time (negative, log-linear)

ITS

Limitations of RP survey data

UNIVERSITY OF LEEDS

Collected by airport or airline authorities

- priorities different from those of modellers

Problems with auxiliary data:

- poor quality of fare data
- no information on availabilities
- no frequent flier information
- not possible to measure scheduling effects

Big assumptions necessary, poor results …

- generally no effect of air-fares …

ITS

Alternatives to RP survey data

UNIVERSITY OF LEEDS

Self-collected RP survey data:

- expensive
- limited sample size
- problems in getting clearances
- problems with availabilities remain

RP bookings data:

- information on availabilities
- generally no information on socio-demographics etc

SP data:

- doubts about reliability
- but: information on actually faced alternatives
- information on fares, frequent flier, scheduling,…

ITS

SP case study

SP choice data

UNIVERSITY OF LEEDS

- Airport & airline choice in US
- Internet-based
- Up to 10 observations per traveller
- Binomial choice

ITS

Air Travel Study2002

Which would you choose for a trip to Jacksonville International, Jacksonville?

	Your Current Flight	Alternate Flight
CARRIER	American Airlines	Northwest
ON-TIME PERFORMANCE	This flight was on time	80% of these flights are on-time
SCHEDULED IN-THE-AIR TRAVEL TIME	5 hrs. 45 mins.	5 hrs. 45 mins.
ARRIVAL TIME	5:45 PM	7:45 PM
NUMBER OF CONNECTIONS	1	None
AIRCRAFT TYPE	Regional Jet and Standard Jet	Standard Jet
FARE	$250	$188
DEPARTURE AIRPORT	Manchester Airport, Manchester NH	Rutland State Airport, Rutland VT

○ I prefer my current trip ○ I prefer the alternate trip

Question 3 of 10

Progress 80%

NEXT

Air Travel Study2002

Which would you choose for a trip to Jacksonville International, Jacksonville?

	Your Current Flight	Alternate Flight
CARRIER	American Airlines	American Airlines
ON-TIME PERFORMANCE	This flight was on time	90% of these flights are on-time
SCHEDULED IN-THE-AIR TRAVEL TIME	5 hrs. 45 mins.	7 hrs. 15 mins.
ARRIVAL TIME	5:45 PM	4:45 PM
NUMBER OF CONNECTIONS	1	1
AIRCRAFT TYPE	Regional Jet and Standard Jet	Widebody and Propeller
FARE	$250	$125
DEPARTURE AIRPORT	Manchester Airport, Manchester NH	Rutland State Airport, Rutland VT

○ I prefer my current trip ○ I prefer the alternate trip

Air Travel Study2002

Which would you choose for a trip to Jacksonville International, Jacksonville?

	Your Current Flight	Alternate Flight
CARRIER	American Airlines	American Airlines
ON-TIME PERFORMANCE	This flight was on time	80% of these flights are on-time
SCHEDULED IN-THE-AIR TRAVEL TIME	5 hrs. 45 mins.	5 hrs. 45 mins.
ARRIVAL TIME	5:45 PM	4:45 PM
NUMBER OF CONNECTIONS	1	2
AIRCRAFT TYPE	Regional Jet and Standard Jet	Widebody and Propeller
FARE	$250	$125
DEPARTURE AIRPORT	Manchester Airport, Manchester NH	Lebanon Municipal Airport, Lebanon NH

○ I prefer my current trip ○ I prefer the alternate trip

Question 10 of 10

Progress 80%

NEXT

Results for 2000 data

UNIVERSITY OF LEEDS

Effects of:

- air fare (log-linear)
  - with income interaction & distance interaction for holiday & VFR
- access time (log-linear)
  - with distance interaction for VFR
- flight time (log-linear, except for VFR)
- aircraft type
- on-time performance
  - with distance interaction for holiday
- schedule delay
  - with distance interaction for business
- airline allegiance (FF & *preferred* airline)
- airport allegiance

ITS

WTP 1 ($)

UNIVERSITY OF LEEDS

	Business	Holiday	VFR
Reduction in access time (1 hr)	75.40	35.80	35.48
Reduction in SDE (1 hr)	13.27	2.61	3.68
Reduction in SDL (1 hr)	11.08		2.25
On-time (+10%)	10.39	7.02	5.57

ITS

WTP 2 ($)

UNIVERSITY OF LEEDS

	Business	Holiday	VFR
FF elite or elite-plus vs none	125.24	11.44	-
FF standard vs none	49.12		-
Top airport vs worst	83.22	53.97	55.73
2nd airport vs worst	30.56	41.42	54.63
3rd airport vs worst	-	18.54	25.89
Airport closes to home	-	-	28.02
Top airline vs worst	-	25.07	21.06
2nd airline vs worst	-	18.16	15.27
3rd airline vs worst	-	20.09	4.77

ITS

WTP 3 ($)

UNIVERSITY OF LEEDS

	Business	Holiday	VFR
No connection vs one connection	44.15	19.60	18.98
No connection vs two connections		62.21	
Jet vs wide-body	29.86	-13.45	-27.84
Jet vs regional jet	79.51	-1.31	10.59
Jet vs turbo-prop	96.94	1.79	17.77

ITS

Joint study

Study Objective

UNIVERSITY OF LEEDS

Determine whether, and in what ways, U.S. domestic air travel preferences have changed over a period in which air service changed dramatically.

- RP/SP data from U.S. domestic air travel surveys over 8-year period: 2000-2008

- Period of dramatic air service changes, along several dimensions

ITS

Combined study

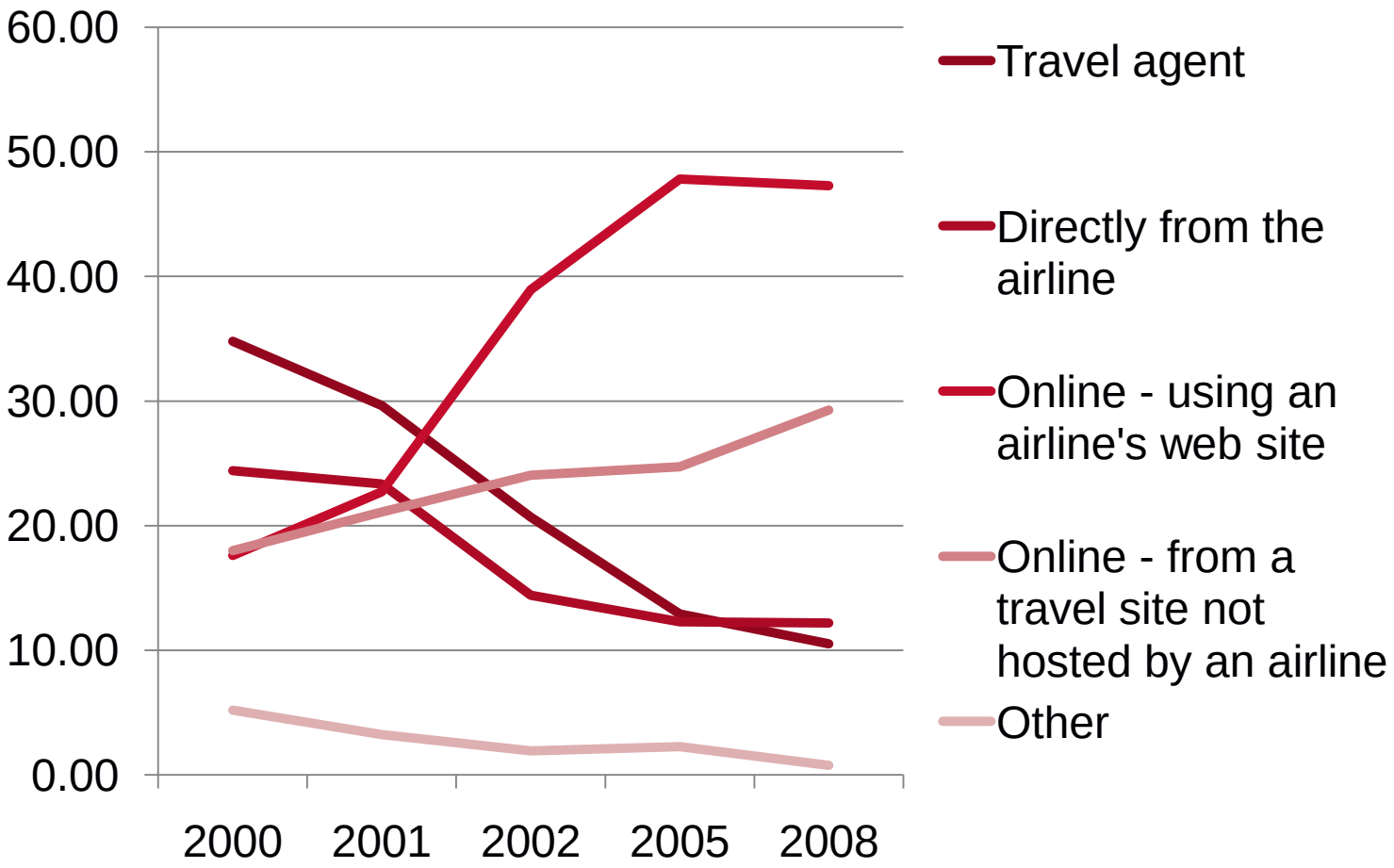
UNIVERSITY OF LEEDS

- Ongoing study
- Look at changes over time
- Combine evidence from four separate datasets
  - Joint model, not just average!
- So far only first four datasets (2000, 2001, 2003, 2005)
- … first, some background questions

ITS

How did you buy your ticket?

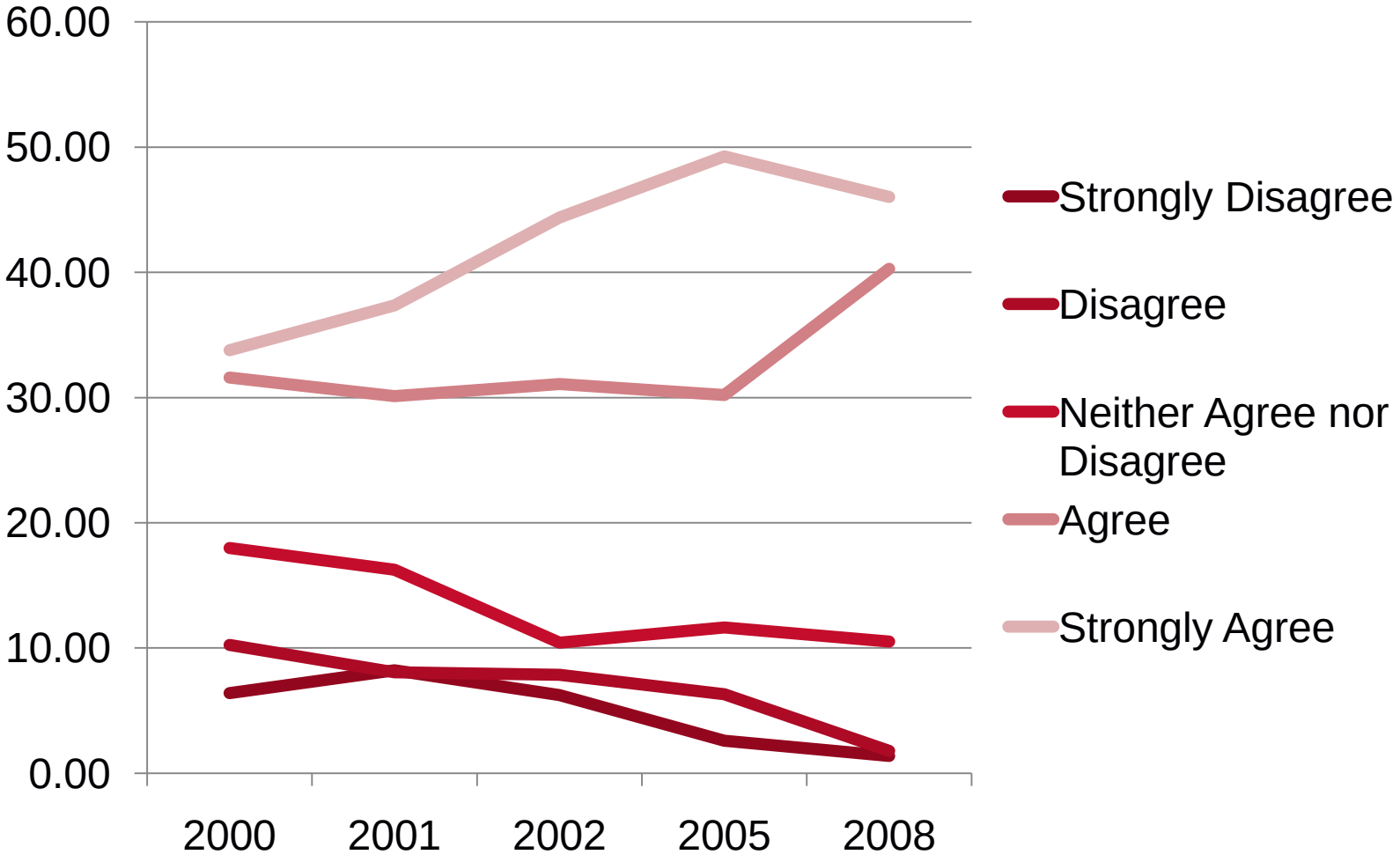
UNIVERSITY OF LEEDS



ITS

I found the best price available

UNIVERSITY OF LEEDS



ITS

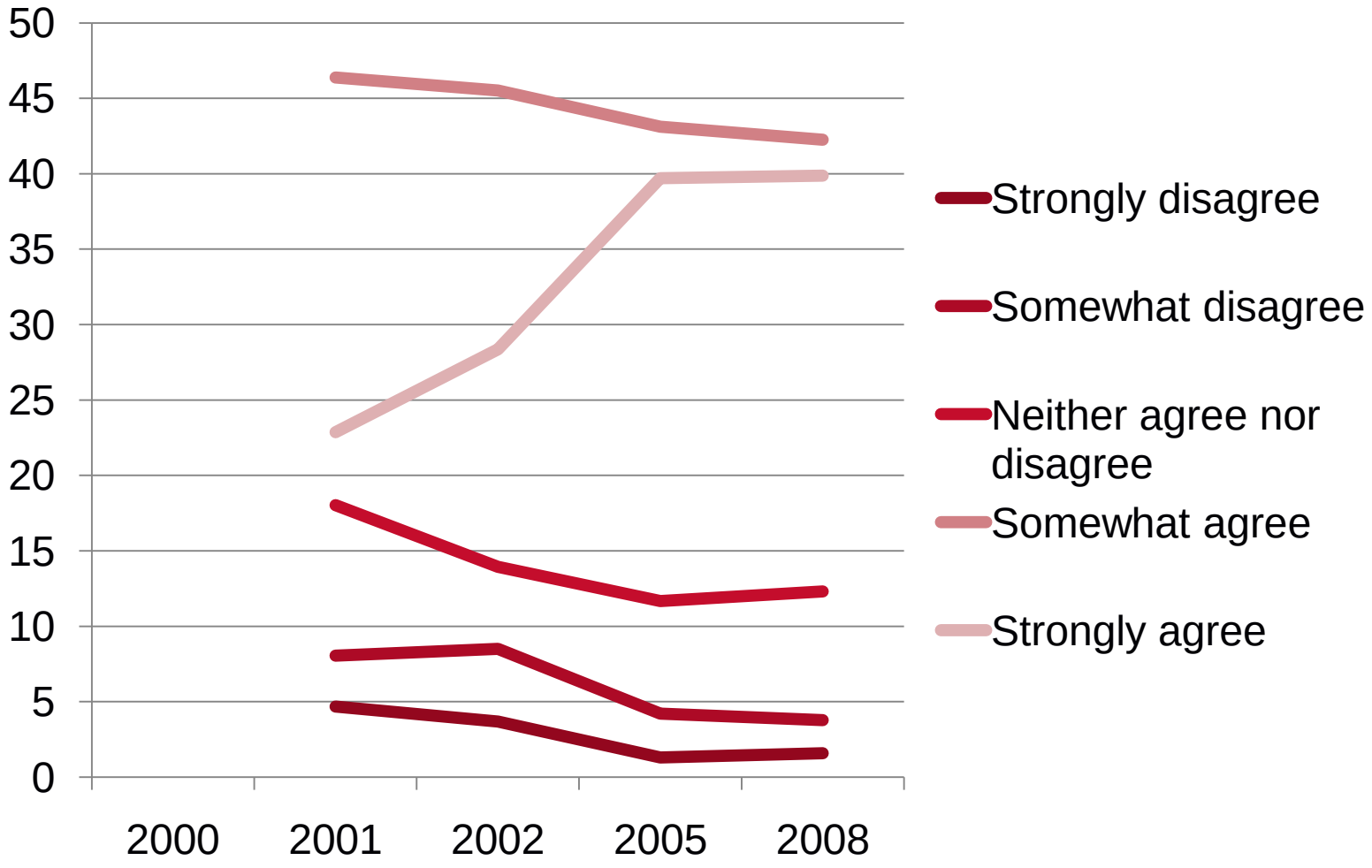
The fare was reasonable

UNIVERSITY OF LEEDS

ITS

Satisfied with everything?

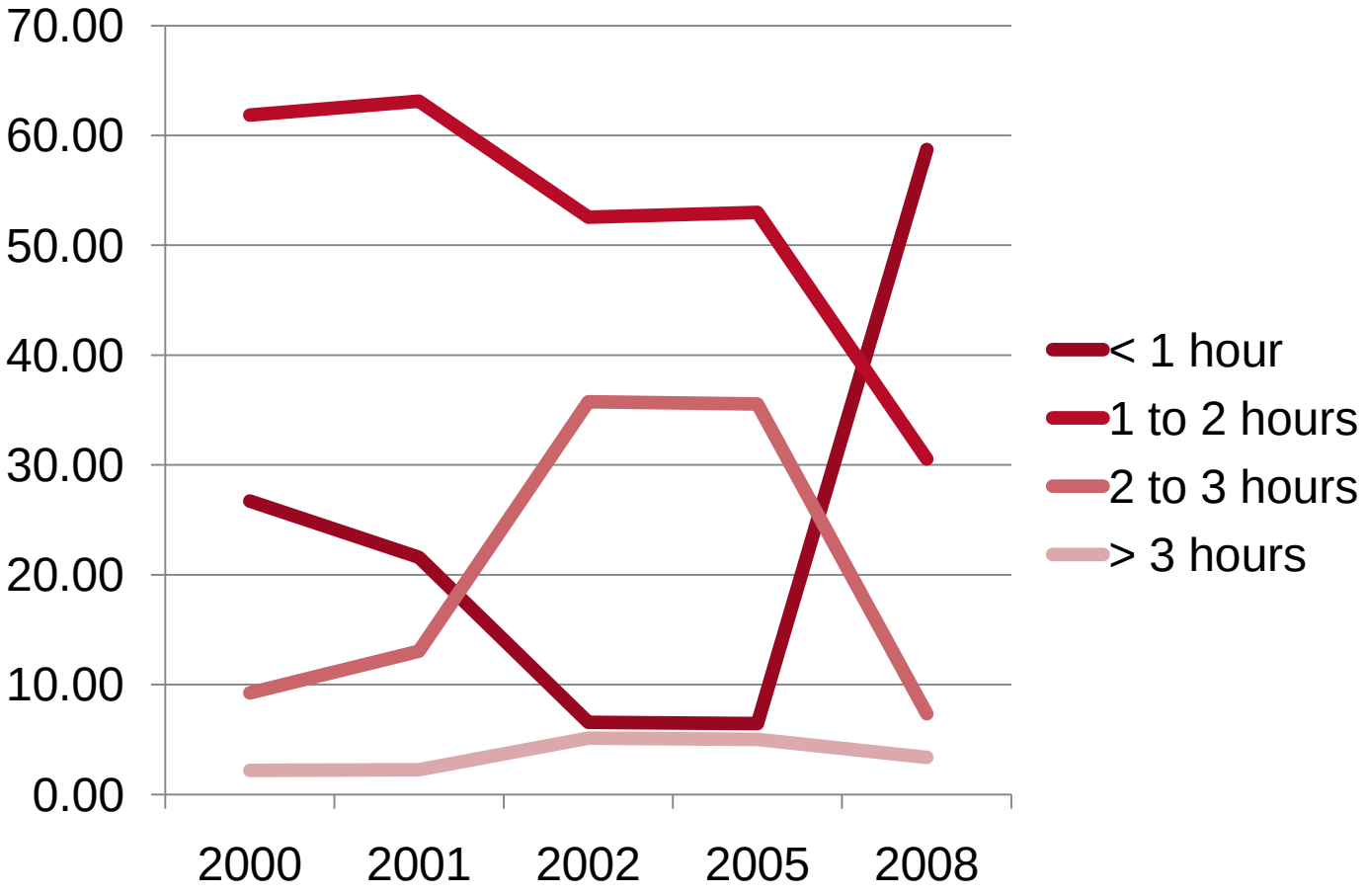
UNIVERSITY OF LEEDS



ITS

Hours before departure at airport?

UNIVERSITY OF LEEDS



ITS

The Survey Datasets

UNIVERSITY OF LEEDS

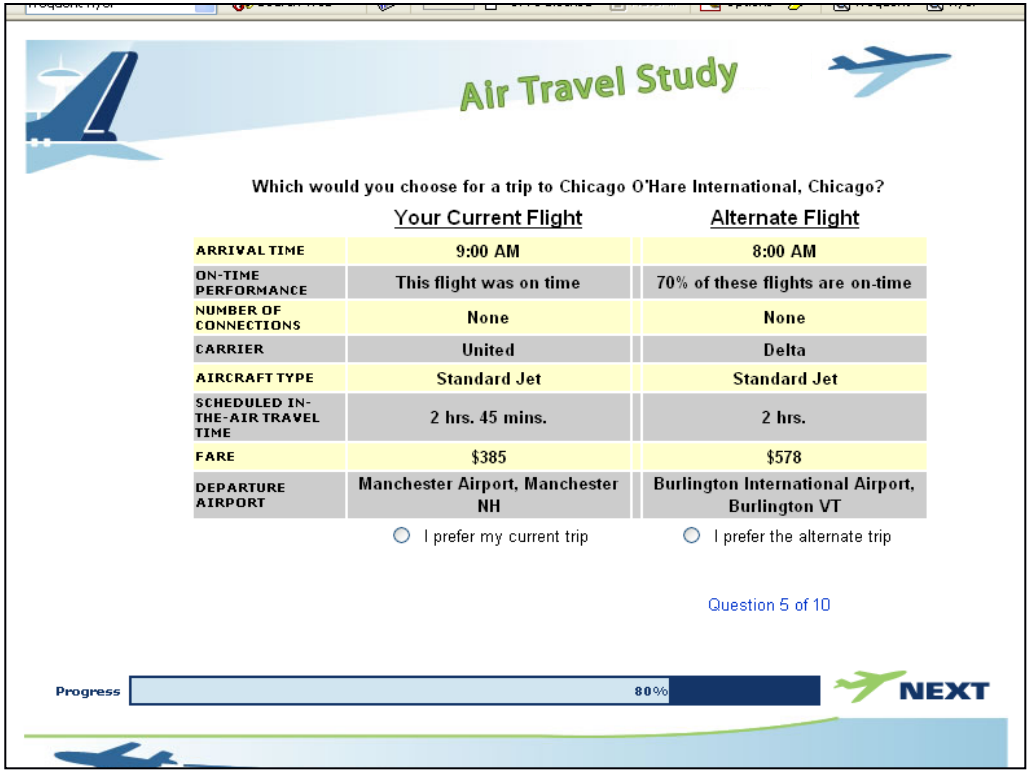
- RSG survey of U.S. domestic air passengers
  - Reservations/ticketing
  - Airport preferences
  - Itinerary choice
  - In-flight service preferences
- Stated choice experiments customised to each respondent's actual itinerary
- Five survey waves to date
  - 2000
  - 2001
  - 2002
  - 2005
  - 2008
- Topical changes each wave but same structure

ITS

Itinerary Choice Data

UNIVERSITY OF LEEDS

- Detailed information on chosen itinerary
  - Airport used plus alternatives
  - Airline used plus alternatives
  - Aircraft type, manufacturer and configuration
  - Desired and actual schedule
  - Service details: fare, access/egress times, flight times, connections, seating, on-time performance
- Stated choice experiments based on chosen itinerary



Air Travel Study

Which would you choose for a trip to Chicago O'Hare International, Chicago?

	Your Current Flight	Alternate Flight
ARRIVAL TIME	9:00 AM	8:00 AM
ON-TIME PERFORMANCE	This flight was on time	70% of these flights are on-time
NUMBER OF CONNECTIONS	None	None
CARRIER	United	Delta
AIRCRAFT TYPE	Standard Jet	Standard Jet
SCHEDULED IN-THE-AIR TRAVEL TIME	2 hrs. 45 mins.	2 hrs.
FARE	$385	$578
DEPARTURE AIRPORT	Manchester Airport, Manchester NH	Burlington International Airport, Burlington VT

I prefer my current trip

I prefer the alternate trip

Question 5 of 10

Progress 80%

NEXT

ITS

Changes in Itinerary Choice

UNIVERSITY OF LEEDS

Air Travel Study2002

Which would you choose for a trip to Jacksonville International, Jacksonville?

	Your Current Flight	Alternate Flight
CARRIER	American Airlines	Northwest
ON-TIME PERFORMANCE	This flight was on time	80% of these flights are on-time
SCHEDULED IN-THE-AIR TRAVEL TIME	5 hrs. 45 mins.	
ARRIVAL TIME	5:45 PM	
NUMBER OF CONNECTIONS	1	
AIRCRAFT TYPE	Regional Jet and Standar	
FARE	$250	
DEPARTURE AIRPORT	Manchester Airport, Manc NH	

I prefer my current t

Progress

Air Travel Study 2005

Which would you choose for a trip to Jacksonville, FL?

		Your Current Flight	Alternate Flight
	AIRLINE	Delta	Continental
	AIRCRAFT TYPE	Regional Jet	Standard Jet
DEPARTURE	AIRPORT	Logan International Airport, Boston MA	Burlington International Airport, Burlington VT
	TIME	8:00 AM	5:00 PM
ARRIVAL	AIRPORT	Jacksonville International	Jacksonville International
	TIME	12:00 PM	10:00 PM
	LAYOVER TIME	1 hr. (your connecting airport requires a minimum of 40 mins. to connect)	40 mins. (the connecting airport requires a minimum of 40 mins. to connect)
	TOTAL TRAVEL TIME	4 hrs.	5 hrs.
	NUMBER OF CONNECTIONS	1	1
	ON-TIME PERFORMANCE	80% of these flights are on time	90% of these flights are on time
	ROUND TRIP FARE	$250	$188
	I would choose:	my current flight	the alternate flight

Question 10 of 10

80%

NEXT

SP exercise modified in 2005 to include transfer detail

Itinerary Choice Modeling

UNIVERSITY OF LEEDS

Previous work:

- Detailed specification testing and mixed logit to capture random heterogeneity
- Identified several important systematic effects
- Found significant random heterogeneity

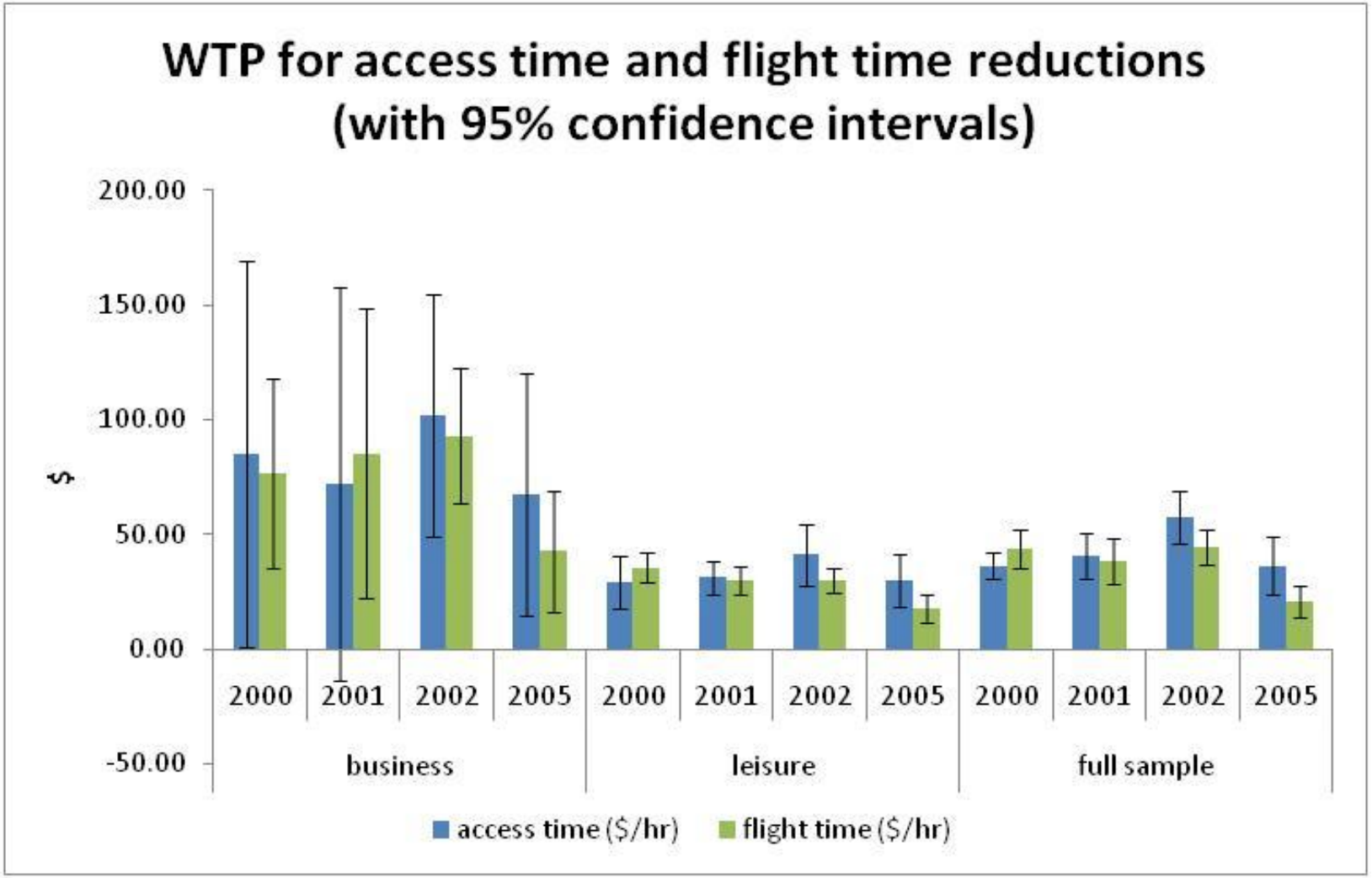
Current work:

- Used simple, consistent specification
- Estimated models in willingness-to-pay (WTP) space
- Included most, but not all SP variables

ITS

WTP to Reduce Access Time and Flight Time

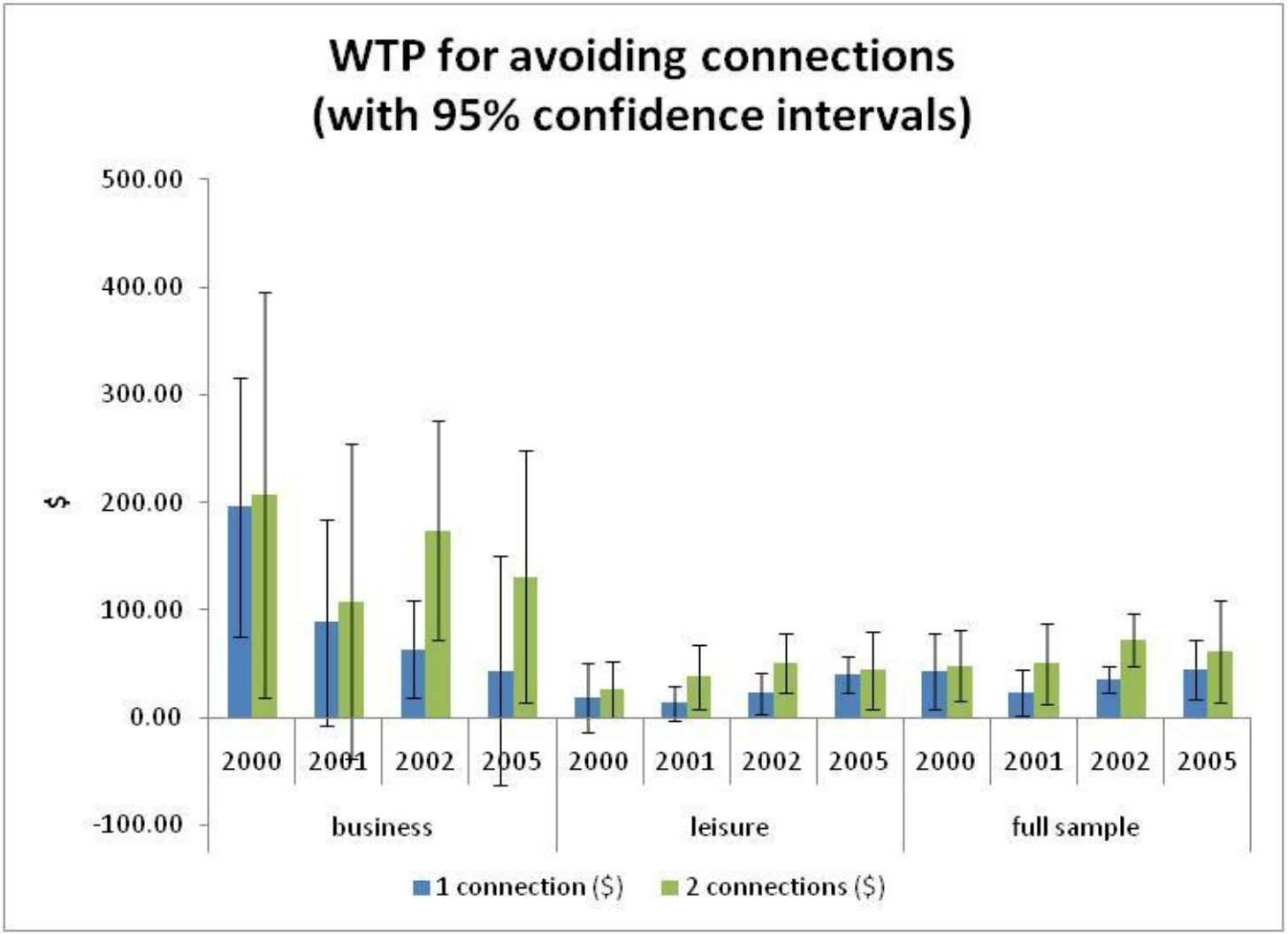
UNIVERSITY OF LEEDS



ITS

WTP to Avoid Connections

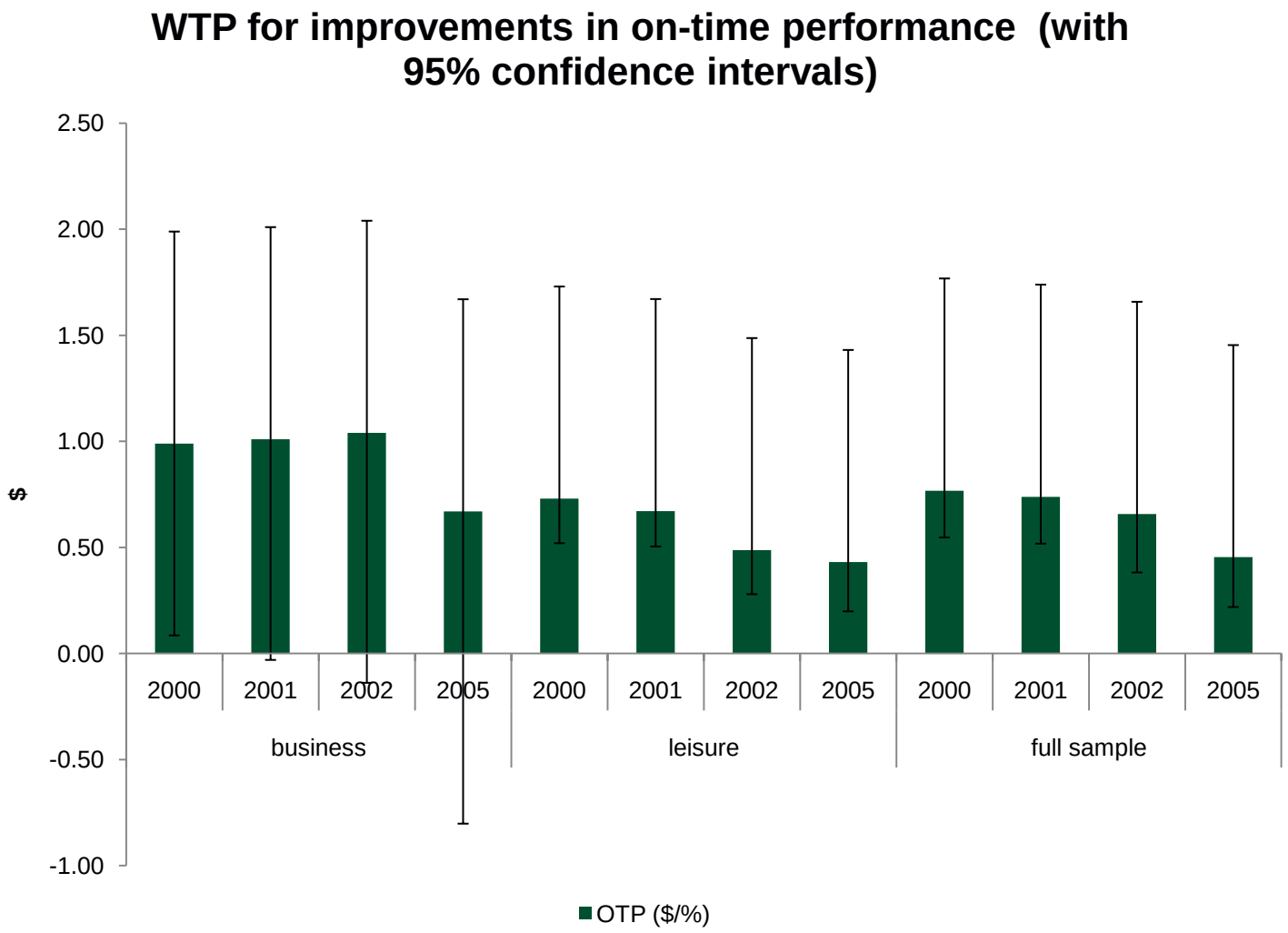
UNIVERSITY OF LEEDS



ITS

WTP for on-time performance improvements

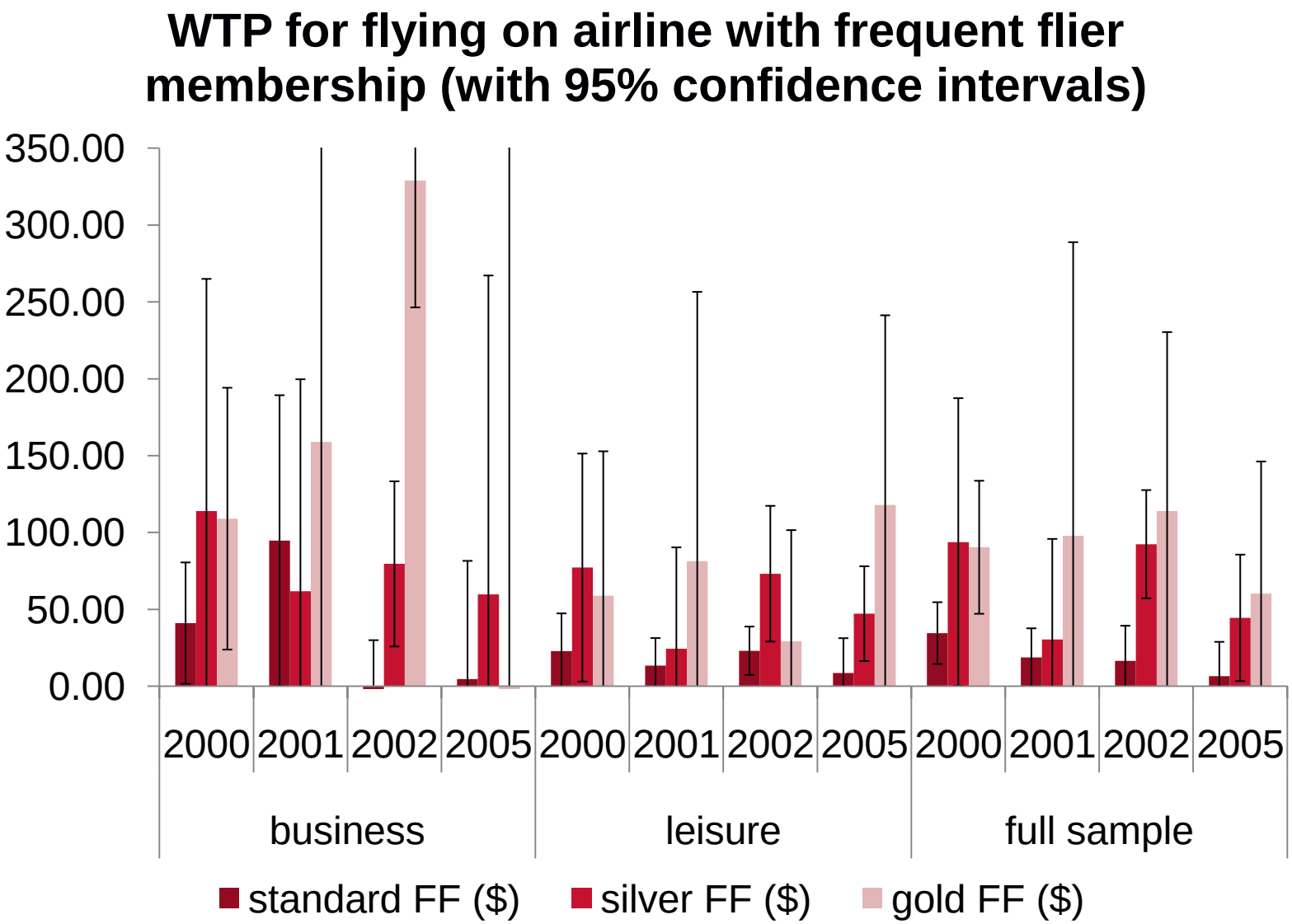
UNIVERSITY OF LEEDS



ITS

WTP for flying on airline with FF membership

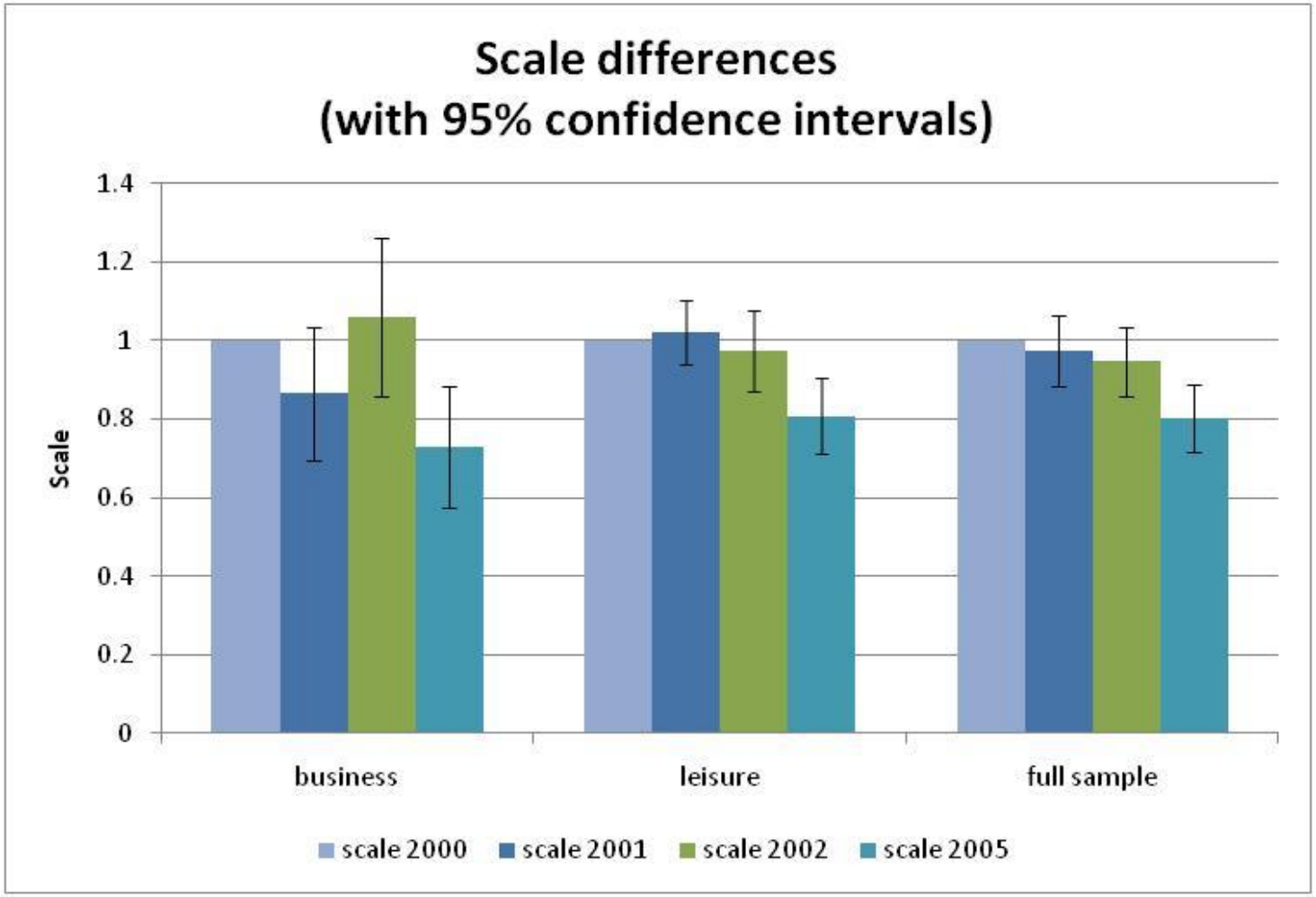
UNIVERSITY OF LEEDS



ITS

Scale Differences Across the Datasets

UNIVERSITY OF LEEDS



ITS

Summary and Conclusions

UNIVERSITY OF LEEDS

- Growing interest in trying to understand what drives air travel behaviour
- While individual studies have been able to produce generally robust and plausible results, results for each study are limited to context of particular data set
- Present paper presents novel application, using four related datasets collected between 2000 and 2005
- Analysis shows decrease in air travellers' WTP measures, especially in 2005, which we explain by growing availability of low cost flight options, increased use of online ticketing and lack of service differentiation among major U.S. carriers
- Results less stable for business travellers: smaller sample, but maybe also greater heterogeneity?

ITS

UNIVERSITY OF LEEDS

Second International Choice Modelling Conference

Leeds, 4-6 July 2011

www.icmconference.org.uk

ITS