



## Wharton Interactive Media Initiative Research Opportunity



PREDICTING & OPTIMIZING CONSUMER RESPONSE  
TO PRODUCT SEARCH RESULTS



# INTRODUCTIONS



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# ABOUT WIMI

## WHARTON INTERACTIVE MEDIA INITIATIVE

- Brings a passionate **data-driven perspective** to media businesses (content distribution and information acquisition).
- Distinguishes itself with a **tight focus on the interaction between content provider and user**, capitalizing on the wealth of individual-level data that is exploding at the crossroads of commerce, technology, and entertainment.
- Is dedicated to bringing **world-class research rigor** to better understand these complex interactions in order to drive new business strategies and tactics that will reshape the media landscape.

# ABOUT WIMI

## WIMI RESOURCES FOR RESEARCHERS

- Research opportunities with corporate partners (e.g., today)
- Assistance with “data wrangling”
- Research funding (e.g., MSI/WIMI CFP on Modeling Multi-Channel Data)
- Promotion of research results among academics
  - Conferences at Wharton
  - Sponsored sessions at conferences (e.g., Marketing Science)
  - WIMI working paper series
- Promotion of results & methods among practitioners
  - Updates on current projects for corporate partners
  - Conferences
  - White papers and other summaries for practitioners
  - On-site tutorials and seminars

# EXPEDIA, INC.

THE DEPTH AND DIMENSION IN EXPEDIA'S PORTFOLIO IS TRULY UNIQUE IN TRAVEL



Retail



Opaque



Package



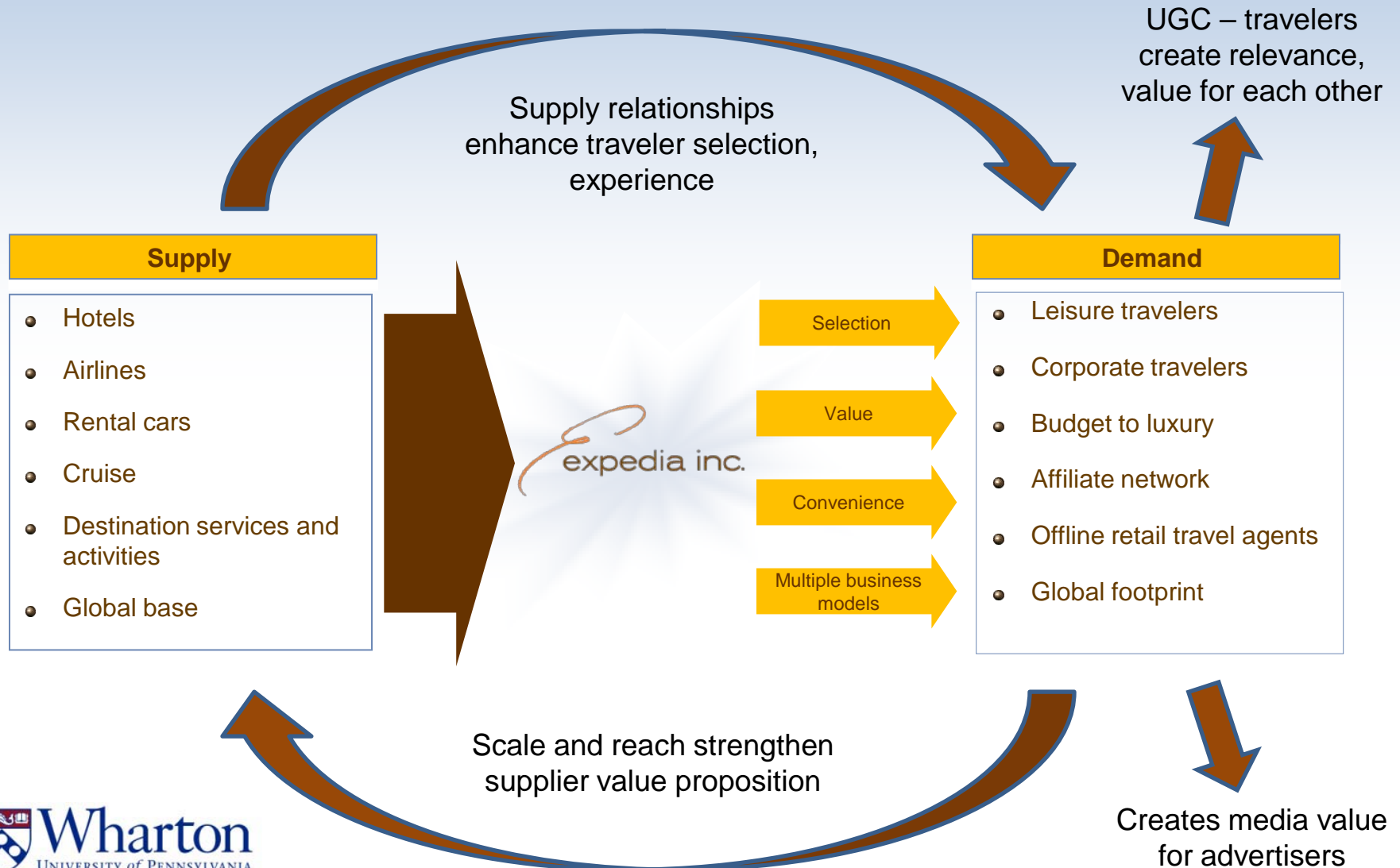
Corporate



Media

# BACKGROUND

## THE WORLD'S LARGEST AND MOST INTELLIGENT TRAVEL MARKETPLACE



# RESEARCH QUESTIONS

- How does the list of hotels displayed to an Expedia user affect the conversion rate for that user?
  - Does the listing order matter? If so, how?
  - Do users respond better to listings that are geographically diverse or diverse in price/quality?
  - Which listing strategies seem to encourage users to continue to refine their criteria versus dropping out? Is there value to looking at the sequence of searches a particular users does?
- How should the search results be optimized to maximize conversion?
- Is there value in tailoring the search results based on other characteristics of the user session? If so, which characteristics are most important?
  - Should results be tailored based on which channel (search engine, tripadvisor.com, etc.) the customer arrived to Expedia through? If so, how?
  - Should results be revised based on which hotels the users looking at in more detail? If so, how?

# DATA

## DATA ON 10,000K+ HOTEL SEARCHES CONDUCTED OCT 1-15, 2009

The image shows a screenshot of the Expedia website's search interface. Several black callout boxes with white text are overlaid on the page, with lines pointing to specific elements:

- Free Text Associated with Search:** Points to the search bar at the top right.
- Region/Distinct Keyword Assigned to that Text:** Points to the search results section, specifically the 'DEALS FROM PHILADELPHIA' header.
- Travel Dates:** Points to the 'Check-in' and 'Check-out' date fields.
- Number of Rooms:** Points to the 'Rooms' dropdown menu.
- Number of Travelers:** Points to the 'Adults (19+)' and 'Children' dropdown menus.
- Time/Date of Search:** Points to the bottom of the page, likely representing the timestamp of the search.

The search form includes the following fields and options:

- Search bar: Search Expedia [Go]
- Navigation: Home, Vacation Packages, Hotels, Cars, Flights, Cruises, Activities, Travel, Rewards
- Search filters: Flight, Hotel (selected), Car, Cruise, Activities, Flight + Hotel, Flight + Car, Flight + Hotel + Car, Hotel + Car
- Find hotels near: [A city]
- What city?: [Center City, Philadelphia, Pennsylvania, U]
- Check-in: [8/15/2010] Check-out: [8/18/2010]
- Rooms: [1] Adults (19+): [2] Children: [0]
- Additional search options (hotel name, hotel class)
- SEARCH FOR HOTELS >

Other visible content includes a 'Book FLIGHT + HOTEL SAVE UP TO \$450\*' banner, an 'Autumn flight sale!' banner, and a 'DEALS FROM PHILADELPHIA' section listing various travel deals.



# DATA

## SOME SEARCHES INCLUDE ADDITIONAL DETAILS

The screenshot displays the Expedia website's search interface for hotels in Philadelphia. At the top, the Expedia logo is on the left, and navigation links for 'Welcome Eleanor', 'Sign Out', 'My Itineraries', 'My Account', 'Customer Support', and 'Feedback' are on the right. A search bar contains 'Search Expedia' and a 'Go' button. Below this is a yellow navigation bar with links for 'Home', 'Vacation Packages', 'Hotels', 'Cars', 'Flights', 'Cruises', 'Activities', 'DEALS & OFFERS', 'Maps', 'Business Travel', and 'Rewards'. The main search area is titled 'Center City hotels' and includes a 'Change your search' link. Search criteria are set to 'Check-in: 8/15/2010', 'Check-out: 8/18/2010', 'Rooms: 1', 'Adults: 2', and 'Children: 0'. A 'NO FEES' badge is visible above the search criteria. On the right, there is a contact box with the number '1-800-551-2409' and a 'Book online or call' button. The search results show '30 Matching hotels (out of 221)'. There are three main filter sections: 'Find by hotel name' with a text input field; 'Select minimum star rating' with a star rating selector set to '3 stars & above'; and 'Hotel preferences' with checkboxes for 'High-speed Internet', 'Air conditioning', and 'Swimming pool'. A 'View hotels on a map' button is also present. Below the filters, there are navigation links for 'Previous', 'Page 1 of 2', and 'Next'. The search results list includes a sponsored listing for 'Sheraton Philadelphia City Center' and a regular listing for 'Hotel Palomar Philadelphia - a Kimpton Hotel'. The Kimpton listing shows a 'Limited Time Offer' of '\$169 \$127 avg/night' and a 'SEE ROOMS & RATES' button. On the right side of the results, there are promotional banners for 'STAY 3 NIGHTS OR MORE, SAVE 20%' and 'plus GET A \$50 PREPAID CARD FOR GAS'.

Specific Property Name

Requested Star Rating

Were Amenities Requested?

# DATA

## FOR EACH SEARCH WE OBSERVE WHICH HOTELS WERE DISPLAYED

Welcome Eleanor [ [Sign Out](#) ] | [My Itineraries](#) | [My Account](#) | [Customer Support](#) | [Feedback](#) | Search Expedia

Home | Vacation Packages | **Hotels** | Cars | Flights <sup>NO FEES</sup> | Cruises | Activities | **DEALS & OFFERS** | Maps | Business Travel | Rewards

**Center City hotels** [Change your search](#)

Check-in:  • Check-out:  • Rooms:

**30** Matching hotels (out of 221)

Sort by:

Find by hotel name:

Show hotels in an area:  [More hotels nearby](#)

Hotel preferences:  High-speed Internet,  Air conditioning,  Swimming pool. [Show more](#)

View hotels on a map

1-800-551-2409  
Book online or call

Previous | Page 1 of 2 | [Next](#)

**Find a deal in our Summer Vacation Sale** (You could save up to 40%! [Show top deals](#))

Sponsored Listing **Sheraton Philadelphia City Center** Star Rating: [SEE DETAILS](#)

**Hotel** Philadelphia, PA  
Spectacular Rates From \$99  
Come enjoy the allure of Philadelphia from the comfort of this centrally located hotel in the heart of the city of Brotherly Love.

Expedia Special Rate **Hotel Palomar Philadelphia - a Kimpton Hotel** **Limited Time Offer!** ~~\$169~~ **\$127** avg/night [SEE ROOMS & RATES](#)

Philadelphia, PA | Area: Center City, Philadelphia [Map](#)  
Centrally located in Philadelphia. this hotel is near

**POINT** Earn **ThankYou® Points** on every hotel. [Learn more](#)

STAY 3 NIGHTS OR MORE, SAVE 20% plus GET A \$50 PREPAID CARD

**Number of Hotels that Meet Search Criteria**

**Hotels Displayed**

**Price Displayed for Each Hotel**

**Was the Price a Promo?**

## WE ALSO OBSERVE WHICH HOTELS WERE VIEWED AND PURCHASED

[Start search over](#)

[Hotel Information](#) ▶

[Pictures](#)

[Location & Map](#)  
Address, Points of Interest

[Hotel Details](#)  
Hotel description, Amenities & facilities

[Traveler Opinions](#)  
Hotel Reviews and Ratings

[Rooms & Rates](#)  
Room description, Room rates

[Bookmark this hotel](#)

[Email this hotel to a friend](#)

[Expedia.com > Hotels > United States of America > Pennsylvania > Philadelphia Hotels > Rittenhouse 1715, A Boutique Hotel](#)

### Rittenhouse 1715, A Boutique Hotel

*Philadelphia boutique bed & breakfast with a complimentary breakfast*

★★★★☆ [Star Rating](#) Book online or call **1-800-551-2409**

**Airport nearby**  
Close to the airport, this bed & breakfast is also near Rittenhouse Square and Rosenbach Museum and Library. Other nearby points of interest include Liberty Bell Center.

[See this hotel on a map](#)

**Complimentary breakfast**  
Rittenhouse 1715, A Boutique Hotel offers a complimentary continental breakfast. Other amenities include concierge services, dry cleaning/laundry services, and a 24-hour front desk.

[More hotel information](#)

**42-inch high-def TVs**  
High-definition televisions come with premium cable channels. Guestrooms also feature complimentary wireless Internet access, a turndown service, and bathrobes.

[More room information](#)

**1-800-551-2409**  
Same great rates plus expert advice.

**Hotels in Philadelphia**

- [Club Quarters in Philadelphia](#)
- [Latham Hotel - Philadelphia](#)
- [Hotel Palomar Philadelphia - a Hotel](#)
- [Sofitel Philadelphia](#)
- [Omni Hotel Independence Park](#)
- [Sheraton Suites Philadelphia Airport](#)
- [The Westin Philadelphia](#)
- [Radisson Plaza Warwick Hotel](#)
- [Le Meridien Philadelphia](#)
- [Sheraton Philadelphia City Center Hotel](#)

[See all hotels in Philadelphia](#)

**4 Star Hotels in Philadelphia**

**Hotels in Philadelphia with 4+ Stars**

- [Hyatt Regency Philadelphia at Penn's Landing](#)
- [Hyatt at The Bellevue](#)
- [Hotel Palomar Philadelphia - a Kimpton Hotel](#)
- [Sofitel Philadelphia](#)
- [Omni Hotel Independence Park](#)
- [Renaissance Philadelphia Airport](#)
- [The Westin Philadelphia](#)
- [Le Meridien Philadelphia aka-Rittenhouse Square](#)
- [Four Seasons Philadelphia](#)

[See all 4+ star hotels in Philadelphia](#)

**Availability: 1 room, 8/15/2010 - 8/18/2010**

To check availability, please supply your dates of stay and the number of travelers below.

Check-in date:  Check-out date:  Rooms:  Adults:  Children:  [Apply](#)

Best Price

Room type	Sun	Mon	Tue	<a href="#">Avg rate</a> (per night)	<a href="#">Book it</a>
Standard Queen <b>Includes: Continental Breakfast</b>	\$170	\$170	\$170	<b>\$169.95</b>	<a href="#">Book it</a>
Superior King <b>Includes: Continental Breakfast</b>	\$260	\$260	\$260	<b>\$259.88</b>	<a href="#">Book it</a>
Deluxe room with queen bed					

Which Hotels Got Click-Throughs? (if any)

Which Hotels got "Book It" Click-Throughs?

Which Hotels Were Purchased?

# DATA

## DATA ON ALTERNATIVE HOTELS DEFINES THE SET THAT COULD HAVE BEEN DISPLAYED

- All hotels available on Expedia in each (Expedia-defined) market
  - Location (latitude and longitude)
  - Star rating
  - Room capacity
  - Parent chain
  - Nearest airport

## COMPETITIVE TRAVEL SITES

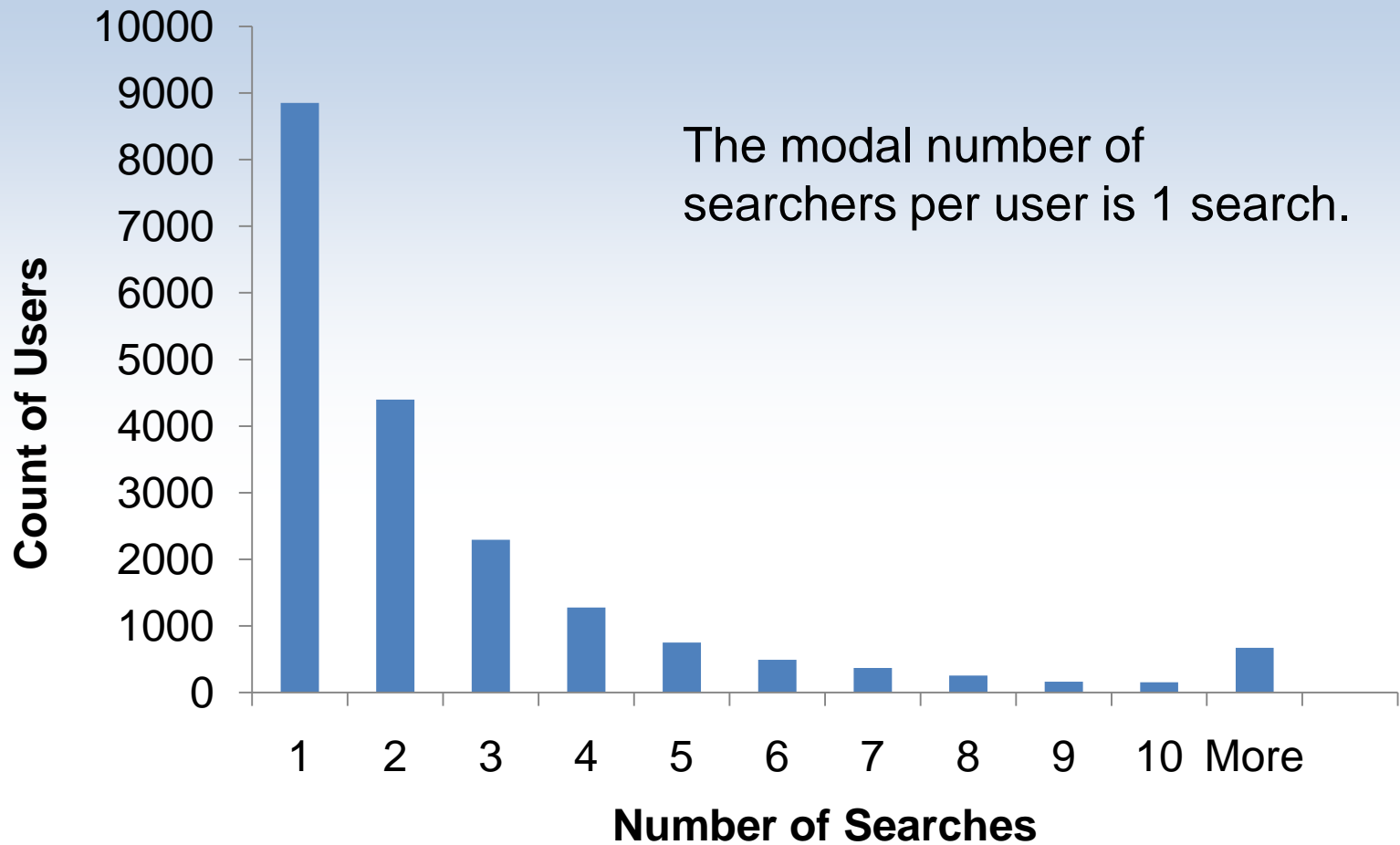
- It is difficult to collect comprehensive data on pricing at competitive sites even using automated scraping tools, due to the large number of possible search criteria
- Some data on available hotels and pricing at competitive travel sites may also be available
  - Competitive site
  - Shop date
  - Check in date / Check-out date
  - Hotel ID
  - Competitive sort rank order
  - Competitive price
  - Boolean indicating whether hotel is sold out on competitor site

# DATA

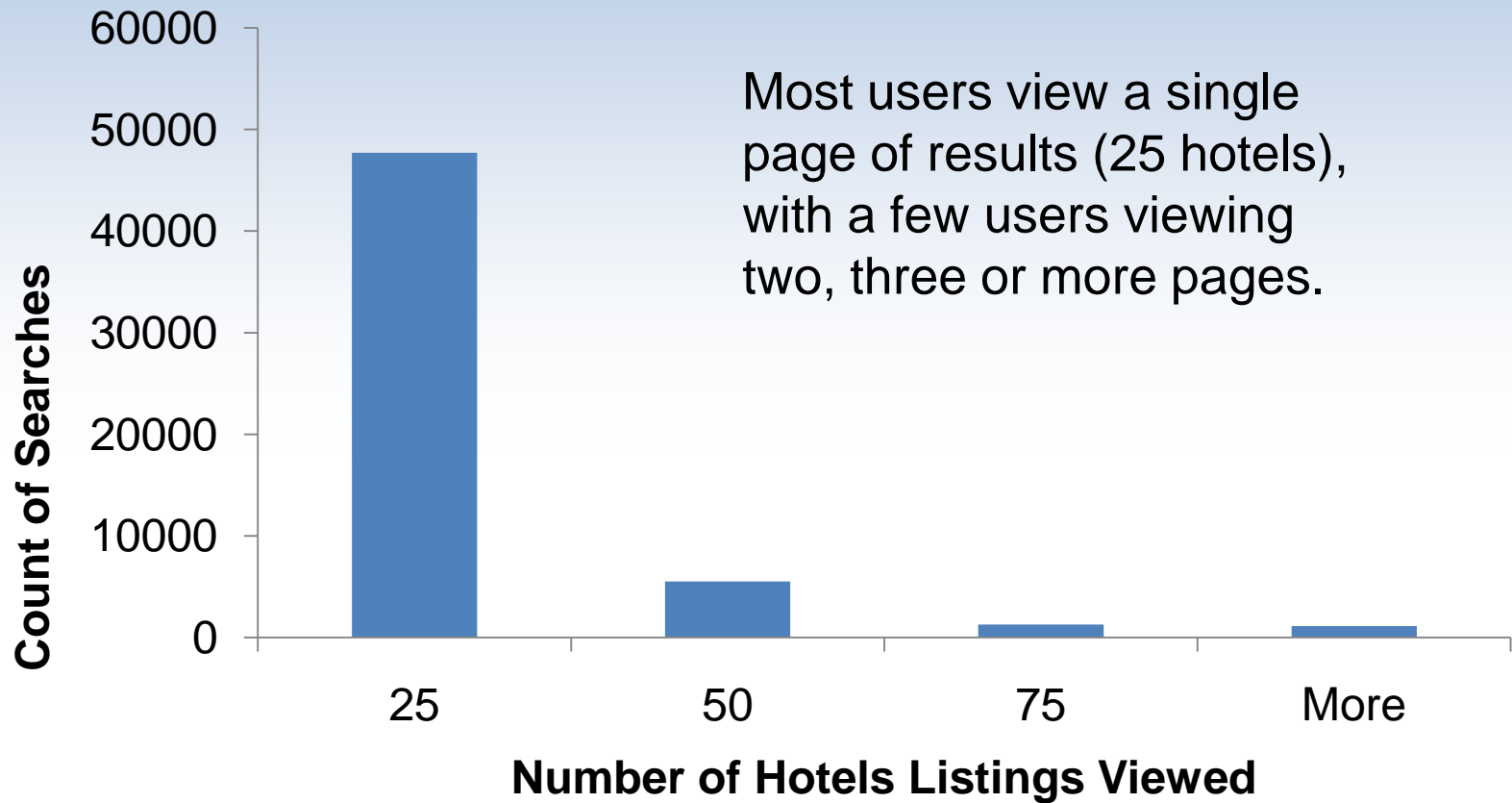
## SUMMARY OF SEARCHERS BY MARKET

Market	Budapest	Cancun	Paris	Manhattan
Hotels	321	115	1674	328
Regions / Distinct Keywords	17	13	102	30
Observed users (cookie-based)	5175	4985	4737	4778
Average number of searchers per user	2.9	2.5	2.8	3.2
Average number of hotel listings viewed for each search	28.5	25.9	28.1	28.4
Average number of hotel details viewed for each search	0.566	0.488	0.394	0.351
Average number of purchases for each search	0.053	0.017	0.024	0.024

# DATA

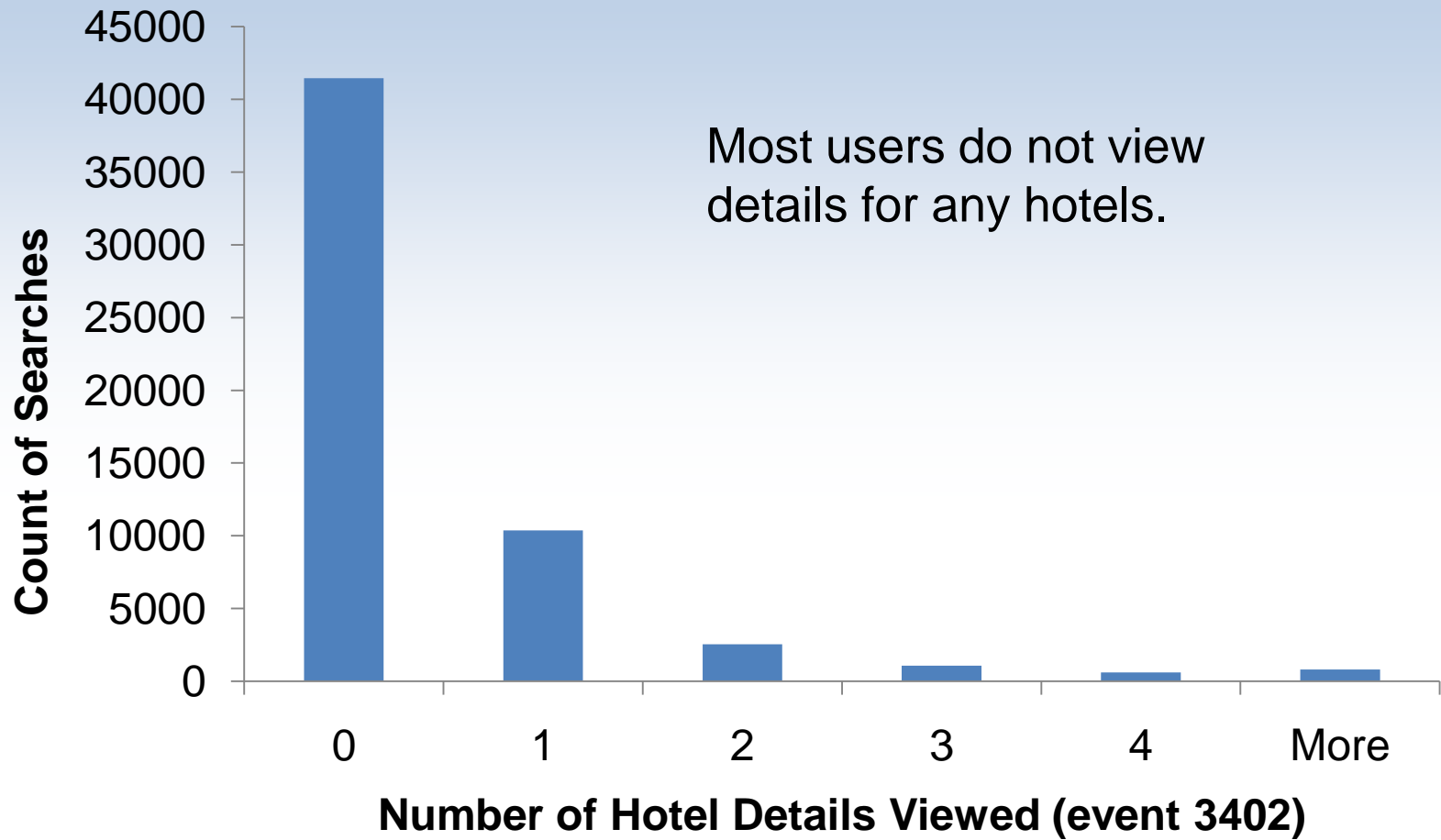


# DATA





# DATA



## CLICK STREAM LEADING UP TO THE SEARCH

- In addition to the search, we have a detailed click stream history for each observed user. From this click stream, we can extract information such as:
  - How did the user arrive at Expedia.com (referring site, search keyword, via online marketing)?
  - What was the landing page at Expedia.com?
  - What promotional pages on Expedia.com were viewed by the user (if any) prior to the search ?

# EXAMPLE COMPLETE CLICKSTREAM

	Date	Channel	Time on Page	Page		
12:34s	6/18/2010 22:17:57	SEM BRANDED	0:39s	Home Page	} First visit, 9 days earlier, looking for flights to Seattle	
			0:33s	Flight Search Disambig		
			1:12s	Flight Search Results (Seattle)		
			0:07s	Home Page		
			0:20s	Flight Search Results (Seattle)		
			2:37s	Flight Search Results (Seattle)		
			0:49s	Flight Search Results (Seattle)		
			2:19s	Flight Search Results (Seattle)		
			3:25s	Flight Search Results (Seattle)		
			0:06s	Flight Search Results (Seattle)		
			0:08s	Flight Search Results (Seattle)		
			0:19s	Home Page		
				Flight Search Results (Seattle)		
	6/27/2010 17:36:56	SEM BRANDED	0:26s	Home Page	} Discovers Opaque	
			0:22s	Hotel Search Results (Seattle, 02-Jul, 03-Jul)		
			0:13s	Hotel Search Results (Seattle, 02-Jul, 03-Jul)		
			0:50s	Opaque Search Results (Seattle, 02-Jul, 03-Jul)		
			0:20s	Opaque Search Results (Seattle, 02-Jul, 03-Jul, Area Map and Details)		
			5:10s	Hotel Search Results (Seattle, 02-Jul, 03-Jul)		
			0:35s	Hotel Search Results (Seattle, 02-Jul, 03-Jul)		
			0:46s	Hotel Search Results (Seattle, 02-Jul, 03-Jul, Show Hotels in an Area)		
			0:46s	Hotel Infosite Overview (The Inn at El Gaucho)		} Begins to filter hotels in area
			0:19s	Hotel Search Results (Seattle, 02-Jul, 03-Jul)		
			0:15s	Hotel Infosite Overview (Hotel Max)		
			0:28s	Hotel Search Results (Seattle, 02-Jul, 03-Jul)		
			0:08s	Hotel Infosite Overview (The Paramount, a Coast Hotel)		
			0:20s	Hotel Search Results (Seattle, 02-Jul, 03-Jul)		
			0:28s	Hotel Infosite Overview (The Paramount, a Coast Hotel)		
			0:15s	Hotel Search Results (Seattle, 02-Jul, 03-Jul)		
			0:28s	Hotel Infosite Map (The Paramount, a Coast Hotel)		
	0:44s	Hotel Search Results (Seattle, 02-Jul, 03-Jul)				

# ADDITIONAL RESEARCH QUESTIONS

- Consumer Behavior/User Interface Design Issues
  - Should Expedia ensure consistency in sort order for repeating shoppers?
  - Would consumers be comfortable with product search listings that adapt to each consumer's past behavior? How can user confusion be minimized?
  - Are there ways to use framing effects to our advantage? E.g., would it be beneficial to show a high priced 5-star next to a great 4-star price to make it more appealing? Or lead in with a very compelling 3-star at the top of page?
  - Should we ensure consistency between our rank order of our hotels vis-à-vis competitors / Trip Advisor to facilitate easy cross-comparison and reinforce the quality of our sort order?
- Strategic issues
  - Can search results can be used by Expedia to manage relationships with hotels (where hotels typically set prices and service quality while Expedia controls search results)?
  - A good majority of Expedia shoppers search on Expedia but buy on the hotel's direct channel? Should we penalize the sort order for those hotels?

We encourage proposals that combine game theoretic or experimental approaches with empirical modeling and optimization.

PLEASE TYPE IN YOUR QUESTIONS FOR EXPEDIA ABOUT  
THE RESEARCH PROBLEM.

# NEXT STEPS

## TO PURSUE THIS RESEARCH OPPORTUNITY:

- Submit a brief proposal to [efeit@wharton.upenn.edu](mailto:efeit@wharton.upenn.edu) by August 16, 2010
  - Research team
  - Objectives & contribution
  - Proposed methods
  - Timeline
  - Potential for managerial insights & impact
  - Preferred data format
  - Funding requests (if any)
- WIMI and Expedia will evaluate the proposals and choose a team
- Clean data can be in your hands by the end of August!

PLEASE TYPE IN QUESTIONS FOR  
WIMI ABOUT THE PROCESS

# NEXT STEPS

## THERE ARE MANY OTHER WAYS TO GET INVOLVED

- See [www.whartoninteractive.com/research.asp](http://www.whartoninteractive.com/research.asp) for the latest information on
  - Future Research Opportunities like this one
  - Funding opportunities
  - WIMI working papers
  - Other ways to get involved with WIMI
- Sign up for e-mail updates at [www.whartoninteractive.com/newsletter.asp](http://www.whartoninteractive.com/newsletter.asp)
- Attend the MSI/WIMI Conference on Modeling Multichannel Consumer Behavior, December 9-10, 2010 at Wharton
- Contact Elea McDonnell Feit, WIMI Research Director ([efeit@wharton.upenn.edu](mailto:efeit@wharton.upenn.edu))