Willingness to Pay and The Demand for Broadband Access

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Presentation to BROADBAND MARKETS: BRINGING TOGETHER SUPPLY AND DEMAND
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Presentation Outline

- Statistics
- Questions
- Broadband Demand
  - Descriptive analysis
- Broadband Demand
  - Models
- Conclusions
Statistics
Cautionary Note

“If data analysis is to be well done, much of it must be a matter of judgment, and ‘theory’, whether statistical or non-statistical, will have to guide, not command.”

John W. Tukey, Annals of Mathematical Statistics, Vol 33, Number 1, March 1962
Also, keep in mind


- “By no process of sound reasoning can a conclusion drawn from limited data have more than a limited application” J.W. Mellor, Higher Mathematics for Students of Chemistry and Physics
Questions

- Are the “drivers” of broadband the same as the “drivers” of dial-up Internet access?
- Is there evidence of a broadband “Digital Divide”?
- Do “applications” correlate with the choice of access?
- How important is price?
Descriptive Assessment

- Broadband Access
  - Income
  - Education
  - Household Size
  - Age
Distribution of Internet Penetration by Income

Source: MSG Centris Omnibus Survey. Unconditional Rates
Internet and Education

Source: MSG Centris Omnibus Survey. Unconditional Rates
Internet Penetration and Household Size

- **No internet**
- **Dial**
- **Broadband**
Internet Penetration by Age

Source: MSG Centris Omnibus Survey. Unconditional Rates
Analysis of Basic Demographics

Whereas the availability of broadband service matters in the choice of broadband, household demographics are of limited value when attempting to classify households as broadband or narrowband!
Descriptive Analysis

Household Internet Activity
Household Activity

- Type of sites visited
- Number of sites visited
- Frequency of sites visited
- Time site was visited
- Duration of a visit
- Other activity derived from the visit
Distribution of Sites by Access
Distribution of type of site visited
Distribution of hours on line
Distribution by time of day

Usage Distribution By Time of Day

- Narrowband
- Broadband
Usage Characteristics

![Bar chart showing usage characteristics for narrowband and broadband.

- **Minutes of Use**
  - **mean**
  - **median**
  - **standard deviation**

- **Narrowband**
- **Broadband**

- The chart compares the usage in terms of minutes of use for different categories of users.
Average Share of Visits by Category

![Bar graph showing average share of visits by category for Dial-Up and Broadband connections.](image-url)
Downloading Intensity

Source: Click-stream data from Plurimus, Inc.
Models

- Discriminant Models
- Discrete Choice
- Discrete – Continuous Choice
- Contingent Valuation
Discriminant Analysis

- Classification of broadband users
  - Higher levels of income
  - Higher levels of education
  - Age 30-50
  - Visits to business sites, financial sites and entertainment sites

- Internet activity important in classifying access
Discrete Choice

- **Choices**
  - Dial-up vs No Internet
  - Dial-up vs Cable modem
  - Dial-up vs ADSL
  - Dial-up vs Cable modem or ADSL
  - Cable modem vs ADSL
## Dial-up vs CM Access Elasticities

<table>
<thead>
<tr>
<th></th>
<th>Dial-up</th>
<th>CM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dial-up</td>
<td>-0.230</td>
<td>0.518</td>
</tr>
<tr>
<td>CM</td>
<td>0.010</td>
<td>-0.895</td>
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## Dial-up vs ASDL Elasticities

<table>
<thead>
<tr>
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<th>ASDL</th>
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<tbody>
<tr>
<td>Dial-up</td>
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<td>0.423</td>
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<tr>
<td>ASDL</td>
<td>0.040</td>
<td>-1.364</td>
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</tbody>
</table>
Discrete – Continuous Choice
Problem: Choice and Usage Jointly Determined

Time online
Choice of Access
Activity
Type of sites visited
Discrete – Continuous Choice

- Issues
  - Access choice and usage jointly dependent
  - All other measures of usage such as sites visited, frequency of visits, duration of visit are also endogenous
  - Modeling requires (at a minimum) a nested logit framework estimated within a simultaneous equations framework
  - Estimation requires detailed household specific variables
Willingness to Pay
Contingent Valuation: Overview

- Method that requires asking people directly, in a survey, how much they would be willing to pay for a specific service.

- “Contingent” in the sense that people are asked their willingness to pay, contingent on specific hypothetical scenario.
Problem(s)

1. Can willingness to pay (WTP) information be obtained from surveys and used to describe “demand”? 
2. How do estimates of elasticities for broadband services compare to published estimates? 
3. Can the use of WTP be generalized and applied to other products and services?
Focus is on the price of the service – thus economic value associated with a service is generally bounded

Application is directed towards the estimation of price elasticities
Lognormal Demand Curves

- Let
- Then
- Assuming that $p$ is distributed as a lognormal with parameters
Lognormal Demand

We have:

Let $Q$ represent the expected proportion of buyers we have:

\[ Q(\tau) \approx 1 - e^{-\frac{\sigma^2}{2} - \frac{\tau^2\sigma^2}{2}}. \]
Data

- 12,000 responses to an omnibus survey administered during the second quarter, 2003.
- Questions included for broadband service (ADSL, Cable Modem) – WTP.
Application to Broadband

- Question 1  What is the least price at which the respondent would consider the item too expensive

- Question 2  What is the highest price at which he would dismiss it as a shoddy article of inferior quality
Computation

- Compute the fraction of respondents quoting a threshold price that exceeds a price \( p \).
- Plot \( Q(p) \) against \( p \)
- Estimate lognormal parameters from the data
- Elasticity given by
Demand for Cable Modem Service

Figure 1: Cable Modem Demand
## Cable Modem Elasticity

<table>
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<tr>
<th>Price</th>
<th>Elasticity</th>
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<tbody>
<tr>
<td>$20</td>
<td>-0.45</td>
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<tr>
<td>$30</td>
<td>-0.65</td>
</tr>
<tr>
<td>$40</td>
<td>-0.87</td>
</tr>
<tr>
<td>$50</td>
<td>-1.23</td>
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<tr>
<td>$60</td>
<td>-1.58</td>
</tr>
<tr>
<td>$70</td>
<td>-1.83</td>
</tr>
</tbody>
</table>
Elasticity

- Initial estimates are in line with previously published values (evaluated at price of $40-$50)
  - Rappoport, Taylor, Kridel
    - CM (-0.81 -1.05)
    - DSL (-1.17 -1.55)
  - WTP
    - CM (-0.87 -1.23)
Conclusions

- Theory of consumer choice appears to “work” (easily implemented)
- Illustrates potential value using WTP approach
- Derived elasticities in line with other published results
Conclusions

- Demographics play a minor role in predicting broadband vs narrowband users
- Internet activity (usage) helps discriminate between narrowband and broadband users
- Price matters
- Keep in mind, in the U.S., the top three usage-based activities are: (1) Gaming, (2) gambling and (3) other entertainment
Conclusion

- Prices for broadband will fall
- Entertainment is the focus of content providers, ISPs and telecom companies
- No evidence of a digital divide, though less densely populated areas are less like to have broadband
- No compelling reason for government subsidies or policies promoting broadband
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