

Online Product Search

Michael R. Baye

Keynote for the

Fifth Annual Federal Trade Commission Microeconomics Conference

Washington DC, November 16, 2012



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Joint Work with Babur De los Santos & Matthijs R. Wildenbeest

- “The Evolution of Product Search”
- “What’s in a Name? The Effects of Prominence on Retailer Traffic from Search Engines”
- “Estimating the Effects of Brand Equity on Consumer Behavior at Search Engines”



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Recent Theoretical Work Suggests “Prominence” Impacts Competition in Search Markets

- Arbatskaya (*Rand* 2007)
- Armstrong, Vickers and Zhou (*Rand*, 2009)
- Armstrong and Zhou (*EJ*, 2011)



This Talk

- How “prominence” impacts the organic clicks retailers get from product searches at search engines
 - Position prominence
 - Name prominence
- Example: Google the search phrase “best selling managerial economics textbook”



Google Search Results



best selling managerial economics textbook



Search

About 1,700,000 results (0.35 seconds)

Web

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★ ★ ★ ☆ ☆ Rating: 3 - 1 review

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Organic Results



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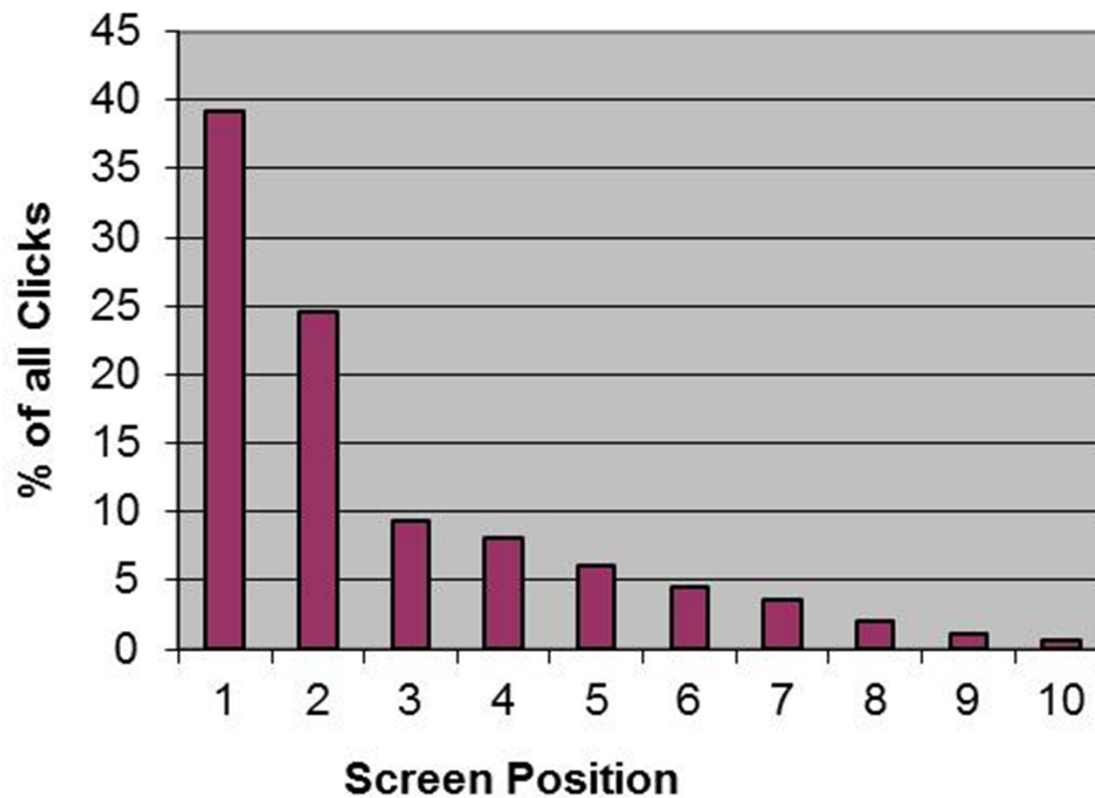


Lots of Evidence That Position Matters

- Offline markets (yellow pages, voting, academic citations, etc.)
 - De los Santos & Koulayev (2012)
- Online markets (price comparison sites, paid ads at search engines, etc.)
 - Brynjolfsson et al., 2010; Ghose and Yang (2009); Baye et al. (2009)



Example: Screen Position and Clicks at Kelkoo.com (Baye et al., 2009)





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Ways Retailers Influence The Prominence of Their Names

- Investments in brand awareness and name recognition
 - Traditional (TV, radio, print) and online advertising
- Build customer-centric websites and distribution networks
 - Product breadth and depth
 - Shopping experience
- Investments in reputation
 - Prices, quality, shipping, returns policy
- Blend of all these and other investments



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Why It's Hard to Measure the Prominence of a Retailer's Name

- Multi-dimensional nature of investments
- Thorny stock/flow issues
- Typically requires time-series data that are often unavailable
 - Many online retailers are not publically traded and don't disclose information
 - Publically traded retailers don't disclose all relevant information



Our Measure: Number of “Name Searches” on a Search Engine

- Name Search: Search phrase that includes the name of the retailer, including misspellings:
 - “Buy camera at Amazon”
 - “Amazon.com”
 - “www.Amazon.com”
 - “Amazn”
- Count a name search when consumers click on results page to the named site.
- Interpret as measuring brand awareness/equity, name recognition, or “name prominence”



Example: Selected Search Terms Leading Users from Google to Amazon

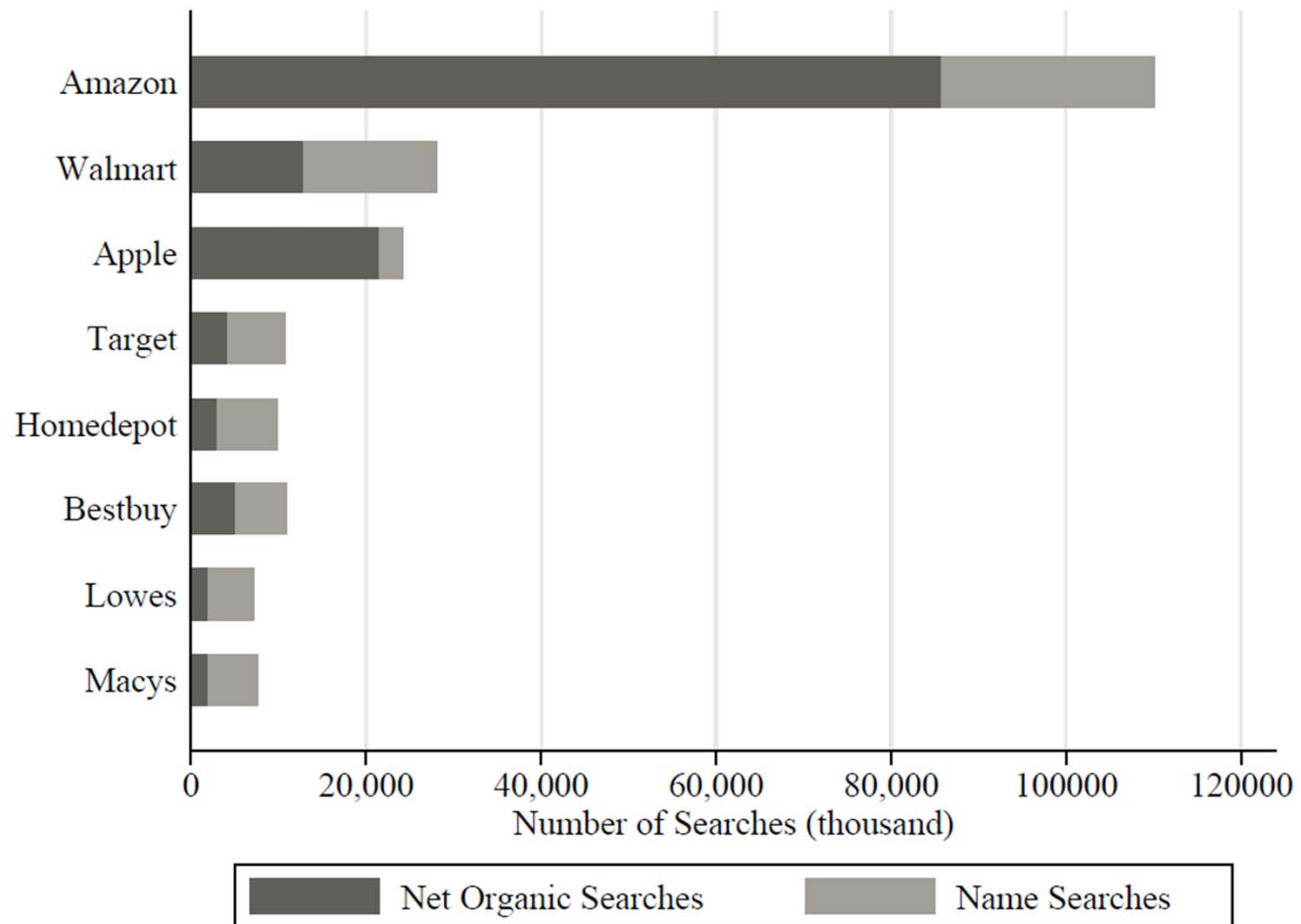
| Rank | Search Phrase | # Organic Clicks |
|------|-------------------|------------------|
| 1 | amazon | 9,006,624 |
| 2 | amazon.com | 1,207,598 |
| 3 | www.amazon.com | 247,793 |
| 4 | kindle | 146,406 |
| 5 | 50 shades of grey | 116,359 |
| 6 | ebay | 106,062 |
| 7 | name name | 105,408 |
| 8 | amazon books | 100,357 |
| 9 | *** | 96,165 |
| 10 | name last name | 90,934 |
| 11 | kindle fire | 76,201 |
| 12 | google | 72,856 |
| 13 | name name book | 66,754 |
| 14 | amzon | 63,852 |
| 15 | amazonprime | 56,407 |

| Rank | Search Phrase | # Organic Clicks |
|------------------|----------------------------|------------------|
| 16 | boss orange name | 55,281 |
| 17 | amazon kindle | 55,272 |
| 18 | amazon prime | 55,259 |
| 19 | kim kardashian sex tape | 54,028 |
| 20 | first name review | 51,240 |
| 30 | fifty shades of grey | 29,303 |
| 40 | amazo | 22,909 |
| 50 | bosch name | 18,878 |
| 60 | insanity workout | 15,634 |
| 70 | metal detectors | 14,419 |
| 80 | the night dad went to jail | 13,502 |
| 90 | target | 12,125 |
| 100 | name name books in order | 11,301 |
| All Search Terms | | 79,244,892 |



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Name Searches and Net Organic Searches, Selected Retailers





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Advantages of Our Proposed Measure of Name Prominence

- Measurable
- Embodies the “effective quality” of all investments by retailers to create brand awareness (consumer preferences)
- Represents the stock of name prominence



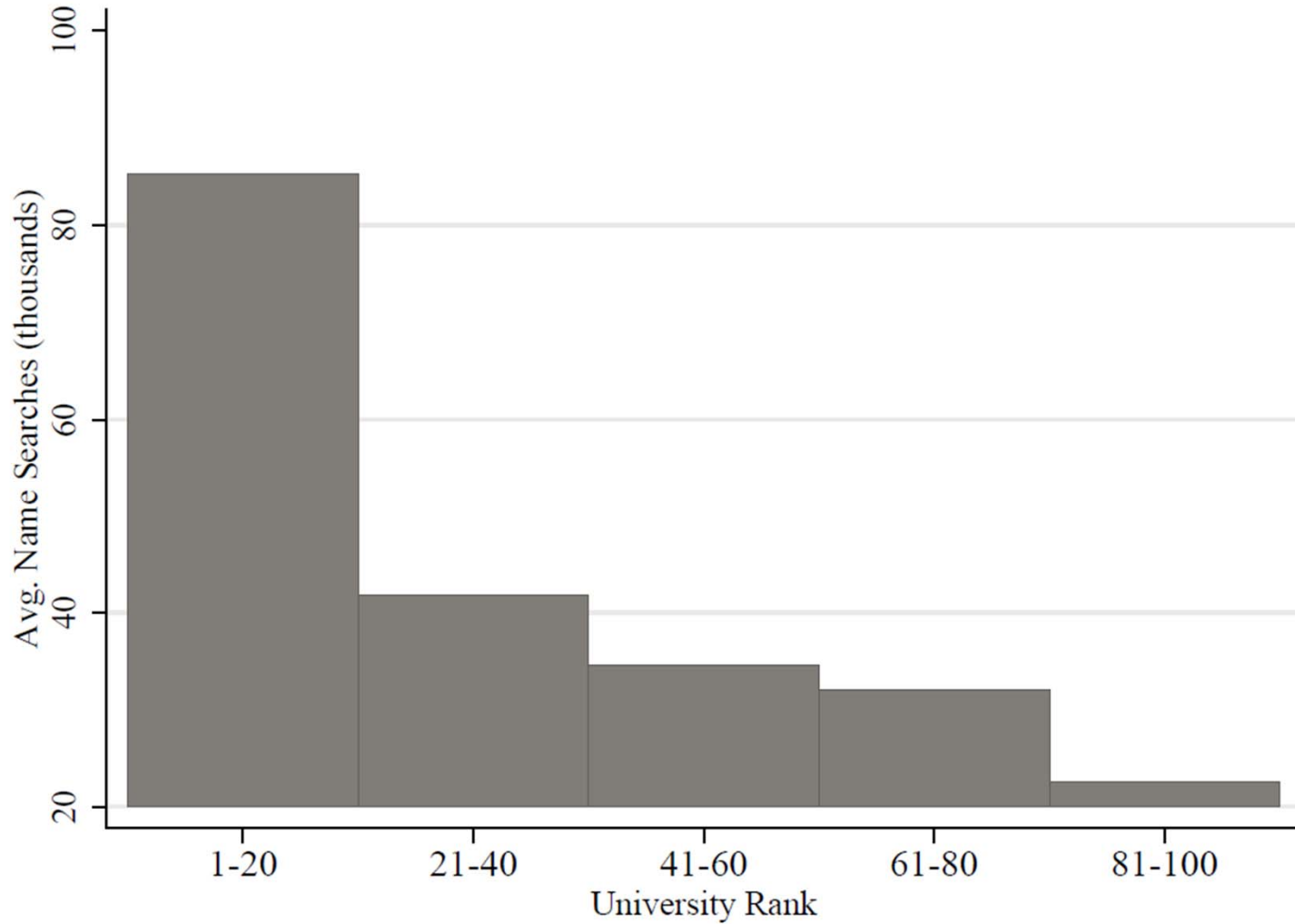
Smell Test: Does the Measure Work?

- Independent measure of “prominence” of universities:
 - *U.S. News and World Report* rankings of top 100 universities
- Used comScore data to measure number of name searches on Google for top 20 universities, second 20 universities, and so on)



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Name Searches and University Rank





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Three Datasets





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Data Set 1: ComScore Search Planner

- Two million users in US, June 2012
- Search phrases leading users from search engines (Google, Bing) to different sites
- Number of organic clicks each site gets from results pages based on each search phrase



Data Set 2: Internet Retailer

- Top 500 internet retailers
 - Amazon/Zappos; Sears/Kenmore, etc.
- Matched these with 759 retail sites tracked by comScore
- Identifies retailer category (15 categories such as apparel/accessories, office supplies, etc.)
- Whether site has presence on a social network site (Facebook/Twitter)
- Age of site
- Whether company is “Web Only” or also has brick-and-mortar presence



Data Set 3: Position Data

- Collected using program we wrote in Java
- 5,549 distinct search phrases in comScore data led users to the 759 sites
- Queried Google and Bing with each phrase, extracted
 - Each retailer's organic results position
 - Whether retailer had a first-page ad based on each distinct search phrase



Key Variables

- **Net Organic Clicks**
 - Retailer's total organic clicks minus its organic clicks from name searches
- **Position:** Bins for retailer's average screen position
- **Name Recognition:** Bins for total number of name searches
- **Ads:** Number of times a retailer's ad was on page 1 of search results
- **Social Network Presence** (indicator)
- **Retailer Age** (years)
- **Web Only** (indicator)



Summary of Baseline Results

- Position and name prominence important
- Position effects overstated if ignore name prominence
- Ads enhance organic clicks
- Robust to including other potential controls

Table 3. Baseline Model
 Dependent Variable: ln(Net Organic Clicks on Google)

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|-----------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <i>Position on Google</i> | | | | | | | |
| Poor | 1.307 (0.226)* | 1.328 (0.235)* | 1.279 (0.230)* | 1.258 (0.234)* | 1.263 (0.238)* | 1.221 (0.204)* | 1.400 (0.212)* |
| Below Median | 2.009 (0.220)* | 1.846 (0.232)* | 1.718 (0.229)* | 1.707 (0.232)* | 1.715 (0.237)* | 1.761 (0.203)* | 1.862 (0.208)* |
| Median | 3.022 (0.223)* | 2.479 (0.246)* | 2.264 (0.250)* | 2.277 (0.254)* | 2.281 (0.259)* | 2.234 (0.226)* | 2.666 (0.225)* |
| Above Median | 3.886 (0.223)* | 2.993 (0.262)* | 2.773 (0.276)* | 2.811 (0.280)* | 2.828 (0.287)* | 2.881 (0.250)* | 3.412 (0.242)* |
| Best | 5.543 (0.223)* | 3.925 (0.300)* | 3.557 (0.344)* | 3.499 (0.349)* | 3.502 (0.358)* | 3.475 (0.311)* | 4.398 (0.290)* |
| <i>Name Recognition on Google</i> | | | | | | | |
| Poor | | 0.691 (0.224)* | 0.729 (0.219)* | 0.703 (0.223)* | 0.731 (0.228)* | 0.738 (0.201)* | |
| Below Median | | 1.094 (0.237)* | 0.957 (0.234)* | 0.942 (0.237)* | 0.967 (0.242)* | 1.042 (0.211)* | |
| Median | | 0.971 (0.239)* | 0.896 (0.234)* | 0.915 (0.237)* | 0.944 (0.242)* | 1.186 (0.220)* | |
| Above Median | | 1.045 (0.259)* | 0.810 (0.256)* | 0.894 (0.259)* | 0.928 (0.264)* | 1.183 (0.245)* | |
| Best | | 2.119 (0.299)* | 1.858 (0.297)* | 1.958 (0.301)* | 1.980 (0.307)* | 1.952 (0.282)* | |
| ln(# Ads on Page 1) | | | 0.253 (0.080)* | 0.253 (0.081)* | 0.249 (0.083)* | 0.289 (0.072)* | 0.379 (0.073)* |
| Social Network Presence | | | | 0.268 (0.221) | 0.243 (0.225) | 0.564 (0.197)* | 0.480 (0.206)* |
| Retailer Age | | | | | 0.006 (0.022) | 0.018 (0.020) | 0.016 (0.021) |
| Web Only Retailer | | | | | | 0.107 (0.145) | -0.206 (0.144) |
| Constant | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Retailer Category Indica | No | No | No | No | No | Yes | Yes |
| Observations | 759 | 759 | 759 | 759 | 759 | 759 | 759 |
| Pseudo R2 | 0.35 | 0.38 | 0.39 | 0.39 | 0.39 | 0.43 | 0.40 |

Notes: Standard errors in parentheses. *significant at 5%.



Potential Worries With Baseline Results

- Measure of name prominence (name clicks at Google) potentially correlated with errors
 - Show results robust to using name clicks at Bing as measure of name prominence
- Name prominence measure includes “buy camera at amazon.com” rather than pure “navigational” searches
 - Show results robust to more narrow definition of name search
- Use of bins might “mask” importance of being on page 1
 - Show results robust to using number of results on page 1 rather than bins



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Principle Worry: Endogeneity of Position and Ads

- Search engines have incentives to provide users with organic results and ads that are “relevant”
- Position & ads may depend on past clicks
 - OK if predetermined at time of actual clicks, but engines continually refine algorithms
- Position & ads on Google may be correlated with error in regression
 - Use position and ads on Bing as instruments for position and ads on Google

Table 5: Specifications Controlling for Endogeneity of Position and Ads
 Dependent Variable: ln(Net Organic Clicks on Google)

| Variable | (1) Two-Stage Ordered Probit | (2) Two-Stage Least Squares |
|---------------------------------|------------------------------------|-----------------------------------|
| <i>Position on Google</i> | | |
| Poor | -0.475 (0.293) | |
| Below Median | 0.455 (0.274) | |
| Median | 0.825 (0.256)* | |
| Above Median | 1.129 (0.270)* | |
| Best | 1.420 (0.252)* | |
| ln(Page 1) | | 1.115 (0.190)* |
| <i>Name Recognition on Bing</i> | | |
| Poor | 1.158 (0.256)* | 1.049 (0.273)* |
| Below Median | 1.648 (0.227)* | 1.299 (0.277)* |
| Median | 1.916 (0.212)* | 1.325 (0.296)* |
| Above Median | 2.149 (0.221)* | 1.277 (0.317)* |
| Best | 2.832 (0.328)* | 1.801 (0.358)* |
| ln(# Ads on Page 1) | 0.815 (0.070)* | 0.010 (0.188) |
| Social Network Presence | 0.093 (0.217) | 0.245 (0.234) |
| Retailer Age | 0.069 (0.026)* | 0.028 (0.024) |
| Web Only Retailer | 0.101 (0.183) | 0.022 (0.171) |
| Constant | Yes | Yes |
| Retailer Category Indicators | Yes | Yes |
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| Poor | -0.475 (0.293) | |
| Below Median | 0.455 (0.274) | |
| Median | 0.825 (0.256)* | |
| Above Median | 1.129 (0.270)* | |
| Best | 1.420 (0.252)* | |
| ln(Page 1) | | 1.115 (0.190)* |
| <i>Name Recognition on Bing</i> | | |
| Poor | 1.158 (0.256)* | 1.049 (0.272)* |
| Below Median | 1.648 (0.227)* | |
| Median | 1.916 (0.212)* | |
| Above Median | 2.149 (0.221)* | |
| Best | 2.832 (0.328)* | |
| ln(# Ads on Page 1) | 0.815 (0.070)* | |
| Social Network Presence | 0.093 (0.217) | |
| Retailer Age | 0.069 (0.026)* | |
| Web Only Retailer | 0.101 (0.183) | |
| Constant | Yes | |
| Retailer Category Indicators | Yes | |
| Observations | 759 | |
| Pseudo R2 | 0.53 | |
| Sargan Test (p-value) | | |

Notes: Standard errors in parentheses. *significant at 5%.

Table 5: Specifications Controlling for Endogeneity of Position and Ads
 Dependent Variable: ln(Net Organic Clicks on Google)

| Variable | (1) Two-Stage Ordered Probit | (2) Two-Stage Least Squares |
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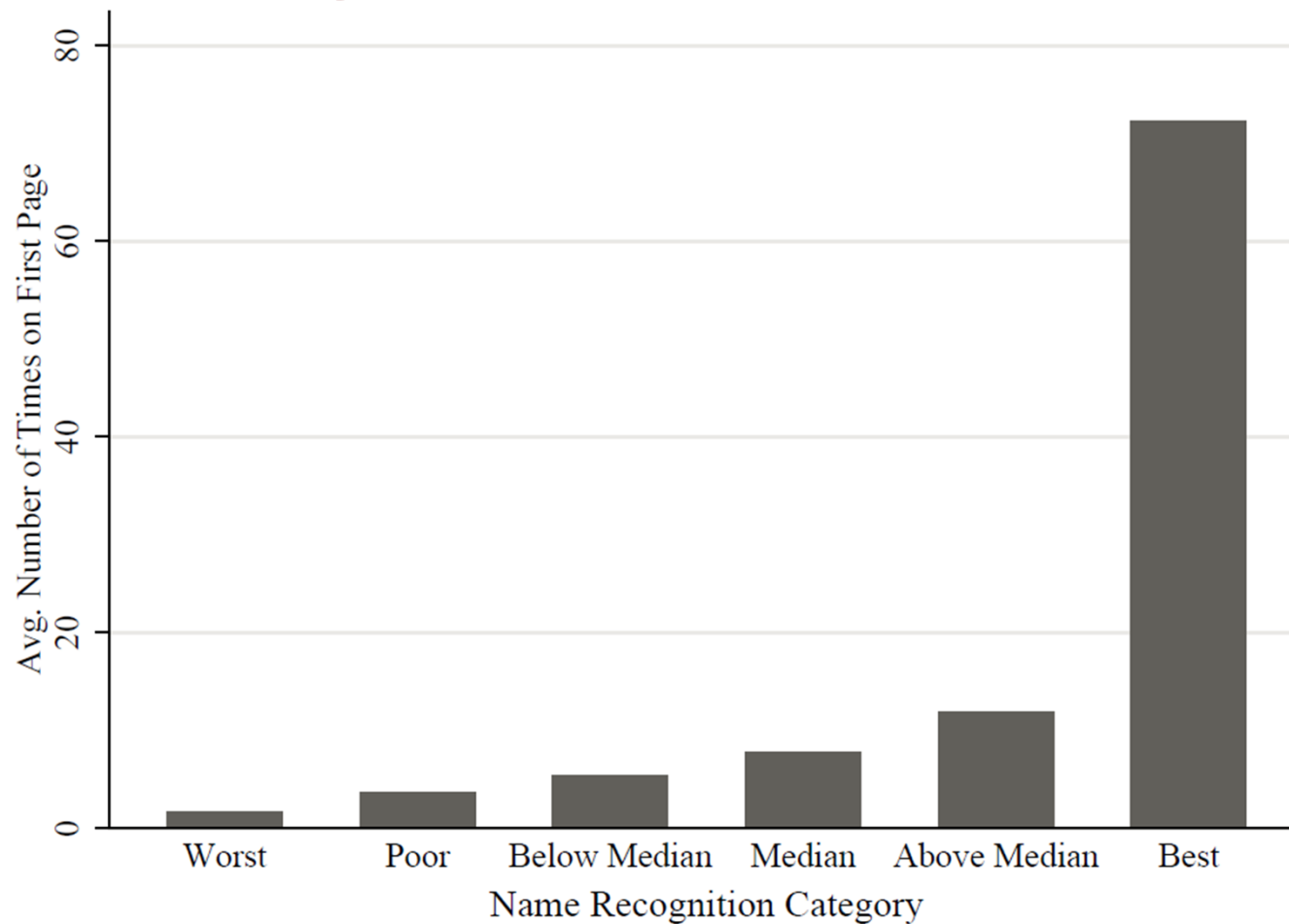


Total Effect of Name Prominence on Clicks

- Firms with more prominent names get more clicks; ultimately translates into better positions
- Effects of retailer investment in name recognition:
 - Direct effect: For a given position, more prominent retailers get more clicks
 - Indirect effect: More prominent retailers get better positions, leading to an additional clicks



Screen Position & Name Recognition



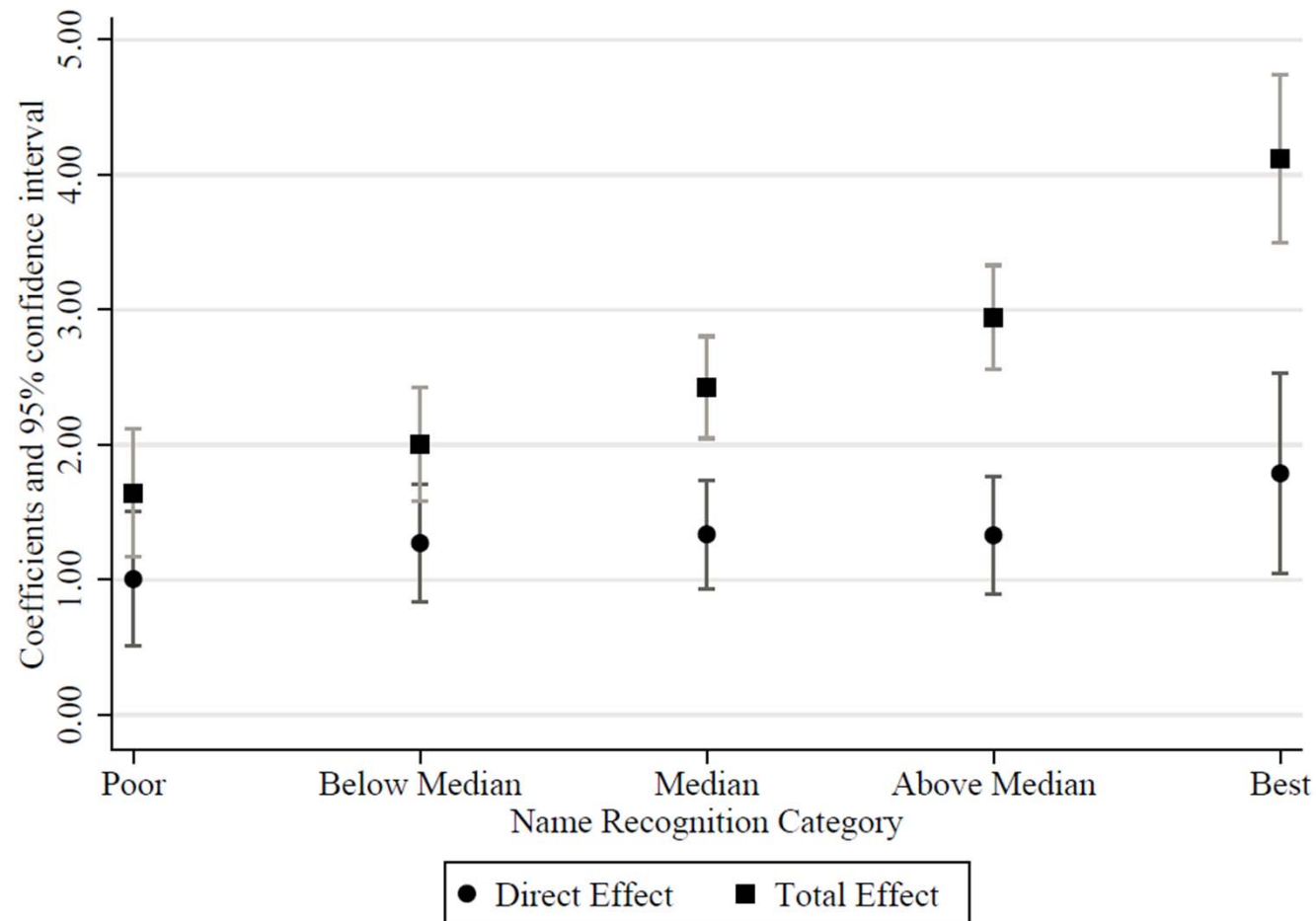


Unpacking the Effects of Name Prominence on Clicks

- Residualized regressions
 - Step 1: Regress position on name recognition; residual captures non-name determinants of position
 - Step 2: Regress clicks on residual and other controls
- Use both OLS as well as IV to control for potential endogeneity



Direct and Total Effects of Name Recognition





Other Robustness Checks

- Replicated the above analysis using search results at Bing rather than Google
 - Qualitatively similar results
- Disaggregated results by search term
 - Corrections for Censoring
 - Corrections for Endogeneity



Summing Up

- Name searches are a potentially useful measure of the “prominence” of retailer names
- Name and position prominence are both important determinants of clicks
- Magnitude of name effects greater than position effects when one accounts for
 - Endogeneity of positions and ads
 - Indirect effects of name prominence