Traditional and IS-Enabled Customer Acquisition on the Internet

Jeonghye Choi / David R. Bell, Leonard M. Lodish

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INTRODUCTION

1) physical stores / Internet retailers
2) recent study
3) this paper
4) 3 new findings
INTRODUCTION

1) physical stores / Internet retailers
   -> distinct/opposing advantage and disadvantages
   -> contrasting cost-benefit trade-offs

① physical stores
   - downside = relatively small trading areas
   - easy to discover and visit
   - travel cost

② Internet retailers
   - upside = large geographic markets
   - products are plentiful
   - initially find the site best suits their needs?

which locations will generate the most online demand, by which acquisition methods, and why???
2) recent study
- Anderson et al. 2010, Brynjolfsson et al. 2009
- Choi and Bell 2011, Forman et al, 2009
  - variation in offline → shopping costs variation in online demand

- Choi et al. 2010
  - proximity among target customers → key role in buyer acquisition
INTRODUCTION

3) this paper
- incorporate and build on these prior findings
- show how / why geographic variation in physical characteristics of local markets
- explain geographic variation in the number of new buyers acquired through 4 different methods
  -> offline WOM/online WOM/online search/magazine advertising
- the empirical analysis
- examine customer acquisitions at Childcorp.com
  - Childcorp.com
  - focus primarily on one product category
  - use 4 methods
4) 3 new findings

- target customer density delivers online demand over and above that created through the total number of target customers alone
- target customer density induces significantly higher number of buyer acquired via interdependent methods vs independent method create synergistic effect from positive social influence among buyers

- senders and recipients of WOM share consumption benefits
  -> WOM is more powerful and compelling

- systematic differences among the four acquisition modes in way each contributes to the total customer base.
  - magazine advertising / online search
BACKGROUND LITERATURE

1) Location-Based Drivers of Online Shopping
2) Target Customers Density, WOM, and Social Multiplier
3) Shared Benefits and the Effectiveness of WOM
1) Location-Based Drivers of Online Shopping

① customer benefits using online retailers -> price ↓ /convenience ↑

-> lower prices
  - online sales tax rates / offline sales tax rates
  - Goolsbee(2000)
    - Internet retail transactions taxed at average offline rates(8%)
      -> online demand would decline by more than 20%
  - Anderson et al(2010)
    - Internet retailer opens physical stores, collects sales tax
      -> Internet sales in those location suffer

-> greater convenience
  - Wall Street Journal study(Gunn 2007)
    - online discount doesn't matter much if you have to pinch-hit with products form grocery store while you wait for order to arrive
BACKGROUND LITERATURE

② Internet retailer convenience -> time distance, travel distance
   benefit when time distance↓ / travel distance↑

-> time distance
   - shipping time proximity of Internet purchase to customer
   - Bynjolfsson and Smith(2000)
     - some customers pay a premium for faster shopping

-> travel distance
   - physical distance from customer's location to nearest office stores
   - Forman et al(2009)
     - travel distance to offline stores ↓ -> online retailers attractive ↓

③ demographics, access to Internet
   -> online demand potential at a particular location
2) Target Customers Density, WOM, and the Social Multiplier

① Location with greater target customer density generate higher online demand in aggregate
   - Bell and Hilber 2006
   - In retailing, high target customer density proxy for higher offline shopping cost for bulky products requiring transport and storage

② Target customer imply target customer density will have additional effect on offline WOM acquisitions in the particular beyond general positive effect on acquisitions overall
   - Bell and Song 2007
   - Choi et al. 2010
   - Emulation among physically close customers has been reported for adoption of an Internet retailer
offline density correlates with online connectivity
- Sinai and Waldfogel (2004)
  - household in more densely populated urban areas are more likely includes blogs and other sources of online WOM
- Katana et al (2011)
  - a persistent significant and positive effect of population location density on propensity of individuals to join online social network
3) Shared Benefits and the Effectiveness of WOM

① shared benefits among senders and recipients further enhance effectiveness of WOM
   - Katz and Lazarsfeld (1955)
     - WOM is 7 times as effective as magazine advertising / 2 times as effective as radio advertising. -> online retailers as well
   - Villanueva et al. (2008)
     - buyers acquired via WOM have long-term equity twice of buyers acquired by marketing
these location based benefits of shopping convenience will have stronger effects on acquisitions through offline WOM that occurs among senders and recipients that are most likely co-located

  - WOM is engendered by benefit matching when the recipient of WOM recommendation experiences positive fit with information conveyed and the product or service recommended
- empirical setting in paper
  - allow to study related idea how shared benefits among senders and recipients can promote acquisitions through WOM
- acquisitions through offline WOM most likely involve co-located senders and recipients and online WOM acquisitions will involve more geographically diffuse senders and recipients
- many of the costs and benefits of using Internet retailer such as Childcorp.com are location dependent
DATA AND MEASURES

1) Zip Code-Level Cumulative Numbers of New Buyers at Childcorp.com

2) Four Variables
   - Target Customer Density
   - Location-Based Convenience Benefits

3) Control Variables and Spatial Clustering of Zip Codes
DATA AND MEASURES

1) Zip Code-Level Cumulative Numbers of New Buyers at Childcorp.com

① 4 acquisition process
   - offline WOM -> personal referral from friends, colleagues, or acquaintance and accidental referrals from unacquainted people in local regions
   - online WOM : referrals through online message boards, blogs, and online communities
   - online search : paid and organic keyword search from search engines and connections from sponsored price comparison sites
   - magazine advertising : ads in affiliated magazine target at customer group

② 4 data sources
   - the 2000 U.S. Census
   - local sales tax rate scheduled
   - the 2007 U.S. Census of Business and Industry
   - UPS shipping t

③ pick one -> exclusive choice
2) Four Variables
   - Target Customer Density
   - Location-Based Convenience Benefits

① Target Customer Density
   - (N of household with children<6) / square mile in each zip code
   - main effect of target customer density via offline shopping costs
     and in the secondary effect via a social multiplier

② Location-Based Convenience Benefits
   - Brynjolfsson and Smith(2010)
     - measure time convenience benefit
     - calculate expected travel distance from each zip code to nearest
       store of each format
     - convenience based on time distance and travel distance are
       both location-based
DATA AND MEASURES

3) Control Variables and Spatial Clustering of Zip Codes

① Online price benefit
   - price =
   - relative online price advantages varies across zip codes
   - sales tax rate from public information from Department of Revenue
   - 1000 randomly selected stores

② Magazine circulations
   - acquire number of customers via magazine advertising
   - control observed heterogeneity in magazine circulation
   - collect data on magazine circulations for the key magazine
   - control spatial variation via model random effects and specification error
3) Control Variables and Spatial Clustering of Zip Codes

③ High-speed Internet access
- difference in Internet access speed -> 200 kbps
- 0 for 0%, 1-5 for each 20% incremental range

④ Geodemographic characteristics
- standard zip code-level control variables -> affect online demand
- Dhar and Hoch(1997)
  - variables are expressed as % / skewed away from simple averages
  - percentage of household with a college degree

⑤ Spatial clustering of zip codes
- U.S census Bureau groups : zip codes -> strong social / economic ties same zip codes in MSA or μSA
- regional clusters of zip codes using destinations
- regional cluster random effects capture the difference in baseline acquisition rates across regional clusters
EMPIRICAL MODEL

① Zip code-level buyer acquisition numbers

\[ y_{k,z(m)} \sim \text{Poisson}(\lambda_{k,z(m)}) \]

- variable explanation
  \( y_{k,z(m)} \): the number of new buyers
  \( k \): acquisition Processes
    - offline/online WOM, online search, magazine advertising
  \( Z(m) \): zip code in regional cluster m

② Why poisson distribution?

- occurrence of an event is rare in comparison with target population
- poisson approximation can be motivated from individual-level utility
  maximizing choice between an online retailer and an outside offline option
- poisson model -> flexible to accommodate geographic variation
③ Model of rate parameter $\lambda$

$$
\log(\lambda_{k,z(m)}) = x'_{k,z(m)} \beta_k + \varepsilon_{k,z(m)} \quad \text{and}
$$

$$
x'_{k,z(m)} \beta_k = \varphi_k \cdot \text{Target Customer Density}_{z(m)}

+ \Delta_k \cdot \text{Location-Based Benefits}_{z(m)}

+ \log(n_{z(m)}) + \Psi_k \cdot \text{Controls}_{z(m)}

+ \alpha_{k,0} + \alpha_{k,m},
$$

- model Involved
  - target customer density
  - location-based benefits (time distance for shipping)
  - the number of target customers
  - observed heterogeneity (tax rates, Internet penetration, magazine)
  - unobserved baseline by regional cluster
  - Zip code–level measurement error
EMPIRICAL MODEL

4 MVN(multivariate normal distribution) for $\alpha_{k,m}$

\[
\begin{pmatrix}
\alpha_{\text{offlineWOM}, m} \\
\alpha_{\text{onlineWOM}, m} \\
\alpha_{\text{Search}, m} \\
\alpha_{\text{Magazine}, m}
\end{pmatrix}
\sim \text{i.i.d. MVN} \left( \begin{pmatrix}
0 \\
0 \\
0 \\
0
\end{pmatrix}, \begin{pmatrix}
\tau_1^2 & r_{21} \tau_1 \tau_2 & r_{31} \tau_1 \tau_3 & r_{41} \tau_1 \tau_4 \\
r_{21} \tau_2 \tau_1 & \tau_2^2 & r_{32} \tau_2 \tau_3 & r_{42} \tau_2 \tau_4 \\
r_{31} \tau_3 \tau_1 & r_{32} \tau_3 \tau_2 & \tau_3^2 & r_{43} \tau_3 \tau_4 \\
r_{41} \tau_4 \tau_1 & r_{42} \tau_4 \tau_2 & r_{43} \tau_4 \tau_3 & \tau_4^2
\end{pmatrix} \right)
\]

- 3 benefits for MVN
- 4 modes are modeled simultaneously and accommodate a variety of nested cases
- 4 modes are modeled as a function of the same variables, and the parameters are jointly estimated so direct comparison of separate effects of one specific variable (e.g. Target customer density, across modes is straightforward)
- the multivariate model offers good control over the Type I error rates in multiple tests and generates more efficient
EMPIRICAL FINDINGS

1) Model Fit, Validation, and Spatial Autocorrelation Test
2) Result of target customer density
3) Result of Location-based benefit y
4) New Managerial Insight
**EMPIRICAL FINDINGS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Specification</th>
<th>Log-likelihood</th>
<th>Mean absolute error*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed model</td>
<td>NBD model with multivariate random effects (( r_{kk'} = 0 ) for all ( k ) and ( k' ), ( k \neq k' ) in Equation (4))</td>
<td>-115,800</td>
<td>0.810</td>
</tr>
<tr>
<td>Nested model 1</td>
<td>NBD model with univariate random effects (( a_{k,m} = 0 ) for all ( k ) and ( m ) in Equation (3))</td>
<td>-115,999</td>
<td>0.848</td>
</tr>
<tr>
<td>Nested model 2</td>
<td>NBD model with no random effects</td>
<td>-117,218</td>
<td>0.911</td>
</tr>
<tr>
<td>Nested model 3</td>
<td>NBD model with no random effects (( a_{k,m} = 0 ), holding the parameter vector for control variables (( \psi_k )) constant across four modes (( k )'s) in Equation (3))</td>
<td>-118,296</td>
<td>0.931</td>
</tr>
<tr>
<td>Nested model 4</td>
<td>NBD with model no random effects (( a_{k,m} = 0 ), holding all parameters (( \varphi_k, \Gamma_k, \Delta_k ), and ( \Psi_k )) constant across four modes (( k )'s) in Equation (3))</td>
<td>-118,785</td>
<td>0.945</td>
</tr>
</tbody>
</table>

*We conduct holdout tests by performing 10-fold cross validation on each partition of the estimation and validation data sets (Breiman and Spector 1992, Kim et al. 2005). Estimation and validation data sets include 26,687 and 2,965 residential zip codes, respectively.
EMPIRICAL FINDINGS

1) Model Fit, Validation, and Spatial Autocorrelation Test

- proposed model: NBD model with multivariate random effects
- most largest log-likelihood
- smallest mean absolute error in estimation and validation data sets

- Moran’s I statistics
  - to check there is no remaining spatial autocorrelation in the residuals
  - using a spatial weighting matrix based on exponential distance decay function
  - Moran’s I formula

\[
I = \frac{N}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij}(X_i - \bar{X})(X_j - \bar{X})}{\sum_i (X_i - \bar{X})^2}
\]
### Table 4: Parameter Estimates from the Multivariate NBO Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Offline WOM</th>
<th>Online WOM</th>
<th>Online search</th>
<th>Magazine ads</th>
<th>Total buyers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>SE</td>
<td>Estimate</td>
<td>SE</td>
<td>Estimate</td>
</tr>
<tr>
<td>Target customer density</td>
<td>0.071*</td>
<td>0.010</td>
<td>0.064*</td>
<td>0.007</td>
<td>0.034*</td>
</tr>
<tr>
<td>Convenience benefit: Time Distance</td>
<td>1.189*</td>
<td>0.126</td>
<td>0.733*</td>
<td>0.194</td>
<td>0.853*</td>
</tr>
<tr>
<td>$\Delta_1$: Day Shopping, Eastern US</td>
<td>0.555*</td>
<td>0.084</td>
<td>0.308*</td>
<td>0.103</td>
<td>0.377*</td>
</tr>
<tr>
<td>$\Delta_2$: Two-Day Shipping, Eastern US</td>
<td>0.326*</td>
<td>0.059</td>
<td>0.218*</td>
<td>0.063</td>
<td>0.254*</td>
</tr>
<tr>
<td>$\Delta_3$: Three-Day Shipping, Eastern US</td>
<td>0.662*</td>
<td>0.164</td>
<td>0.442*</td>
<td>0.135</td>
<td>0.451*</td>
</tr>
<tr>
<td>$\Delta_4$: One-Day Shipping, Western US</td>
<td>0.285*</td>
<td>0.081</td>
<td>0.136*</td>
<td>0.073</td>
<td>0.202*</td>
</tr>
<tr>
<td>$\Delta_5$: Two-Day Shipping, Western US</td>
<td>0.026*</td>
<td>0.094</td>
<td>-0.138</td>
<td>0.100</td>
<td>-0.014</td>
</tr>
<tr>
<td>$\Delta_6$: Three-Day Shipping, Western US</td>
<td>-0.076*</td>
<td>0.020</td>
<td>-0.044</td>
<td>0.033</td>
<td>-0.061*</td>
</tr>
<tr>
<td>Convenience benefit: Travel Distance</td>
<td>-7.045*</td>
<td>2.099</td>
<td>-8.328*</td>
<td>1.84</td>
<td>-6.832*</td>
</tr>
<tr>
<td>$\Delta_7$: Distance to Nearest Supermarket</td>
<td>0.268*</td>
<td>0.030</td>
<td>0.179*</td>
<td>0.029</td>
<td>0.231*</td>
</tr>
<tr>
<td>$\Delta_8$: Distance to Nearest Discount Store</td>
<td>0.126*</td>
<td>0.021</td>
<td>0.073*</td>
<td>0.031</td>
<td>0.060*</td>
</tr>
<tr>
<td>Control variables</td>
<td>-7.045*</td>
<td>2.099</td>
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</tr>
<tr>
<td>$\alpha_0$: Model intercept</td>
<td>0.150</td>
<td>0.199</td>
<td>0.141</td>
<td>0.157</td>
<td>0.186</td>
</tr>
<tr>
<td>$\alpha_1$: No Tax Dummy</td>
<td>0.048*</td>
<td>0.023</td>
<td>0.043*</td>
<td>0.021</td>
<td>0.043*</td>
</tr>
<tr>
<td>$\alpha_2$: Local Sales Tax Rate (%)</td>
<td>0.058</td>
<td>0.046</td>
<td>0.013</td>
<td>0.036</td>
<td>0.060*</td>
</tr>
<tr>
<td>$\alpha_3$: Magazine Circulations</td>
<td>0.005</td>
<td>0.046</td>
<td>-0.002</td>
<td>0.071</td>
<td>0.017</td>
</tr>
<tr>
<td>$\alpha_4$: High-Speed Internet access</td>
<td>0.005</td>
<td>0.046</td>
<td>-0.002</td>
<td>0.071</td>
<td>0.017</td>
</tr>
<tr>
<td>Geodemographic characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\gamma_0$: Growth Rate in Number of HH</td>
<td>0.181*</td>
<td>0.026</td>
<td>0.145*</td>
<td>0.031</td>
<td>0.188*</td>
</tr>
<tr>
<td>$\gamma_1$: Percent Population Aged 20 to 39 Years</td>
<td>0.155*</td>
<td>0.030</td>
<td>0.164*</td>
<td>0.032</td>
<td>0.101*</td>
</tr>
<tr>
<td>$\gamma_2$: Percent HH with Working Female</td>
<td>0.010</td>
<td>0.041</td>
<td>0.006</td>
<td>0.045</td>
<td>0.027</td>
</tr>
<tr>
<td>$\gamma_3$: Percent with College Education</td>
<td>0.596*</td>
<td>0.037</td>
<td>0.494*</td>
<td>0.056</td>
<td>0.478*</td>
</tr>
<tr>
<td>$\gamma_4$: Percent of Whites</td>
<td>0.339*</td>
<td>0.060</td>
<td>0.276*</td>
<td>0.056</td>
<td>0.236*</td>
</tr>
<tr>
<td>$\gamma_5$: Percent of Blacks</td>
<td>0.087</td>
<td>0.058</td>
<td>0.050</td>
<td>0.043</td>
<td>0.069*</td>
</tr>
<tr>
<td>$\gamma_6$: Percent HH Earning $50K-$75K</td>
<td>0.029</td>
<td>0.030</td>
<td>0.016</td>
<td>0.030</td>
<td>0.028</td>
</tr>
<tr>
<td>$\gamma_7$: Percent HH Earning $75K-$150K</td>
<td>0.149*</td>
<td>0.035</td>
<td>0.129*</td>
<td>0.040</td>
<td>0.167*</td>
</tr>
<tr>
<td>$\gamma_8$: Percent HH Earning $150K or more</td>
<td>0.078*</td>
<td>0.015</td>
<td>0.065*</td>
<td>0.017</td>
<td>0.008</td>
</tr>
<tr>
<td>Variances</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma_1$</td>
<td>0.378*</td>
<td>0.028</td>
<td>0.258*</td>
<td>0.022</td>
<td>0.257*</td>
</tr>
<tr>
<td>$\sigma_2$</td>
<td>2.481*</td>
<td>0.119</td>
<td>2.935*</td>
<td>0.216</td>
<td>4.715*</td>
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2) Result of target customer density

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<td>Target customer density ( \varphi ), Density, HH with Children Aged ( \leq 6 ) Yrs</td>
<td>0.071* 0.010</td>
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<td>0.034* 0.009</td>
<td>0.033* 0.006</td>
<td>0.048* 0.005</td>
</tr>
</tbody>
</table>

- the largest incremental effects -> Interdependent acquisitions via WOM
- social multiplier
  -> online connectivity is positively correlated with physical population density
- WOM
  - 25 % of the pool of buyers
  - 50 % of New customer from changes in Density
EMPIRICAL FINDINGS

3) Result of Location-based benefit

<table>
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<tr>
<th>Convenience benefit: Time Distance</th>
<th>( \Delta_1 ), One-Day Shipping, Eastern US</th>
<th>( \Delta_2 ), Two-Day Shipping, Eastern US</th>
<th>( \Delta_3 ), Three-Day Shipping, Eastern US</th>
<th>( \Delta_4 ), One-Day Shipping, Western US</th>
<th>( \Delta_5 ), Two-Day Shipping, Western US</th>
<th>( \Delta_6 ), Three-Day Shipping, Western US</th>
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<td>0.068</td>
</tr>
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- Location-based benefit is more effective in generating new buyers through offline WOM (more powerful when senders and recipients are more likely to be physically co-located)

- Shoppers are closer to supermarkets they are more likely to shop online at Childcorp.com
  - Superior price knowledge for product
  - Travel further customer buy larger baskets of item (including toys)
EMPIRICAL FINDINGS

4) New Managerial Insight

- offline WOM is especially effective in high potential locations that are also fertile for interaction.

- traditional methods remain vital in a complementary manner.

**Figure 3**

Decomposition of New Buyers by Acquisition Mode and by Target Customer Density

*Note*: The high, medium, and low groups of zip codes are defined so that each group has roughly equal numbers of target customers and new buyers, but differs substantially by target population density.
EMPIRICAL FINDINGS

② preliminary evidence for gains from geo-targeting
  - locally targeted search keywords and cost

Geographic Variation in the Most Effective Acquisition Mode

(a) Zip codes with more than one expected buyer

(b) Zip codes with more than 10 expected buyers
EMPIRICAL FINDINGS

③ top groups: 5.5 new clicks for one new customer
middle, bottom groups: 10, 12 new clicks for one new customer
→ conversion rate respond positively to improved ability to identify locations with receptive customers

<table>
<thead>
<tr>
<th>Cities per group</th>
<th>HHs w/children (1)</th>
<th>Expected buyers (2)</th>
<th>First orders (3)</th>
<th>First clicks (4)</th>
<th>Expected buyers per HHs w/children (5) = (2)/(1)</th>
<th>Conversion rates (6) = (4)/(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top two groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>67,098</td>
<td>5,194</td>
<td>9,924</td>
<td>54,119</td>
<td>0.077</td>
<td>0.183</td>
</tr>
<tr>
<td>21</td>
<td>80,260</td>
<td>2,405</td>
<td>2,260</td>
<td>11,904</td>
<td>0.030</td>
<td>0.190</td>
</tr>
<tr>
<td>Middle two groups</td>
<td></td>
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</tr>
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<td>46</td>
<td>228,172</td>
<td>2,154</td>
<td>1,133</td>
<td>10,673</td>
<td>0.009</td>
<td>0.106</td>
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<td>16</td>
<td>208,026</td>
<td>1,914</td>
<td>1,013</td>
<td>11,207</td>
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<td>0.090</td>
</tr>
<tr>
<td>Bottom two groups</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>42</td>
<td>394,773</td>
<td>1,816</td>
<td>868</td>
<td>10,942</td>
<td>0.005</td>
<td>0.081</td>
</tr>
<tr>
<td>44</td>
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<td>976</td>
<td>905</td>
<td>10,946</td>
<td>0.004</td>
<td>0.083</td>
</tr>
</tbody>
</table>

Notes. Each group of cities has about 11,000 of clicks (i.e., roughly equal marketing costs), and all cities in a group have approximately equal predictions for the expected number of new buyers per household (HH). The best-performing group contains one city, New York City. The number of cities in the other groups is variable. In the interests of space, we show only six groups of cities and indicate the differences between the “best” (top two), “average” (middle two), and “worst” (bottom two) groups of cities. Full information for all 50 groups is available from the authors upon request.
CONCLUSION

① 3 conclusions
- acquisitions in general and WOM acquisitions in particular benefit from physical proximity among target customers.
- location-based benefits enhance offline WOM acquisitions more than they enhance online WOM acquisitions.
- acquisition modes are complementary and gain from geo-targeting are possible

② 2 future research directions
- identify a comprehensive set of “geographic factors”
- learn more about what leads to WOM conversations, whom they are among, and what is discussed.
THANK YOU