Size is not all that matters: The many dimensions of heterogeneity in consumer price dispersion and dynamics

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In a nutshell

Stylized facts on price dispersion and dynamics:

▶ prices for identical grocery products are far from identical across stores in France
▶ price levels and dispersion vary with store type
▶ retail chains have very different price levels and dispersion
▶ price levels vary with local conditions such as urban density, household median revenue, and local competition
▶ also price dynamics differ across store types and retail chains
Data

Analysis based on two original data sets:

1. **price data**: millions of price records of thousands of precisely identified products (name, barcode) sold in about one thousand precisely identified medium and large grocery stores (name, address) provided by price comparator Prixing

2. **store data**: virtually all medium and large grocery stores in France (name, address) self-assembled
Price data

- ‘drive-through’ prices
  1. buyers collect goods they have previously ordered online
  2. prices are exactly the same as in associated physical store
     → physical store price data
- some online shop price data
- actual, geolocalized, daily prices

Due to size and research questions, (at least for now) focus on most frequently observed price over a month for a product (barcode) sold in a store, balanced over period Oct2011-Sep2012, weighted by retail chain mkt shares

- ≈ 17 million monthly modal prices of physical stores
- > 10 thousand monthly modal prices of online shops
Store data

1. store data contains geolocalization and retail chain of virtually all medium and large grocery stores in France *N.B. medium and large grocery stores* \([\text{hypermarkets (Hmkt), supermarkets + discounts (Smkt)}]\) *represents more than 80% of French grocery sales*.

2. about 1 thousand geolocalized Smkt and Hmkt for which we have prices

→ Combined to characterize local competition of the stores for which prices are observed by computing

- distance of closest competitor
- total number of competitors
Local competition definitions

French Competition Authority defines:

- **who could be a competitor?** Hmkt compete only with Hmkt, while Smkt also compete with Hmkt in their catchment area

- **what’s the catchment area?** depends on store type:
  - within 30 minutes’ drive for Hmkt, 15 for Smkt

We consider same potential competitors, but use more flexible catchment area, which also depends on urban density:

<table>
<thead>
<tr>
<th>Urban density categories</th>
<th>rural</th>
<th>semi-urban</th>
<th>urban</th>
<th>metropolitan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store type: Hmkt or Smkt is competing with Hmkt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>within minutes</td>
<td>18</td>
<td>15</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>within kilometers</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>Store type: Smkt is competing with Smkt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>within minutes</td>
<td>12</td>
<td>7.5</td>
<td>3.75</td>
<td>3</td>
</tr>
<tr>
<td>within kilometers</td>
<td>10</td>
<td>5</td>
<td>1.5</td>
<td>1</td>
</tr>
</tbody>
</table>
Example: medium and large stores in France
Example: geolocalized stores
Example: all potential competitors of Hmkt
Example: all potential competitors of Smkt
(French competition Authority definition of catchment area)
Example: competitors of Smkt
(our definition of catchment area)
Example: competitors of Smkt
(competitor’s distance example)
Percentage relative price difference

Percentage price difference with respect to monthly mode for each product (i.e., EAN barcode)

\[
\% \text{ relative price } \Delta_{ist} = \left[ \frac{(P_{ist} - P_{it}^{mode})}{P_{it}^{mode}} \right] \times 100
\]
Price levels and dispersion across store type

- on average Hmkt are less expensive than Smkt, which are less expensive than online shops
- Hmkt prices are less dispersed than Smkt prices
Example: Price levels across retail chains

Mean % relative price difference (over time) is higher in Smkt than Hmkt retail chain (belonging to same group)
Price levels and dispersion across retail chains

Heterogeneous:
- price levels across retail chains
- price dispersion within retail chains
Price levels and dispersion in Hmkt and Smkt

Percentage price difference with respect to product monthly mode of the same type of store
(e.g., % price difference of 33ml Coke can sold in a Hmkt w.r.t. modal price of 33ml Coke can that month across all Hmkt)
Disentangling price difference determinants

By store type, $\%$ relative price $\Delta^{Hmkt, Smkt}$:

▷ retail chain

▷ local factors:
  1. urban density
     ▷ rural
     ▷ semi-urban
     ▷ urban
     ▷ metropolitan
  2. household median revenue
  3. intensity of local competition faced by stores
     (excluding stores belonging to same group)
     ▷ minutes’ drive to closest competitor
     ▷ number of competitors located in catchment area
<table>
<thead>
<tr>
<th>% relative price $\Delta^{Hmkt,Smkt}$</th>
<th>Hmkt</th>
<th>Smkt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Retail chain:</strong></td>
<td>Hmkt</td>
<td>Smkt</td>
</tr>
<tr>
<td>1 H/S</td>
<td>0.30 (0.04)***</td>
<td>1.34 (0.06)***</td>
</tr>
<tr>
<td>2 H/S</td>
<td>0.63 (0.06)***</td>
<td>1.99 (0.08)***</td>
</tr>
<tr>
<td>3 H/S</td>
<td>1.49 (0.04)***</td>
<td>4.43 (0.08)***</td>
</tr>
<tr>
<td>4 H</td>
<td>-1.69 (0.04)***</td>
<td></td>
</tr>
<tr>
<td>4 S a</td>
<td></td>
<td>8.82 (0.41)***</td>
</tr>
<tr>
<td>4 S b</td>
<td></td>
<td>-0.57 (0.02)***</td>
</tr>
<tr>
<td>4 S c</td>
<td></td>
<td>5.07 (0.14)***</td>
</tr>
<tr>
<td>5 H</td>
<td>-2.04 (0.03)***</td>
<td></td>
</tr>
<tr>
<td>6 H/S (reference category)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Urban density:</strong></td>
<td>Hmkt</td>
<td>Smkt</td>
</tr>
<tr>
<td>rural</td>
<td>-1.07 (0.09)***</td>
<td>-3.94 (0.10)***</td>
</tr>
<tr>
<td>semi-urban</td>
<td>0.60 (0.04)***</td>
<td>-1.37 (0.04)***</td>
</tr>
<tr>
<td>urban (reference category)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>metropolitan</td>
<td>2.59 (0.14)***</td>
<td>4.24 (0.08)***</td>
</tr>
<tr>
<td><strong>Ln HH median revenue</strong></td>
<td>-159.90 (7.67)***</td>
<td>41.04 (11.51)***</td>
</tr>
<tr>
<td><strong>Ln HH median revenue</strong>$^2$</td>
<td>8.01 (0.38)***</td>
<td>-1.93 (0.58)***</td>
</tr>
<tr>
<td><strong>In minutes &amp; excl. same group stores:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>distance from closest competitor</td>
<td>0.01 (0.00)***</td>
<td>0.05 (0.00)***</td>
</tr>
<tr>
<td>number of competitors</td>
<td>-0.20 (0.01)***</td>
<td>-0.01 (0.00)***</td>
</tr>
</tbody>
</table>
Price dynamics in physical stores and online shops

- about 20% of prices change each month
- online prices have same frequency of price increases but less price decreases (not of larger absolute size)
Physical store price dynamics across store types & chains
Online price dynamics across retail chains
Conclusions

1. pervasive price dispersion of grocery products in France
2. both mean and interquartile range of % price difference with respect to product modal price is half in Hmkt than is Smkt
3. in online shops % price relative difference mean is 4 times larger than in Smkt
4. price levels are heterogeneous across retail chains and prices are (more or less) dispersed across stores within same retail chain
5. price levels tend to increase with urban density, median revenue, the further away the closest competitor is located, and the fewer the competitors faced
6. price dynamics differ across retail chains, beyond store types
Thanks!
APPENDIX
Distribution of grocery sales by store format across EA

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<th>11</th>
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<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>DE</td>
<td>IE</td>
<td>GR</td>
<td>ES</td>
<td>FR</td>
<td>IT</td>
<td>NL</td>
<td>LU</td>
<td>MT</td>
<td>SI</td>
<td>FI</td>
<td>CY</td>
<td>AT</td>
<td>area</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Euromonitor (2011) and Eurosysterm staff calculations.
Definition of urban density categories

<table>
<thead>
<tr>
<th>Pop. density</th>
<th>0 to 10,000</th>
<th>10,000 to 50,000</th>
<th>50,000 to 300,000</th>
<th>300,000 +</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 200</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200 to 500</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 to 3,000</td>
<td>1</td>
<td>2</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>3,000 to 15,000</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15,000 +</td>
<td>1</td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Urban density:
- 0=Rural
- 1=Semi-urban
- 2=Urban
- 3=Metropolitan
Price levels across retail chains online

![Graph showing price levels over time for different retail chains.](image-url)
Intensive margin across store types and retail chains
Intensive margin across online retail chains