Search Cost Reduction Through Product Bundling

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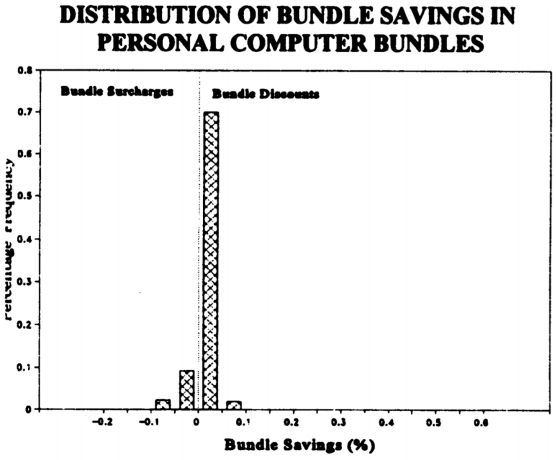
Motivation

- Bundling: two or more products or services sold together as a single package
- Widely used: fast food menu, home theater system, PC+screen
- Motivations include economies of scale (production) and scope (distribution), simplification of purchase decision,...
- Usually grants a price discount
- Empirical evidence associated with bundling
  - Significant fraction of surcharges on bundled products (Estalami 1999)
  - Bundled products are more appealing for consumers who do not know well the market (Harris and Blair 2006a)
  - and for consumers who are concerned about compatibility between the individual products (Harris and Blair 2006b)

Distribution of bundle savings (Estelami 1999)



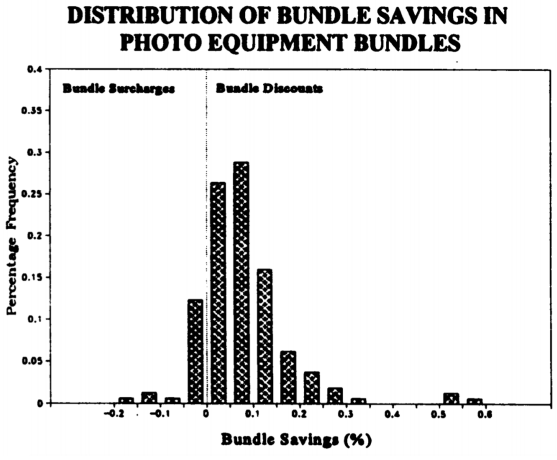


TABLE 1
SUMMARY STATISTICS ON BUNDLE SAVINGS

	Fast-food Meals	Photo Equipment	Personal Computers
Number of Bundles Sampled	230	163	87
Average Savings	12.5%	8.6%	2.5%
Standard Deviation of Savings	7.95%	9.79%	2.38%
Maximum Savings	37%	57%	7%
Minimum Savings	-18%	-15%	-7%
Percent of Bundle Surcharges	3.5%	11.0%	11.5%

- Surcharges apply to a non negligible fraction of products
- Heterogeneity within and across sectors

Research question

- Q1: Can we explain demand for product bundles and existence of product surcharge with a simple search cost model?
- Endogenous bundle search: the consumers search for a bundle in order to reduce the total search time

- How can we accommodate for these evidence?
- Bundling as a way to reduce search cost:
  - bundles are more appealing for non expert consumers (high search cost per sample)
  - and are more appealing at the begin of the search process (high expected number of samples)

Research question

- Q2: In a search cost model with perturbed consideration set, which products should the retailer advertise?
- Exogenous bundle search: the producers advertise bundles more often than single items (attention manipulation)

- Can we connect search cost and advertising?
- The consumer is more likely to sample the advertised products (dynamic version of the consideration set in Goeree 2008)
- The producer can use advertising to perturb the standard search process

Literature review

- Estelami (1999) distribution of bundle savings/surcharge.
  No market share data, no evolution in the last 20 years.
- Harris and Blair (2006a, 2006b) role of reduced search costs for product bundles, hypothetical purchase behavior
- **Product bundling**: Jedidi, Jagpal, and Manchanda (2003), Derdenger and Kumar (2013), Mikonnen et al. (2015), Pathak, Gupta, and McAuley (2017), Chen and Ni (2017)
- **Search cost**: Stigler (1961), McCall (1970), Hong and Shum (2006), Santos, Hortacsu, and Wildenbeest (2012)
- **Advertising**: Stivers and Tremblay (2004), Goeree (2008), Chen and He (2011) [advertising and search cost, welfare analysis]

Ideal dataset

- Physical or online electronics store data (e.g. Best Buy)
- Data grouped by transaction (better if credit card number)
- Product category: home theater system or photo equipment; ideally a composed product that requires all the components
- Computer components could be problematic (assembling cost)
- Desired data: choice set (product availability, both individual and bundle), market shares, prices, advertising

Endogenous bundle search model

- Endogenous bundle search: the consumer with high search cost prefers to search among bundles

- Unsorted sequential search model
- At each step, the consumer can
  - Randomly sample a new bundle and pay a cost λ_b
  - Randomly sample a new single item j_i and pay a cost λ_{j_i}
  - Purchase the best bundle or set of single products viewed
  - Stop the search process without buying (outside option)
- Assume CDFs of utilities $F_b(u)$, $F_{j_i}(u)$ $\forall i$ are initially known
- Further assumptions on search cost $\forall i$ $\lambda_{j_i} = \lambda_j \leq \lambda_b$
- Assume no additional complexity/compatibility costs

Endogenous bundle search model

- $n + 1$ possible search actions (n bundle size)

$$v(i \in \{j_1, \ldots, j_n, b\}) = \int_{u_i^*}^{\bar{u}_i} (u - u^*) dF_i(u) - \lambda_i$$

- Sample the product with the highest expected net value

$$argmax_i \{v(i \in \{j_1, \ldots, j_n, b\}), 0\}$$

- Stops the search process if $v(i) \leq 0 \ \forall i$
- Select the best compound product, or outside option, $u(\varnothing) = 0$

- Two product: j (PC), k (screen), bundle b (PC and screen)
- If k is much less relevant than j to determine the total utility, and the consumer has observed a good bundle, she may not find convenient to sample k, as only a good j could modify the current choice, that is in favor of the bundle [search shutdown]

Exogenous bundle search model

- Exogenous bundle search: the retailer manipulates product awareness (attention) through advertisement

- Same assumptions as before, but relax the search process: stop, purchase, or randomly sample (b or j_i)
- Advertisement affects the random search process: sampling probability for advertised products is higher: $\pi_a > \pi_{na}$
- Dynamic version of consideration set
- Advertising bundles is more convenient for the retailer than advertising single products (higher purchase rate)
  - to promote bundles over subset of items
  - to promote expensive/surcharged bundles

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