The Welfare Effects of Bundling in Multichannel Television Markets

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Econ 220B Presentation

Motivation and Background

How would bundling affect consumer and producer welfare?

1. bundling with fixed input costs: extraction $>>$ inclusion benefits

   $(p_1 + p_2 - c_1 - c_2)(1 - F(p_1 + p_2)) >> (p_1 - c_1)(1 - F_1(p_1)) + (p_2 - c_2)(1 - F_2(p_2))$

   $\Rightarrow$ separately selling improves consumer welfare

2. bilateral cost bargaining: flat demand function incurs high costs

   $p_F \in \arg\max\, [(p - c)(1 - F(p))]^{\tau} \cdot [c(1 - F(p))]^{1-\tau}$ where $c = G^{-1}(1 - F(p))$

   $(p_F, c_F) > (p_{F'}, c_{F'})$ if $F' \prec_{dispersed} F \Rightarrow$ separately selling raises costs and reduces welfare

ambiguous answer, depending on the structure of preferences, relative bargaining power, ...

empirical case: bundling in multichannel television markets

Households Optimization and Demand Estimation

consumer i bundle j market n: $u_{ijn} = v^*_{ijn} + z'_{jn}\psi + \alpha_i p_{jn} + \xi_{jn} + \epsilon_{ijn}$

v^*_{ijn} indirect utility to i consuming j (microfoundation: allocate time to maximize Cobb-Douglas utility)

$$\max_{t_{ij}} \sum_c \gamma_{ic} \log(1 + t_{ijc}) \text{ subject to } \quad \sum_c t_{ijc} \leq T,$$

parametrization: $\gamma_i = \chi_i \circ (\Pi o_i + v_i)$, $\hat{t}_{ijcn}(\Pi, \rho, \Lambda, \Sigma)$

where the coordinator $\chi_{ic} \sim \text{Bernoulli}(\rho_{o_i c})$ (selection of bundle), o_i demographic attributes,

v_i unobs heterogeneity vector drawn from a multidimensional dist G with exponential marg dist with parameters Λ, and a correlation structure Σ

identification:

1. $\rho_{d_i c}$: the fraction of households that watch zero hours by channel and demographic group
2. Π: mean hours watched by household & the covariance in DMA ratings
3. Λ: the mean and variance in hours & Σ: the cross-channel covariance of household hours watched

consumer i bundle j market n: $u_{ijn} = v^*_{ijn} + z'_{jn}\psi + \alpha_i p_{jn} + \xi_{jn} + \epsilon_{ijn}$

p_{jn} subscription fee of bundle j, $\alpha_i = \alpha + \pi_p y_i$ the marginal utility of income, y_i i income.

z_{jn} observed system and bundle characteristics of bundle j in market n, ψ corresponding tastes

ξ_{jn} unobserved common term, ϵ_{ijn} idios term

$\epsilon_{ijn} \sim_{i.i.d.}$ Gumbel$(0,1)$ $\Rightarrow$ market share s_{jn} (standard mixed Logit choice probability)

BLP (2004): using market shares to estimate $\delta_{jn} = z'_{jn}\psi + \alpha p_{jn} + \xi_{jn}$

$\Rightarrow$ estimate α and ψ by linear IV reg using $Z_{jn} = \begin{bmatrix} z_{jn} & w_n \end{bmatrix}$, where z_{jn} observed nonprice product characteristics, w_n the average price of other cable systems' bundles

using the aggregate cable and satellite market share by income level to estimate π_p

Supply Cost and Estimation

upstream f, market n: $\Pi_{fn}(\mathbf{b}_n, \mathbf{p}_n) = \sum_{j \in b_{fn}} \left(p_{jn} - \sum_{c \in C_{jn}} \tau_{fc} \right) s_{jn}(\mathbf{b}_n, \mathbf{p}_n)$

where (b_n, p_n) a list of offered bundles with prices in n, b_{fn} the bundles offered by f, τ_{fc} f-channel fees

parametrization: $\hat{\tau}_{fc}(\eta, \varphi) = (\eta_1 + \eta_2 \tau_c) \exp(\varphi_1 MSOSIZE_f + \varphi_2 VI_{fc}) \Rightarrow$ using F.O.M to estimate (η, φ)

where τ_c the observed average input cost for c, $MSOSIZE_f$ f's total number of consumers,

VI_{fc} is the ownership share f has in c, same effect of distri size & vertical integration on input costs of c

upstream f, market n: $\Pi_{fn}(\mathbf{b}_n, \mathbf{p}_n) = \sum_{j \in b_{fn}} \left(p_{jn} - \sum_{c \in C_{jn}} \tau_{fc} \right) s_{jn}(\mathbf{b}_n, \mathbf{p}_n) \Rightarrow$ Nash equil

Nash equil $\Rightarrow$ F.O.C conditions

$\Rightarrow$ solving implied marg cost of each bundle & $cov(\text{estimated marg}, \text{implied marg}) = 0$

Nash equil $\Rightarrow$ no deviations (punishing candidate parameter estimates enabling profitable devia)

$\Rightarrow E[\Delta r_{fn}(b, b') + \Delta r_{fn'}(b', b)] \geq 0$

approximation: $\Pi_{fn}((\mathbf{b}_{fn}, \mathbf{b}_{-fn}), (\mathbf{p}_{fn}, \mathbf{p}_{-fn})) \approx r_{fn}((\mathbf{b}_{fn}, \mathbf{b}_{-fn}), (\mathbf{p}_{fn}, \mathbf{p}_{-fn})) + \nu_{fnb,1} + \nu_{fnb,2}$

$\approx r_{fn}$ the profits predicted from the model

$\nu_{fnb,1}$ the error unknown to the firms when making decisions, $\nu_{fnb,2}$ the error known to firms at that time

Bargaining and Estimation

bargaining with dnst K: $\max_{\tau_{fK}}[\Pi_f(\tau_{fK},\Psi_{-fK})-\Pi_f(\infty;\Psi_{-fK})]^{\zeta_{fK}}[\Pi_K(\tau_{fK},\Psi_{-fK})-\Pi_K(\infty;\Psi_{-fK})]^{1-\zeta_{fK}}$

where Π_f is f's total profits over n and $\Pi_K(\tau_{fK},\Psi_{-fK})=\sum_{c\in K}\left(\sum_f \tau_{fc}Q_{fc}(\Psi)\right)+r_c^{ad}t_c(\Psi)$,

$\Psi=\{\tau_{fc}\}$ a set of input costs: downstream externality in bargaining

Q_{fc} total number of c from f, r_c^{ad} advertising rev of c per hour

estimation: choose ζ_{fK} to minimize the distance of model's equil input costs and estimated ones

1. estimate pair-specific input costs τ_{fc}
2. marg cost $=0$

comuptation, results, counterfactuals... (reducing $>$ enhancing)