The Effects of Full-Line Forcing Contracts

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Movie studios offer titles to video rental stores under three types of contracts:

1. Linear Pricing (LP): fixed price per tape, $65-70
2. Revenue Sharing (RS): upfront fee per tape, $3-$10, plus store keeps approx 45% of revenues
3. Full-Line Forcing (FLF): RS on better terms, store takes *all* studio’s titles for period of contract (usually 12 months).
Potential Effects of Full-Line Forcing Contracts

Three potential effects on welfare:

- **Efficiency Effect.**
  - If no FLF, stores choose LP contracts for high-demand titles, RS contracts for others
  - Efficiency loss from double marginalization mitigated only for low-value titles (adverse selection)
  - FLF contract pulls these titles into revenue-sharing terms.

- **Market Coverage:** store now has to take all of the studio’s titles.

- **Leverage:** non-zero cost of holding inventory implies store may drop other studios’ titles.

Aggregate welfare effect is an empirical question.
The Market
The Dataset
Summary statistics and reduced form analyses
Demand estimates
Supply side: moment inequalities methodology
Counterfactuals (no results yet)
Previous Literature on Bundling

- **Theoretical:** focused on reasons for offering bundling contracts.
  - Efficiency effect not considered in this literature.

- **Empirical:** few previous papers.
  - Chu, Leslie and Sorensen (2007): bundling of theatre tickets sold to consumers
  - Crawford (2005): discriminatory incentives for bundling in cable TV
  - Marx and Shaffer (2004): slotting allowances and shelf space in supermarkets
An Introduction to the Market

- Two tiers to the industry: studios and stores
- Three contractual forms: LP, RS, FLF. LP and RS operate on a per-title basis, FLF on a per-period (12 months) basis
- Min and max quantity restrictions for RS and FLF contracts
- Antitrust laws: studios cannot offer the same product to different retailers for different prices; quantity restrictions do vary by store size.
- Not all stores had technology for RS contracts by beginning of our panel (50% in 1998); FLF contracts introduced during the data.
- Studios offer almost all titles (86%) on LP contracts. 61% on RS; 7% on FLF contracts.
How do Stores Choose between Contract Types?

- Terms of the contract: one-part or two-part tariffs, different costs per tape and revenue splits
  - If no FLF, stores choose LP contracts for high-demand titles, RS contracts for others
- Minimum quantity constraints: often binding for RS and FLF titles
  - Average minimum of 10 tapes per title for RS, 11 for FLF contracts
- Not an issue re: physical shelf space
- But affects cost of taking a title and demand for the title (visibility) and other titles (substitution)
  - Cross-title, cross-month effects not accounted for in demand model
  - Will be captured in estimated "cost" from supply side analysis
The Dataset

- Source: Rentrak Corporation
- Transaction data January 1 1998 - June 30 2002
- 7,189 retailers (over 30% of all stores in the industry): not Blockbuster Video or Hollywood Video
- Follow 963 titles released by 59 studios: 201 A titles, 188 B titles, 574 C titles.
- Store data: zipcode, chain size, product mix, monthly revenue
- Movie data: studio ID, release month, genre, MPAA rating, box-office category, contract terms
- Store-title data: number of tapes purchased, weekly rentals per tape, weekly revenues per tape
- Track each title for at least 6 months and aggregate to month level: 54 months of transaction data.
## Average Contract Terms and Store Choices

<table>
<thead>
<tr>
<th></th>
<th>LP</th>
<th>RS</th>
<th>FLF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No. titles offered</strong></td>
<td>830</td>
<td>588</td>
<td>67</td>
</tr>
<tr>
<td><strong>No. of stores</strong></td>
<td>7107</td>
<td>6687</td>
<td>4896</td>
</tr>
<tr>
<td><strong>Ave no. taken per store</strong></td>
<td>345</td>
<td>75</td>
<td>20</td>
</tr>
<tr>
<td><strong>Ave upfront fee</strong></td>
<td>$66.82</td>
<td>$8.48</td>
<td>$3.60</td>
</tr>
<tr>
<td></td>
<td>($5.59)</td>
<td>($1.07)</td>
<td>($1.24)</td>
</tr>
<tr>
<td><strong>Ave retailer share of revenue</strong></td>
<td>100%</td>
<td>46.0%</td>
<td>59.0%</td>
</tr>
<tr>
<td></td>
<td>(-)</td>
<td>(3.0%)</td>
<td>(2.0%)</td>
</tr>
<tr>
<td><strong>Ave month 1 rental price</strong></td>
<td>$2.67</td>
<td>$2.69</td>
<td>$2.71</td>
</tr>
<tr>
<td></td>
<td>($0.61)</td>
<td>($0.52)</td>
<td>($0.63)</td>
</tr>
<tr>
<td><strong>Ave month 1 rentals per tape</strong></td>
<td>5.63</td>
<td>4.27</td>
<td>4.13</td>
</tr>
<tr>
<td></td>
<td>(4.42)</td>
<td>(2.89)</td>
<td>(3.13)</td>
</tr>
<tr>
<td><strong>Ave inventory</strong></td>
<td>8.81</td>
<td>14.60</td>
<td>12.53</td>
</tr>
<tr>
<td></td>
<td>(13.92)</td>
<td>(17.64)</td>
<td>(17.33)</td>
</tr>
</tbody>
</table>

Averages across store-title pairs; standard deviations in parentheses.
Rentals per Month for each Contract Type

Averages taken across store-title pairs
Other Summary Statistics

- 7 out of 59 studios offer FLF at some point in the data (first introduced February 1999)
- Average number of titles released per studio per year:
  - 10.5 for FLF studios
  - 7.2 for other studios
- Average take-up rate: 42% of titles released per studio-year
  - 69% for FLF studios (43% excluding FLF contracts)
  - 38% for other studios
Consider percent of each store’s titles adopted under a particular contract type

Divide distribution into quintiles

Report the average store size (tier) in each quintile:

<table>
<thead>
<tr>
<th>Ave store tier</th>
<th>LP</th>
<th>RS</th>
<th>FLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quintile 1</td>
<td>2.52</td>
<td>5.24</td>
<td>2.91</td>
</tr>
<tr>
<td>Quintile 2</td>
<td>3.07</td>
<td>4.94</td>
<td>4.18</td>
</tr>
<tr>
<td>Quintile 3</td>
<td>3.46</td>
<td>3.16</td>
<td>4.47</td>
</tr>
<tr>
<td>Quintile 4</td>
<td>4.83</td>
<td>3.01</td>
<td>4.01</td>
</tr>
<tr>
<td>Quintile 5</td>
<td>5.11</td>
<td>2.70</td>
<td>4.54</td>
</tr>
</tbody>
</table>
Regression Analyses: Efficiency Effect

- Regress store revenues on "adoption of RS contract", "adoption of FLF contract", title FEs
- Results for A titles:
  - Revenues $109 lower under RS contracts: adverse selection
  - Consistent with efficiency effect
  - Revenues under FLF not significantly different from LP contracts
- Similar results for B and C titles
Regression Analyses: Market Coverage

- Look at store-studio pairs that have a FLF contract at some point
- Average uptake per month in non-FLF months: 0.59
- Average uptake in months where these pairs have FLF contracts: 1.32.
- Regression analysis:
  - Regress titles, tapes per title, transactions on "active FLF contract with this studio" and store fixed effects

<table>
<thead>
<tr>
<th></th>
<th>Number of titles</th>
<th>Tapes per title</th>
<th>Transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLF active</td>
<td>0.76** (0.02)</td>
<td>1.01** (0.24)</td>
<td>-63.0** (4.18)</td>
</tr>
</tbody>
</table>

- Market coverage effect may be substantial
- But the titles generate fewer rentals.
Regression Analyses: Leverage Theory

- Include only store-studio pairs that never have a FLF contract
- Average uptake per month in store’s non-FLF months: 0.281
- Average uptake in months where store does some FLF: 0.224
- Regress number of titles, tapes per title, transactions on "store takes FLF contract of another studio in same month" and store fixed effects

<table>
<thead>
<tr>
<th></th>
<th>Non-FLF titles</th>
<th>Tapes / title</th>
<th>Transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store takes FLF</td>
<td>-0.064** (0.003)</td>
<td>0.21* (0.10)</td>
<td>-21.9** (1.74)</td>
</tr>
</tbody>
</table>

- Leverage effect may be small.
- Transactions per title show substitution effect.
Overview of Full Model

- Reduced form results consistent with efficiency and market coverage effects
- Leverage effect may be small
- To say more we need a more detailed model. Three steps:
  - Nested logit model of consumer demand
  - Moment inequalities methodology: infer effect of contract types on store costs
  - Counterfactual experiments
- Step 1 completed; part-way through Step 2.
Demand Methodology

- Data: rentals and store revenues for each title-month
- Calculate price as monthly revenues / transactions (includes late fees)
- Title-month’s competitors are titles released during the previous 4 months: only these titles are included in the analysis for that month
- Nested logit demand model:

  \[ u_{ijmt} = \delta_{jmt} + \zeta_{igmt} + (1 - \sigma)\varepsilon_{ijmt} \]

  where nests are genre-box office class groups and

  \[ \delta_{jmt} = \delta_j + \gamma_j z_m + \eta_m + \theta_t + \beta_t x_j - \alpha p_{jmt} + \xi_{jmt} \]
Demand Methodology: Details

- Decay rates $\theta_t + \beta_t x_j$ capture 3 effects:
  - Demand for a title falls over time with advertising, word-of-mouth
  - Durable goods issue
  - Higher inventory implies more visibility, higher initial volume

- Rarely observe more than one store per zip code.
  - Assume same-market stores have independent customer populations
  - Stores do not predict competitor responses to their choices
Instruments

- **Inventory**: average inventory for same store-box-contract type titles in other months
- **Within-group share**: average across other same-tier stores of
  - number of movies of same type in same month,
  - within-group share of same title-month pair
- **Price**: no successful instruments
### Demand Results: Nested Logit

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Std Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>-0.024</td>
</tr>
<tr>
<td>Month 2</td>
<td>0.168</td>
</tr>
<tr>
<td>Month 3</td>
<td>-0.172</td>
</tr>
<tr>
<td>Month 4</td>
<td>-0.478</td>
</tr>
<tr>
<td>Month 5+</td>
<td>0.313</td>
</tr>
<tr>
<td>Inventory</td>
<td>0.019</td>
</tr>
<tr>
<td>Inv*Month2</td>
<td>-0.005</td>
</tr>
<tr>
<td>Inv*Month 3</td>
<td>-0.011</td>
</tr>
<tr>
<td>Inv*Month 4</td>
<td>-0.015</td>
</tr>
<tr>
<td>Inv*Month 5+</td>
<td>-0.016</td>
</tr>
<tr>
<td>(\sigma)</td>
<td>0.499</td>
</tr>
</tbody>
</table>

Nested logit demand estimation for Mid-Atlantic Region. \(R^2 = 0.76\). \(N = 405,831\) store-title pairs. Standard errors in parentheses.
Demand Results: Predicted Decay Rates by Box

All titles by box (using expected numbers)

Transactions

Month

Ho, Ho and Mortimer

Full-Line Forcing Contracts

03/08 21 / 35
Demand Results: Predicted Decay Rates for Box A Titles

A titles only

Month
Transactions
Act/Adv
Child/Fam
Com
Dram
Hor/Sus
Rom
Sci-Fi

Ho, Ho and Mortimer ()
Full-Line Forcing Contracts
03/08 22 / 35
<table>
<thead>
<tr>
<th></th>
<th>Price Elasticity</th>
<th>Inventory Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month 1</td>
<td>-0.134</td>
<td>0.331</td>
</tr>
<tr>
<td>Month 2</td>
<td>-0.138</td>
<td>0.246</td>
</tr>
<tr>
<td>Month 3</td>
<td>-0.146</td>
<td>0.168</td>
</tr>
<tr>
<td>Month 4</td>
<td>-0.150</td>
<td>0.108</td>
</tr>
<tr>
<td>Month 5</td>
<td>-0.135</td>
<td>0.072</td>
</tr>
</tbody>
</table>
Unweighted Average Price Elasticity Estimates

-0.16
-0.155
-0.15
-0.145
-0.14
-0.135
-0.13
-0.125
-0.12
-0.115

Month
All boxes
Box A
Box B
Box C

Ho, Ho and Mortimer ()
Full-Line Forcing Contracts
Unweighted Average Inventory Elasticity Estimates

Months: 1 2 3 4 5

- All boxes
- Box A
- Box B
- Box C

Ho, Ho and Mortimer ()

Full-Line Forcing Contracts

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Demand Results: Regression of Store-Title-Month Quality on Characteristics

Dependent variable: $\hat{\delta}_j + \hat{\gamma}_j z_m + \hat{\eta}_m + \hat{\theta}_t + \hat{\beta}_t x_j$

<table>
<thead>
<tr>
<th></th>
<th>Coefficient (Std Error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release date:</td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>-0.014 (0.004)</td>
</tr>
<tr>
<td>Quarter 3</td>
<td>-0.122 (0.004)</td>
</tr>
<tr>
<td>Quarter 4</td>
<td>-0.042 (0.004)</td>
</tr>
<tr>
<td>Box Office:</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>-0.701 (0.046)</td>
</tr>
<tr>
<td>C</td>
<td>-1.291 (0.042)</td>
</tr>
<tr>
<td>Genre:</td>
<td></td>
</tr>
<tr>
<td>Comedy</td>
<td>0.270 (0.047)</td>
</tr>
<tr>
<td>Child/Family</td>
<td>-0.605 (0.052)</td>
</tr>
<tr>
<td>Romance</td>
<td>-0.669 (0.047)</td>
</tr>
<tr>
<td>Science Fiction</td>
<td>-0.545 (0.055)</td>
</tr>
<tr>
<td>N</td>
<td>405831</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.39</td>
</tr>
</tbody>
</table>
Supply Side Analysis: Overview

- Demand model tells us how store revenues change with contract types
- Missing piece: effect of contract types on store costs
- We observe contract terms and capacity constraints but not other costs of holding inventory:
  - rent, restocking fee, insurance
  - cross-title, cross-month demand effects
- Estimate this using moment inequalities methodology
  - Function of store and studio characteristics (store tier, inventory, contract type, past "hits" from other studios...)
  - Start with single cost for all stores: $C$
Any store could have changed its contracts/portfolio with any studio
Since it chose not to, we must have

\[ E(\pi_{m}^{obs}(.) \mid I_{m}) \geq E(\pi_{m}^{alt}(.) \mid I_{m}) \]

Assume store has perfect foresight re: demand, perhaps not re: inventory holding costs
Write \( \pi_{m}(.) \) in terms of data, demand estimates and store costs:

\[ \pi_{m}(.) = \sum_{s} \sum_{j \in J_{s}} (r_{jm}(.) - C.c_{jm}) + \eta_{m} + \rho(c_{ms}, k_{ms}) + \epsilon_{ms} \]

Use inequality to place bounds on inventory holding cost.
Write return to the store from title $j$ as:

\[ r_{jm}(.) = \sum_{k \in \{LP, RS, FLF, 0\}} l_{jm}^k \left( y_j^k \left( \sum_{\bar{t} = t_j}^{t_j + 4} q_{\bar{t}jm} p_{\bar{t}jm} - u_j^k c_{jm} \right) \right) \]

Next step: predict inputs to $r_{jm}(.)$ under different contract types: $p_{tjm}, q_{tjm}(\tau_{tjm}, c_{jm}, s_{tjm}(.)), y_j^k, u_j^k$.

Values vary only slightly within store-contract type-box.

Ho, Ho and Mortimer (.)

Full-Line Forcing Contracts

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Do not directly model price change (or other variable change) after contract change

Instead, for any contract type, predict

- $p_{tjm}$, max rentals per tape ($\tau_{tjm}$): ave/max in store-box-contract type
- $c_{jm}$: same ave constrained by store capacity constraints & $c_{jm}$, $\bar{c}_{jm}$
- $q_{tjm}$ using demand estimates and maximum feasible supply

$$q_{tjm} = \min(Ms_{tjm}(.), \tau_{tjm}c_{jm})$$

- $(y^k_j, u^k_j, c_{jm}, \bar{c}_{jm})$ from modal values for contract type-title across stores
Define instruments $z_{ms}$ with $E(\varepsilon_{ms}|z_{ms}) = 0$ so that:

$$E \left( \Delta \pi_{m}^{s',j'}(.) | z_{ms'} \right) = E \left\{ \sum_{s} \sum_{j \in J_s} \left( \Delta r_{jm}^{s',j'}(.) - C \cdot \Delta c_{jm}^{s',j'} \right) | z_{ms'} \right\} \geq 0$$

Instruments:
- Studio-year level: number of titles released, percent A, percent B
- Store level: market size, demographics

Average ineqs over alternatives in studio-year and stores
Identify parameters satisfying implied system of inequalities.
Choice of alternative contract types:

- Store-title level: If store took LP for title $j'$, switch to RS and vice versa
- Studio-year level: If store took FLF, switch all relevant titles to RS. If not, switch to FLF.

Portfolio changes only in 4th case

Result: estimated bounds on inventory holding cost.
Counterfactuals: Welfare Effects of FLF Contracts

1. What would happen if studio s delayed implementation of its FLF contract?
2. Solve backwards from last to first month of counterfactual
3. Predict sequential choices that maximize store profits
4. Use results to evaluate:
   - Change in number of titles from this and other studios (market coverage and leverage effects)
   - Change in consumer surplus, store profit and studio revenues (total welfare effect).
Can We Model Retailer Learning?

- FLF contracts first offered by studios in February 1999, mid-way through dataset

<table>
<thead>
<tr>
<th>FLF titles offered</th>
<th>A Titles</th>
<th>B Titles</th>
<th>C Titles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1999</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>2000</td>
<td>4</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>2001</td>
<td>9</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

- We observe first take-up by retailers
- Can compare decisions to take LP/RS contracts to FLF takeup
- Also compare year-1 to year-3 FLF takeup
- Should help identify profitability of FLF contracts, retailer learning process.
Conclusions

- One of the first empirical bundling analyses
- Ideal dataset for considering effects of bundling contracts on welfare
- Demand model accounts for changing choice sets over time
- Reduced form analysis consistent with efficiency and market coverage; leverage effect looks small
- Counterfactuals using estimated effect of contract type on costs will quantify relative importance of these effects.