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Justin Ho
Katherine Ho
Julie Holland Mortimer

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ABSTRACT

Theoretical investigations have examined both anti-competitive and efficiency-inducing rationales for vertical bundling, making empirical evidence important to understanding its welfare implications. We use an extensive dataset on full-line forcing contracts between movie distributors and video retailers to empirically measure the impact of vertical bundling on welfare. We identify and measure three primary effects of fullline forcing contracts: market coverage, leverage, and efficiency. We find that bundling increases market coverage and efficiency, but has little impact on one distributor gaining leverage over another. As a result, we estimate that full-line forcing contracts increased consumer and producer surplus in this application.

Justin Ho
Dean & Company
8065 Leesburg Pike, 5th Floor
Vienna, VA 22182
ho@dean.com

Katherine Ho
Columbia University
Department of Economics
1037 International Affairs Building
420 West 118th Street
New York, NY 10027
and NBER
kh2214@columbia.edu

Julie Holland Mortimer
Department of Economics
Harvard University
207 Littauer Center
Cambridge, MA 02138
and NBER
mortimer@fas.harvard.edu

1 Introduction

Upstream firms in vertically-separated markets use a variety of contractual arrangements to influence the behavior of downstream firms (e.g., resale price maintenance, exclusive dealing, exclusive territories, revenue-sharing contracts, and bundling). Such vertical arrangements and bundling options are especially important in markets for information goods (e.g., music, television, movies, and books), particularly as digitalization of these markets increases and new distribution channels emerge. An extensive theoretical literature has examined firms' incentives to adopt various types of vertical and product-bundling contracts, as well as their competitive effects and welfare impacts more generally. In the case of vertical arrangements, some theoretical explanations focus on anti-competitive rationales for firms to bundle, whereas others focus on efficiency-inducing rationales. Thus, empirical evidence is essential for understanding the impact of different vertical bundling arrangements in place across different markets, both for information goods, and for markets more generally.

Limited product-level data are a key challenge to empirical analyses of the impact of vertical arrangements and bundling. This is especially true for information-goods markets, which are characterized by a continual introduction of new products over time, with demand that peaks early and decays rapidly. In many cases, consumer demand for content in these markets is unobserved or poorly measured. In this paper we rely on an extensive dataset on the video-rental industry that provides detailed information on both consumer demand for products, and vertical contractual and bundling arrangements between upstream and downstream firms. The data contain substantial information on the introduction of new content (i.e., movies) and the subsequent demand profiles for this new content over time at the individual store level. The data are used to analyze the demand effects of a change in the variety of new movies stocked at a store that are induced by a revenue-sharing form of bundling, along with the general welfare implications of the vertical bundling contract. The video-rental industry is an early example of bundling in an information-goods market. While the technology for distributing information goods has changed, we believe that our empirical approach provides a useful guide for how to analyze the welfare effects of vertical bundling contracts for more current markets (e.g., content bundling in cable television, iTunes, or movie downloading services).

The bundling arrangement in the video-rental industry takes the form of a "full-line forcing" contract, in which firms are rewarded for accepting a producer's full line of products. Movie distributors offer video rental stores the choice of three contract types for distributing the bulk of their titles: linear pricing (LP), revenue sharing (RS), and full-line forcing (FLF). Under linear-pricing contracts, the store pays a fixed, upfront cost per tape, usually between \$65 and \$70. Under revenue-sharing contracts the upfront cost is much lower (around \$8-\$10 per tape) but the store also pays a fraction of the rental revenues (in the region of 55 percent) to the distributor. Full-line forcing contracts provide better revenue-sharing terms than the RS contracts (upfront costs of \$3 per tape and revenue-sharing payments of 35 - 40 percent), but require the store to buy minimum quantities of every title released by the distributor during the period of the contract (usually 12 months).[1] FLF contracts represent a mixed

[1]Distributors sell some additional titles on "sell-through pricing" contracts, in which all buyers, including video rental stores, can purchase tapes for around \$20-\$25 each. There is no contract choice for these titles, which usually include children's movies or titles with "teenager" appeal.

bundling arrangement because retailers can still acquire a distributor's titles through LP or RS contracts.

In a previous paper, Ho, Ho and Mortimer (2010), hereafter referred to as HHM, we used the same data as in this paper to analyze the decisions of distributors and retailers to offer and adopt FLF contracts. HHM develops a detailed model of consumer demand and estimates the value to retailers of holding inventory in this market. That paper then uses the demand and supply-side models to investigate distributor decisions to offer FLF contracts, retailer decisions to take FLF contracts, and the profitability of these choices. Most large distributors offer FLF contracts in our data. The analysis in HHM indicates that distributors make profit-maximizing choices when they decide whether or not to offer FLF. While that paper develops an approach for analyzing the contracts observed in the industry and investigates the direct impacts of the FLF contracts for firms, it does not address the implications for the retailer's decision to stock competing titles not distributed through FLF contracts. It also does not analyze the implied effects of these choices on the overall variety of products offered to consumers and on social welfare.

In this paper we extend the previous findings by analyzing and quantifying the magnitudes of the effects of FLF adoption on the decision to stock competing titles, and the implications of the FLF contracts for social welfare. We discuss three potential welfare effects of FLF contracts, a "market-coverage effect" a "leverage effect" and an "efficiency effect."

An efficiency effect occurs if there are titles for which the retailer stocks higher levels of inventory in response to the lower upfront cost per tape on FLF compared to LP. Any vertical contract that aligns the costs of upstream and downstream firms can result in an efficiency effect for the relevant products. In our setting, both RS and FLF contracts result in lower upfront costs per tape compared to LP. However, RS mitigates the problem only for low-value titles because of a selection effect: stores tend to choose RS contracts for titles where they expect to have low demand. When FLF contracts are introduced, the store is required to take all of the distributor's titles on revenue-sharing terms, implying that some titles will be pulled out of LP contracts and into contracts with much lower costs per tape. This reduces the inefficiency from the store's low inventory choices under LP (conditional on taking FLF), and is the source of the efficiency effect.

A market-coverage effect occurs if a retailer chooses a FLF contract when it would otherwise not have taken all of the distributor's titles, increasing the number of titles that are available to consumers. Conversely, a leverage effect occurs if the retailer compensates for the requirement to take all of a distributor's titles by dropping some titles produced by other distributors. The market-coverage and leverage effects both address the impact of FLF on retailer decisions to stock titles, and together they determine the impact of FLF adoption on the breadth of product variety potentially available to consumers. The overall effect of FLF on efficiency and welfare depends on the relative importance of these three effects and is an empirical question.

We first investigate these effects using regression analyses of our detailed dataset. Our results are consistent with the existence of both an efficiency effect and a market-coverage effect, but indicate that the leverage effect may go in the opposite direction from that predicted by theory. There are a few potential sources of this "positive" leverage effect. For example, the relatively low prices in the FLF contract may induce credit-constrained retailers to use the savings of the FLF terms to purchase more titles from competing distributors. Alternatively, this result may reflect simultaneity bias. For example, our regressions control for a rich set of fixed effects, but cannot control for demand shocks at the retailer-month level that may prompt retailers to adopt FLF contracts and simultaneously increase their holdings of other titles. A structural model is needed to address the selection issues and to conduct a full welfare analysis. We utilize the detailed model of the industry that was estimated in HHM and perform counterfactual analyses to investigate the three effects of bundling contracts. We ask how different the market would look in terms of the number of titles offered to consumers, and the mix of distributors producing those titles. We also predict inventories and prices under a counterfactual exercise in which FLF distributors choose not to offer FLF and, conversely, non-FLF distributors choose to offer these bundling contracts.

Our findings are consistent with the reduced-form results. We document the market-coverage, leverage, and efficiency effects. We find that the leverage effect is very small (between -0.1 and +0.2 titles per distributor per year) and that, for four out of the six large distributors analyzed, retailers slightly increase the number of titles taken from other distributors when they adopt a FLF contract. The findings of a substantial, positive market coverage effect and a negligible leverage effect imply a positive effect of FLF contracts on the variety of titles made available to consumers. We also find a positive effect of FLF contracts on consumer surplus generally. In addition, we find that retailers always benefit from the option to take FLF. However, in almost all cases these effects are dominated by the impact of the FLF contract on the focal distributor's profits. Our overall finding is that distributors' choices regarding whether to offer FLF contracts tend to be both profit maximizing and welfare enhancing.

We note that the non-FLF distributors in our data are major suppliers that have high retailer take-up of their titles even without bundling contracts.[2] It is not surprising that the loss to these distributors from offering the more generous FLF terms to retailers outweighs the downstream benefits to retailers and consumers. In contrast, the FLF distributors we consider are somewhat less strong players that profitably utilize FLF to persuade retailers to take their titles. The very small leverage effect means that the benefits to consumers, retailers and the focal distributor dominate any costs borne by competing distributors.

Understanding the effects of FLF contracts speaks broadly to two literatures. First, the literature on bundling/tying focuses on the benefits that firms receive from bundling arrangements through their ability to mimic price discrimination or apply leverage across products or markets. Second, the literature on vertical arrangements focuses on their potential to both soften competition (through foreclosure or by raising rivals' costs) and induce efficient investments. All of these mechanisms may be present in FLF contracts, because they represent bundling in the context of a vertical arrangement. In the example we study, FLF terms include a revenue-sharing component, making the vertical structure particularly salient.[3]

[2] See HHM for a more complete discussion.

[3] Burstein (1960) views full-line forcing as a means of achieving the effects of vertical integration, and several papers discuss the leverage effect including, for example, Whinston (1990), Choi and Stefanadis (2001), Carlton and Waldman (2002) and Nalebuff (2004). Price discrimination is another potential explanation that is examined in theoretical papers such as Stigler (1962), Adams and Yellen (1976), McAfee, McMillan and Whinston (1989) and Salinger (1995). There is also a small but growing empirical literature studying

The three effects that we discuss (market-coverage, leverage, and efficiency) are impacted by both the bundling and revenue-sharing components of FLF contracts. Bundling affects market coverage (the decision to take a title), while revenue-sharing terms may further affect the number of tapes taken (i.e., the size of a store's inventory). Similarly, FLF contracts affect leverage, both through the decision to hold another distributor's titles as well as the inventory level of those titles. Finally, the efficiency effect depends on both the bundling and the revenue-sharing aspects of the contracts as well: bundling is required to induce firms to forgo less efficient LP contracts on high-value titles, and revenue-sharing terms are necessary to reduce upfront costs so that inventory levels are closer to what an integrated firm would choose.

Many aspects of the legal environment in the U.S. make a welfare study of FLF contracts particularly interesting. Referring to U.S. law, Shy (1995) notes "courts have been more receptive to vertical arrangements that [do] not involve price restraints." This is due in part to the potential for conflict between federal antitrust laws that govern price fixing and state laws that govern fair trade between firms. To the extent that firms can navigate their vertical relationships via non-price strategies (such as tying/bundling, revenue-sharing, quantity requirements, etc.), the potential for facing allegations of antitrust violations may be reduced. As a result, such strategies are widely-adopted in vertical settings in many industries, making our study an important first step for understanding the use and implications of these types of arrangements more generally.

This paper continues as follows. In Section 2 we outline the important institutional features of the industry and discuss the empirical implications of the theoretical literature on bundling; Section 3 describes the data. In Section 4 we provide regression analyses to understand the selection effect and the likely magnitudes of the welfare effects. Sections 5 and 6 outline the model developed in HHM, which is applied in this paper to investigate welfare effects. Section 7 describes our welfare analyses and Section 8 concludes.

2 Full-Line Forcing in the Video Rental Market

This section summarizes some important institutional features of the market and discusses the implications of bundling for efficiency in this industry.

2.1 The video rental market

The video rental industry has two primary tiers: distributors, who distribute movies, and video rental stores, who acquire movies and offer them for rental and sale to consumers. Three different contractual forms are used to distribute titles targeted to the rental market

bundling. Chu, Leslie and Sorensen (2007) studies bundling of theater tickets. Crawford (2008) examines discriminatory incentives for bundling in cable TV, and Byzalov (2008) and Crawford and Yurukoglu (2008) estimate the welfare effects of bundling in the retail market for cable television. Relatedly, Asker (2005) provides an empirical study of exclusive-dealing contracts in the context of beer distributors, and Marx and Shaffer (2004) use reduced-form analyses to investigate the pro-competitive and anti-competitive effects of slotting allowances, which are paid by manufacturers to supermarkets in order to reserve shelf space for their products. For further information, HHM provides a more detailed literature review.

from distributors to rental stores. The first is linear pricing (LP), in which a store purchases a title from the distributor for a fixed cost per tape, usually between \$65 and \$70.[4]

The second contractual form is revenue sharing (RS), in which a rental store leases a title for a low upfront cost per tape, and shares the revenues generated by renting out a title with the distributor. In the typical RS contract, the distributor charges an upfront cost of around \$8 per tape and receives about 55% of the rental revenue. The inventory taken by the rental store under RS is generally constrained by both maximum and minimum quantity requirements. RS and LP contracts are both implemented on a per-title basis.

The third form of contract is full-line forcing (FLF), in which the rental store agrees to accept all titles released by the distributor during the period of the agreement (typically 12 months).[5] The terms of the FLF contracts resemble generous RS contracts: the distributor receives an upfront payment per tape of around \$3 and a share of the revenues of around 30 percent, and the inventory of the retailer is restricted to be within a range, which varies by distributor with the box office of the movie and the size of the store.

In addition to setting terms for each contractual form, the distributor can, in theory, choose which contractual forms to offer. In practice, RS contracts were not widely used before the end of 1997, and FLF contracts were not introduced until February 1999. One reason that these contracts were not used earlier is that both RS and FLF require extensive computer monitoring of millions of transactions, and only about half of the stores in the industry had the technology to adopt these contracts by 1998.

Finally, a few titles are offered on "sell-through pricing" (STP) terms. These titles include, for example, children's movies and a few very popular titles. Under STP terms, the distributor sells tapes for a wholesale price of around \$15 each; these titles are purchased both by video rental stores and also by end-users upon release. There are no alternative contract choices for these titles. Finally, the sales market is important for distributors and should be included in any model of their choices of contract types. However, sales provide only a small proportion of total revenues of rental stores, whose choices are the focus of this paper.

2.2 Empirical Implications of Theory on Bundling

We consider three potential welfare effects of introducing FLF contracts. First, the contracts affect retailers' inventory choices. The high cost of tapes under LP contracts causes stores to choose low inventory levels for LP titles compared to the inventory choice of a vertically-integrated firm. This inefficiency is reduced when titles shift to RS contracts because the average upfront cost per tape falls and the store's inventory level increases. However, when choosing between RS and LP contracts, retailers have incentives to choose LP contracts when

[4]As discussed in our companion paper, rental stores may legally resell tapes purchased under LP contracts (although in spite of this, we do observe a few volume discounts offered under LP).

[5]Some exceptions apply: titles released by the distributor on sell-through pricing contracts (i.e., fixed price contracts, similar to LP, but with a low initial release price) are exempt, and several distributors allow for limitations on the total number of titles that a retailer must accept within any given month. Usually, this limit is three titles per month: if the distributor releases more than three titles in a month (a rare event), the retailer is only obligated to accept three of them. Finally, FLF contracts also typically include opt-out clauses for movies with 'objectionable' content.

expected demand for the title is relatively high.[6] Thus, offering RS contracts in addition to LP contracts may not mitigate the efficiency loss from low inventory choices for high-value titles, for which the loss is relatively large. This is the source of the efficiency effect of a FLF contract: since the contract requires the store to take all of the relevant distributor's titles under terms that include a low upfront cost and a low average cost per tape, valuable titles are pulled out of LP contracts, and this may significantly reduce the low inventory problem.

The low inventory effect of LP may not substantially affect the prices charged to consumers because there are two opposing effects. First, the selection of high demand titles under LP contracts (and possibly the higher average cost per tape) provides an incentive to increase the average rental price compared to RS or FLF titles. However, once the inventory has been purchased, the store has an incentive to price LP titles below the RS or FLF titles that compete with them, in order to draw consumers to the titles for which they capture 100% of the rental revenues. These two offsetting effects may imply small differences in rental prices between contract types.

There are two other potential welfare effects of introducing FLF contracts. First, if the store previously took only a subset of the distributor's titles, the fact that it must now take all of them implies a positive effect on market coverage. This is probably welfare-improving because it increases the size of consumers' choice sets. Conversely, this effect may prompt the store to drop other distributors' titles: this is the leverage effect and is likely welfare-reducing, because it reduces consumers' choice sets and competition between distributors.

The relative magnitudes of these three effects will depend on the mean and variance of demand for the titles released by different distributors, the extent of complementarities between them, and the benefit or cost to stores of holding inventory. The aggregate effect of FLF contracts on consumer choice sets and welfare is therefore an empirical question.

3 Data and Summary Statistics

We observe transaction data recorded at the store-title-month level from January 1, 1998 to June 30, 2002. The data cover 6,393 video retail stores, 961 titles (201 in the A box-office category, 188 B titles and 572 C titles) and 59 distributors. We observe store location at the zipcode level, which allows us to combine the transaction data with phonebook listings of competing video retail locations in each year, and data from the 2000 US Census on the local demographic characteristics of each store.[7]

Summary statistics are provided in tables 1 to 5. Table 1 sets out average contract terms, numbers of rentals, prices and inventories for each contract type. Averages are taken across store-title pairs. The average estimated wholesale cost for LP contracts is \$66.82, compared to an average upfront cost of \$8.47 for RS contracts, \$3.62 for FLF contracts and a cost of \$15.17 for sell-through priced contracts. Retailers on average keep 46% of revenues under RS contracts, and 59% of revenues under FLF contracts. The minimum number of tapes per title is 10 on average for RS contracts and 11 for FLF contracts. On average, the maximum number of tapes allowed per title is 23 for both contracts. Average month 1 rentals are

[6] The fact that retailers can choose between contracts presents an adverse selection problem for the distributor. Mortimer (2008) formalizes this intuition under an assumption that demand is independent across titles.

[7] For additional detail on the data, please see our companion paper.

higher under RS contracts than FLF or LP contracts but the decay rate is also greatest for these titles; by month 2 LP titles have higher demand and this remains true in months 3, 4 and 5.

Average inventory levels are highest for titles purchased under STP and RS contracts and lowest for those under LP contracts. This is the source of the efficiency effect described above. Not surprisingly, retailers also extract the largest number of rentals per tape for titles purchased under LP contracts. Average rental prices under RS contracts are very similar to prices under LP contracts in the first month of release, although they fall faster for RS titles than for LP titles over time.[8] This may indicate that the price-increasing effect of a high cost per tape under LP slightly outweighs the opposing effect of the two-part tariff under RS. It also implies that the margin on which prices adjust may be the timing of removal of the "new release" sticker, with concurrent price reduction or increase in the rental period (and a resulting decrease in late fees collected).

Tables 2 and 3 summarize the number of titles released by distributors, and taken by stores, under different contract types. Roughly 90% of titles in our data are offered under LP contracts; 56% of these are also offered under RS contracts.[9] No FLF contracts are offered in the first year of our data; a total of ten titles are offered on FLF terms in year 2, eighteen in year 3, and 38 in year 4. Table 3 further reports that stores on average adopt many more titles under LP terms than under other contract types.

Table 4 provides information on the size distribution of stores choosing different types of contracts. Stores are categorized into ten sizes, called "tiers," with tier 1 containing the smallest stores and tier 10 the largest stores. We begin by calculating the percent of each store's titles that were taken under each contract type. We then break down this distribution into quintiles and report, in the first panel of the table, the average store size (tier) for each quintile. The results demonstrate that stores that accept very few titles on LP contracts (the lowest quintile) are the small stores - these stores take a relatively high proportion of their titles on RS contracts. A similar pattern holds for STP titles. The stores that accept a high proportion of their titles on LP contracts are on average larger stores. This is consistent with the adverse selection effect noted above: large stores tend to be located in high-demand markets and therefore expect high demand for their titles. LP contracts are most profitable for these stores. The pattern for FLF contracts is more evenly spread, with mid-size stores being more likely to accept a high proportion of their titles on FLF contracts.

The second panel of table 4 looks at these patterns in more detail. For each quintile and contract type, we examine the percent of stores in that quintile/contract type that are in store tiers 1-3 or store tiers 7-10. We normalize these percentages by the overall percent of stores that are in those tier groups across all quintiles and contract types. Thus, the result of 1.59 for tier 1-3 under LP and Quintile 1 indicates that store tiers 1-3 (small stores) are relatively over-represented in the first quintile of LP contracts (a value greater than 1 indicates over-representation, and a value less than 1 indicates under-representation). Overall, small stores are over-represented in the first, second, and third quintiles of LP contracts, the third, fourth and fifth quintiles of RS contracts and the first and second quintiles of FLF contracts. The

[8] Average rental prices are calculated as total monthly revenue (including late fees) divided by total monthly rentals.

[9] Approximately 10% of titles are offered under STP terms only.

reverse pattern holds for large stores: these are over-represented in the fourth and fifth quintiles of LP and FLF contracts and in the first and second quintiles of RS contracts. However, similar to small stores, large stores are also over-represented in the first quintile of FLF contracts.

Table 5 provides information on the contractual take-up of stores based on their chain size. The construction of the table is analogous to table 4. Larger chains take more LP contracts, and fewer RS contracts. Take-up of FLF contracts is highest for mid-sized chains (note that both single stores and large chains are underrepresented in the highest quintile of FLF take-up).

4 Reduced-Form Evidence

We now discuss preliminary evidence and patterns from the data. In particular, we ask whether reduced-form analyses can provide any evidence on the importance of the efficiency, market-coverage and leverage effects of full-line forcing contracts. First, we summarize evidence from previous papers that pertains to the efficiency effect. Second, we provide new analyses of the market-coverage and leverage effects.

4.1 Previous Evidence on the Efficiency Effect

Recall that the efficiency effect fundamentally concerns the issue of double marginalization. Specifically, when upstream firms sell inputs (i.e., tapes) to downstream retailers with a mark-up, the level of inventory chosen by downstream retailers will be lower than the inventory level that a vertically-integrated firm would have chosen. LP contracts have a much larger upfront mark-up per tape, and titles distributed on LP contracts are subject to greater inefficiencies than titles distributed on RS or FLF contracts. It is difficult to measure this effect because of the importance of selection by retailers across contracts (i.e., retailers expecting to earn lower revenues are more likely to take RS or FLF contracts), and this selection confounds our ability to measure an efficiency effect. Two previous papers (Mortimer (2008) and Ioannou, Mortimer, and Mortimer (forthcoming)) examine this in detail. The relevant findings from those papers indicate the following: smaller stores are more likely to participate in RS contracts; stores accepting RS contracts purchase approximately three times more tapes (compared to similar titles under LP contracts at the same store), but rentals increase by only 30-40 percent; and the marginal return of a tape under different contracts is close to its net cost.[10]

4.2 Market Coverage

On average, stores take 53% of titles released by distributors that offer FLF contracts at some point, excluding FLF contracts themselves. This is consistent with a potentially large effect of FLF on market coverage. To investigate this issue, we estimate the following regression:

$$Titles_{mdt} = \beta FLF_{mdt} + \eta_m + \eta_d + \eta_t + \epsilon_{mdt}. \qquad (1)$$

[10] In this prior research, the average net cost for LP titles reflects estimates of additional retailer discounts not observed in the data, and is estimated to be on the order of \$45 per tape.

The dependent variable, $Titles_{mdt}$, denotes the number of titles taken at the store-distributor-month level; FLF_{mdt} is an indicator that store m has active FLF contracts for distributor d in month t. To control for potential simultaneity resulting from time-invariant store and distributor characteristics, we include store and distributor fixed effects, η_m and η_d respectively. In addition, we include month fixed effects, η_t, to absorb any unobserved effects that are time-varying but invariant across stores and distributors (e.g., the catalog of titles covered by a FLF contract in any given month). We include only store-distributor pairs for which a FLF contract exists at some point in our panel, and only months when the distributor offers FLF contracts. We are therefore looking within-store and asking whether taking a FLF contract from a particular distributor is correlated with title choices specific to that distributor, controlling for average distributor and month effects.

The first column of table 6 provides the results from this regression. The coefficient on FLF activity in this regression is positive and significant, with a value of 0.38, implying that FLF stores carry 0.38 more titles per studio per month than they would have carried in the absence of FLF contracts (or roughly 4.5 more titles per year for every studio with which the retailer has a FLF contract). We also run similar regressions at the store-title level, in which the dependent variables are the number of tapes per title and the total number of transactions per title over its life.[11] Thus, we estimate:

$$y_{jm} = \beta FLF_{jm} + \eta_m + \eta_j + \epsilon_{jm}. \tag{2}$$

The dependent variable is either the number of tapes for title j at store m, or the number of rentals for title j at store m. We replace distributor and month fixed effects with title fixed effects.[12] The second and third columns of table 6 provide the results of these regressions. The coefficient on FLF activity in the regression considering the number of tapes per title is 2.77 (standard error 1.16).[13] This implies a positive market expansion effect in terms of both the number of titles taken and the number of tapes per title. The equivalent coefficient in the transactions regression is also positive, but no longer significant (coefficient 12.71, standard error 9.30). Taken together, the findings indicate that a retailer's adoption of a FLF contract with a distributor is associated with increased retailer product variety (i.e., more titles) and increased availability (i.e., more tapes for those titles) for titles sold by that distributor.

4.3 Full-line Forcing and Competing Products

Our second reduced-form analysis investigates the leverage theory: that full-line forcing can have anticompetitive effects in the upstream market by reducing retailers' orders from other distributors. We might expect this effect to generate a negative correlation between the adoption of FLF contracts by a retailer and the orders (or rentals) of products from other, non-bundling distributors, whether that is measured in terms of the number of titles or the

[11] As in Mortimer (2008), all titles are tracked for a minimum of six months.

[12] Month-level variation is suppressed. In the case of inventories, this is because inventories are only ordered once for a given store-title pair. In the case of rentals, the estimation of month-level rental demand requires a more careful model of decay rates and capacity constraints over time, which we address later in the structural model.

[13] All standard errors account for correlation within store and title by clustering on both variables.

number of tapes per title. However, most of the theories that generate such predictions consider full bundling rather than mixed bundling. In our application (and consistent with many information-goods markets), large stores can select into different contractual forms in particular months and for particular distributors or titles. This added complication may mitigate some of the theoretical findings that are focused on full bundling.

We analyze the leverage effect by examining the results of regressions that are very similar to those run in the market-coverage analysis. The estimating equation is:

$$Titles_{mdt} = \beta FLFOther_{mdt} + \eta_m + \eta_d + \eta_t + \epsilon_{mdt} \tag{3}$$

where $FLFOther_{mdt}$ is an indicator that store m is using at least one active FLF contract in month t with any other distributor, measured at the store-distributor-month level. As in the previous section, we include store, distributor and month fixed effects. For each store, we exclude from the regression distributors with which the store ever has a FLF contract, and all months before FLF was offered by any distributor. The results are shown in table 7. The coefficient on the number of titles taken per store-distributor-month is positive and significant (coefficient of 0.026, standard error 0.007). That is, the leverage effect seems to go in the opposite direction than a theorist would predict, albeit to a relatively small extent, with the coefficient implying one additional title every three years per non-FLF distributor.

As above, we also run similar regressions at the store-title level, where the dependent variables are again the number of tapes per title and the number of transactions per title (replacing month and distributor fixed effects with title fixed effects). The coefficient on the $FLFOther$ variable in the specification using the number of tapes per title as the left-hand side variable is 0.31 (standard error 0.25); that on transactions per title regression is 9.36 (standard error 4.33). Thus, while the coefficients also suggest a positive effect of taking FLF on other-distributor activity for these specifications, neither of the outcomes are significantly different from zero. The market-coverage and leverage effects together suggest that adoption of FLF contracts increase product variety and availability at retailers, thus expanding the consumer choice set.

At least three possible factors may explain the result of a positive leverage effect. The first is an income effect that arises from the FLF contracts' low prices relative to other contractual forms. For titles that the retailer would have taken even without FLF, the improved terms under FLF may permit an increase in the number of titles taken from other distributors.[14] A second possible cause is that the adoption of FLF contracts, and the expansion of product variety and availability through the market-coverage effect creates increased traffic at the retailer, which spills over to increase demand for non-FLF titles. The third possible cause is a selection effect. While we include store fixed effects to address bias due to retailers selecting into FLF contracts, and distributor and month (and where possible, title) fixed effects to absorb the average effect of the numbers and qualities of titles released in particular months or by particular distributors, it is not feasible to include interactions between these fixed effects. The results may be consistent with stores taking FLF in periods when there is a shock to demand (e.g. periods in which a distributor runs an especially effective promotional campaign, or there is entry or exit of a close competitor). The structural model, described

[14] This income effect explanation requires some underlying inefficiency or assumption where retailers face restrictions in obtaining outside financing.

below, is needed to separate this and similar demand effects from the leverage effect we wish to identify.

5 A Model of Demand

We use the demand estimation results of HHM. To briefly summarize the method, we define a title's competitors in each month as the titles that are released during the previous four months (including the current month) and offered by the retailer. We specify a nested-logit model of demand, for which the demand equation is:

$$u_{ijmt} = \delta_{jmt} + \zeta_{igmt} + (1-\sigma)\varepsilon_{ijmt} \tag{4}$$

where i indexes consumers, j titles, m stores, t months and g the genre/class group of the title. The term ζ_{igmt} is an idiosyncratic preference term common to all titles in group g and ε_{ijmt} is an idiosyncratic preference term specific to consumer i and the product indexed by jmt. Cardell (1997) gives conditions such that $[\zeta_{igmt} + (1-\sigma)\varepsilon_{ijmt}]$ has an extreme value distribution with $\sigma \in [0,1]$ parameterizing the correlation of the idiosyncratic preferences within group ($\sigma = 0$ means no correlation; $\sigma = 1$ means perfect correlation). The term δ_{jmt} is specified as:

$$\delta_{jmt} = \delta_j + \gamma_j z_m + \eta_m + \theta_t + \beta_t x_j + \lambda_t c_{jm} - \alpha p_{jmt} + \xi_{jmt} \tag{5}$$

where δ_j is a title fixed effect, η_m is a store fixed effect, θ_t is a month fixed effect, p_{jmt} is the average price per rental of the tape at store m in month t, and c_{jm} is the inventory of title j at store m. The last term ξ_{jmt} captures any unobservable quality of renting title j in market m in month t (e.g. local promotions of a particular movie in a month). We interact title dummies with store characteristics: these describe the demographics of the store's market. Demographic variables are the percent white, the percent single and the percent with children. We therefore permit each store to predict the demand for a particular title based on the demographics of local consumers.[15] Month fixed effects are interacted with title characteristics and with the store's inventory level for the title. The latter accounts for the different average inventory levels associated with different contract types. We instrument for inventory using the average inventory of the same title across stores of the same tier. Our instruments for within-group share are the log of the average number of movies of the same type (same box-genre-store group) in the month, where the average is across other stores in the same size tier that offer the relevant title, and the average of $\ln(s_{jmt/gmt})$ for the same title-month pair across same-tier stores. The assumptions under which these instruments are valid are discussed in HHM.

[15]The HHM specification could also have interacted store dummies with title characteristics. We choose not to do this partly because our title characteristics are not very informative. In addition, the implied effect, that the "quality of a store" differs across types of movies - would identify essentially the same effect as the $\gamma_j z_m$ term: that stores serving different demographic groups expect different movies to be popular.

5.1 Demand Results

HHM run the demand model separately for 15 different geographic regions of the country because the dataset is too large to run the model using all the data together. We reproduce the results for the first geographic region in table 8.[16] The specification also includes title and store fixed effects and interactions between title fixed effects and store characteristics and between month fixed effects and title characteristics (box office category, genre and rating and interactions between these). Column 1 of the table reports results for the OLS regression. Column 2 adds instruments for within-group share and Column 3 also instruments for inventory.

The R^2 is approximately 0.80 in all three models. The fact that the model fits the data well is particularly useful since our supply side estimation will stay within-sample in terms of titles and stores, allowing stores to deviate only in terms of contract choices. We will therefore use all the estimated fixed effects in our inequalities and counterfactuals. Additional discussion of the results may be found in the original HHM paper.

6 The Supply Side: Moment Inequalities

Having estimated a detailed demand model, the final piece of information needed to analyze stores' choices of contract types is the value (positive or negative) of holding additional tapes. This includes negative effects such as rent, insurance and restocking costs and also the potential value of selling used tapes and of drawing new customers into the store. We use the inequalities estimator developed in HHM. The estimator assumes the existence of a Bayesian Nash equilibrium where each retailer's profit from its observed portfolio of titles and choice of inventory per title is greater than its profit from any of its alternative choices. A series of inequality constraints are derived from this assumption and used for estimation. The value of additional inventory is permitted to differ between titles taken on LP and RS contracts and also between titles in different box office groups and between different types of retailers. The results are reproduced in table 9.

Most of the estimated coefficients are negative, implying a positive value of holding inventory for almost all retailers and titles. Most retailers (all but the stand-alone outlets) have a much higher value per tape for LP titles than for RS titles. HHM notes two hypotheses that may explain this finding. First chains may make more money from LP than from RS, for example because of volume discounts. Second they may have deep relationships with LP wholesalers that make them inclined to take more titles on LP even though this does not directly increase their bottom line profits. The paper distinguishes between these hypotheses by using the model (including both demand and supply side estimates) to predict retailers' decisions regarding FLF take-up when different proportions of the estimated incremental value of LP tapes is assumed to affect bottom line profits. The proportion that best fits the model's prediction to observed data on FLF take-up is 44%. We assume that this is the correct proportion and use it in the welfare analyses that follow.

[16] This region contains zip codes from 20000 to 24999. It includes areas in the mid-Atlantic such as Washington DC and parts of Virginia.

7 Impact on Consumer Choice Sets and Welfare

We now use the model to estimate the effect of FLF contracts on consumer choice sets (i.e., the variety of products carried by retailers) and welfare. Our methodology expands upon that used in HHM to investigate the decisions of distributors to offer, and retailers to adopt, FLF contracts. We focus on six large distributors during a 12-month period of our panel. Two of the six offer FLF terms. For each focal distributor we predict retailers' choices when FLF is offered in the relevant year and when it is not, in each case allowing each retailer to optimize over the titles offered by other distributors as well as by the focal distributor. We make the simplifying assumption that retailers' orders only take into account titles that are released in the previous four months or in the current month (i.e., the time period during which the bulk of all rentals occur for a title). Inventory and rental price are assumed to be determined by contract type (the average in the data for the store-box-contract type-month).

HHM reports predicted retailer take-up of the focal distributor's titles and retailer and distributor profits when FLF contracts are offered and when they are not. Tables 10 through 12 extend the results of the HHM analysis to identify the leverage effect, as well as the implications of the FLF contracts on social welfare that result from the leverage, efficiency, and market-coverage effects. Table 10 reports results from the structural model for the predicted changes in retailers' choices of titles that result from the use of a FLF contract. The effect of the FLF contracts on the titles of the focal distributor describe the market-coverage effect, and were originally provided in HHM. The effect of the FLF contracts on the titles of competing distributors identifies the leverage effect, which is estimated by predicting retailers' choices of titles for those distributors. Table 11 reports the average predicted change in the number of tapes per title taken by retailers from the focal distributor when they adopt FLF, helping to identify the efficiency effect. Finally, table 12 provides a welfare analysis of the effect of the FLF contracts. The effect of the contracts on the profits of distributors and retailers was previously reported in HHM; table 12 adds an analysis of the impact of FLF on consumer surplus, and the net effect for social welfare.

Each table has seven panels that relate to the six distributors considered in the simulations. The first FLF distributor has two panels relating to the 294 (1574) retailers that take (do not take) the FLF contract in reality. The second FLF distributor has just one panel relating to 2093 retailers, all of which took the FLF contract.[17] Four additional panels relate to each of the non-FLF distributors.

The results are consistent with the reduced-form analyses. Table 10 documents the market-coverage effect: for every focal distributor the mean number of titles predicted to be dropped per retailer falls when FLF is offered (for example from 3.4 to 1.5 for the second FLF distributor and from 2.8 to 0.9 for the third non-FLF distributor). In contrast the leverage effect is very small. In four out of six cases the introduction of FLF by the focal distributor coincides with a slight increase in the average take-up of other distributors' titles.[18] The title

[17] Only 35 retailers choose not to take FLF from this distributor, a sample too small to analyze. We exclude one additional retailer that was included in the sample in HHM because its consumer surplus effects are in the tail of the distribution and we wish to prevent our estimates being affected by outliers. This has no effect on the results reported in table 10 and changes each of the profit numbers reported in table 12 by less than \$11.

[18] For the first non-FLF distributor the average number of other-distributor titles dropped falls from 5.44

fixed effects and their interactions with retailer demographic characteristics in the demand model control for the positive demand shocks that were the third possible cause of the leverage results in the regression analyses. We conclude that the results are likely to be due to retailers using the savings from improved terms to increase their overall portfolios or responding to increased demand caused by the market-coverage effect. The results for the market-coverage and leverage effects indicate that adoption of FLF contracts substantially increases the choice set available to consumers, by increasing the number of titles taken from the FLF distributor, while having little or no change in the number of titles taken from other distributors.

Table 11 documents the efficiency effect. We consider only retailers that are predicted to adopt FLF from the focal distributor and only titles released by the focal distributor that the retailer is predicted to take when FLF is not available.[19] We report the average predicted difference between the number of tapes taken per title by the retailer when it adopts FLF and the number taken when FLF is not available, where the average is taken across titles and then across retailers. We then report the averages separately for titles taken on LP contracts and those taken on RS contracts in the no-FLF scenario. As expected, we observe an increase in inventory overall, with the average increase ranging from 1.08 tapes per title for the third non-FLF distributor to 4.16 tapes per title for the second non-FLF distributor. The increase is substantially larger for titles that are taken on LP when FLF is not available than for those taken on RS.[20] This is the source of the efficiency effect.

Finally table 12 reports welfare effects. Columns 1-3 report retailer and distributor profits. Mean retailer profits always increase when they are given the additional option of choosing FLF contracts. Each focal distributor's observed choice of whether to offer FLF is profit-maximizing: FLF distributors have higher profits when FLF is made available while non-FLF distributors' profits are higher when it is not.[21] The very small leverage effect implies that other distributors' profits differ very little across the two scenarios. Column 4 indicates that the average consumer surplus per store is always slightly higher when FLF is offered than when it is not. The sign of this effect comes from the larger set of titles and inventory made available to consumers under FLF. Its small magnitude reflects the fact that many of the most popular titles were already being offered, implying that the benefits of increasing variety are not well captured by mean results.

The overall welfare estimates indicate that distributors' observed choices of whether to offer FLF contracts are almost always welfare-maximizing as well as profit-maximizing. For

to 5.35 when FLF is adopted. Both are reported as 5.4 in the table to ensure format consistency across panels.

[19] We reduce the sample further by including only retailers that are predicted to take titles on both LP and RS contracts when FLF is not available. We exclude retailers that take only LP contracts in this scenario because the selection effect already discussed implies that their inventory per title under LP is higher than that for other stores. Including them would make it difficult to compare the numbers for titles taken on LP to those that are taken on RS contracts in the no-FLF scenario.

[20] As shown in Table 1, the average inventory taken per title under FLF is in fact slightly lower than that under RS when the average is across all store-title pairs. The different results reported here are likely to be due to the different sample of retailers and titles considered.

[21] FLF distributor 1 would lose money on average from FLF contracts with retailers that in reality do not take a FLF contract. These retailers differ in several observable dimensions from retailers that take FLF from the distributor.

both FLF distributors, the loss to other distributors from the introduction of FLF is outweighed by the gains to the focal distributor, to retailers and to consumers. For three out of four non-FLF distributors, the loss to the focal distributor from offering FLF outweighs the gains to all other agents. Only non-FLF distributor 4 makes a choice that reduces total welfare. In that case the large benefit to retailers and consumers from FLF would have outweighed the loss to the focal distributor.

8 Conclusion

The results from the detailed model are in line with our reduced-form estimates. We document the market-coverage and efficiency effects but find that the leverage effect is very small in magnitude and often implies an increase in the take-up of other-distributor titles when FLF is adopted. The leverage effect finding is interesting because the distributors we consider are among the largest in the data in terms of both numbers of titles released and revenues. These major suppliers might be expected to have some influence over retailers' portfolio choices outside their own product offerings. The finding that this is not the case may be explained by the relatively generous terms of FLF contracts in our data coupled with the concentration of FLF take-up among larger retailers, whose choice of other-studio titles is less likely to be affected by an increase in inventory taken from one distributor.

Overall, the adoption of FLF contracts is associated with increased product variety and availability for consumers, and increased profits for retailers. However, the decision to offer FLF contracts rests with the focal studio. In our previous work, we found that the distributors choosing not to offer FLF had high take-up rates from retailers, even in the absence of these bundling contracts. It is perhaps not surprising then, that the cost of offering more generous terms to retailers outweighs the potential benefit for these distributors. Conversely, the FLF distributors we analyze have lower take-up rates in general; for these distributors, we predict that the benefits of offering bundling contracts outweigh the costs. This together with the positive consumer surplus and retailer profit effects imply welfare gains from FLF.

The methodology developed in this paper is generally applicable to other information-goods industries where there is a constant cycle of new content introduction and relatively rapid peaks and decay in demand. Furthermore, vertical and downstream contractual and content bundling arrangements are constantly evolving in these industries as content is digitized and new distribution channels are pursued. Our detailed consumer demand information combined with detailed vertical contractual information is unusual for empirical analyses of the impact of product bundling. These detailed data allow for unique insights on the impacts of vertical arrangements and bundling, and provide a basis for considering the impact of similar contractual arrangements in information-goods industries generally.

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Table 1: Summary Statistics

Contract	Linear Pricing	Revenue Sharing	Full-Line Forcing	Sell-Through Pricing
Avg. Upfront Cost	66.82	8.47	3.62	15.17
	(5.60)	(1.08)	(1.20)	(1.63)
Avg. Retailer's Share of Revenue	100%	45.99%	59.02%	100%
	(-)	(2.99%)	(1.99%)	(-)
Avg. Minimum quantity	-	10.32	10.87	-
	(-)	(11.55)	(10.53)	(-)
Avg. Maximum quantity	-	23.49	22.61	-
	(-)	(22.48)	(21.38)	(-)
Avg No. of Rentals				
Month 1:	52.11	62.58	52.16	91.28
	(81.85)	(86.88)	(88.72)	(120.49)
Month 2:	67.36	66.21	61.87	85.32
	(92.91)	(91.18)	(82.27)	(101.92)
Month 3:	40.22	33.24	33.12	41.31
	(52.88)	(44.99)	(44.23)	(47.93)
Month 4:	25.90	21.22	20.93	23.00
	(32.42)	(27.54)	(26.94)	(25.80)
Month 5+:	69.89	56.79	51.45	74.56
	(101.98)	(83.37)	(74.42)	(134.51)
Avg Rental Price				
Month 1:	2.65	2.68	2.68	2.69
	(0.57)	(0.49)	(0.60)	(0.53)
Month 2:	2.83	2.78	2.88	2.87
	(0.56)	(0.50)	(0.56)	(0.59)
Month 3:	2.83	2.78	2.87	2.94
	(0.61)	(0.55)	(0.64)	(0.71)
Month 4:	2.83	2.78	2.86	2.96
	(0.67)	(0.60)	(0.68)	(0.83)
Month 5+:	2.79	2.68	2.86	2.93
	(0.72)	(0.67)	(0.76)	(0.89)
Avg Rentals per Tape				
Month 1:	5.58	4.19	4.14	5.26
	(4.44)	(2.72)	(3.14)	(4.85)
Month 2:	7.59	4.71	5.54	5.19
	(4.93)	(3.11)	(3.84)	(3.75)
Month 3:	5.06	2.51	3.46	2.71
	(3.83)	(1.86)	(2.91)	(2.17)
Month 4:	3.59	1.67	2.48	1.65
	(2.98)	(1.32)	(2.43)	(1.69)
Month 5+:	13.59	5.00	7.42	6.72
	(14.47)	(4.93)	(9.56)	(8.99)
Avg Inventory	9.09	14.20	12.74	18.18
	(14.25)	(16.86)	(17.27)	(21.60)

Notes: Averages are across store-title pairs. Standard deviations in parentheses.

Table 2: Titles Released by Distributors

Contract	Linear Pricing	Revenue Sharing	Full-Line Forcing	Sell-Through Pricing
Total No. of Titles Released by Distributors				
Year 1:	219	115	0	27
A Titles:	30	12	0	15
B Titles:	36	17	0	6
C Titles:	153	86	0	6
Year 2:	204	125	10	24
A Titles:	32	23	1	14
B Titles:	42	29	2	6
C Titles:	130	73	7	4
Year 3:	231	132	18	21
A Titles:	43	29	4	15
B Titles:	44	29	3	1
C Titles:	144	74	11	5
Year 4:	209	113	38	26
A Titles:	36	20	9	16
B Titles:	50	19	5	3
C Titles:	123	74	24	7

Notes: Total number of titles released by distributors and offered under each contract type. Titles may be counted in more than one column. All Revenue-Sharing and Full-Line Forcing titles are also offered under Linear-Pricing contracts. No Sell-Through Pricing titles are offered under alternate contracts.

Table 3: Titles Taken by Stores

Contract	Linear Pricing	Revenue Sharing	Full-Line Forcing	Sell-Through Pricing
Number of Stores				
	6,358	6,150	5,111	6,171
Avg No. of Titles Taken by Stores				
Year 1:	32.54	7.92	-	6.72
	(23.80)	(11.21)	-	(4.56)
A Titles:	19.57	4.94	-	11.83
	(7.52)	(3.56)	-	(4.12)
B Titles:	23.61	5.29	-	4.27
	(9.33)	(5.39)	-	(1.64)
C Titles:	54.51	13.56	-	3.99
	(28.74)	(16.97)	-	(1.69)
Year 2:	23.15	6.84	1.39	5.05
	(18.97)	(7.74)	(1.53)	(4.11)
A Titles:	14.29	7.04	0.61	8.87
	(8.69)	(5.99)	(0.49)	(4.34)
B Titles:	19.94	6.94	1.22	3.85
	(11.68)	(7.68)	(0.85)	(2.37)
C Titles:	35.63	6.54	2.36	2.32
	(25.23)	(9.25)	(2.14)	(1.55)
Year 3:	32.69	6.30	2.09	4.90
	(23.50)	(8.37)	(2.07)	(5.57)
A Titles:	23.35	7.32	1.57	11.23
	(12.18)	(7.31)	(0.98)	(5.21)
B Titles:	26.26	5.35	0.92	0.78
	(13.20)	(7.51)	(0.66)	(0.41)
C Titles:	48.79	6.20	3.80	2.53
	(30.95)	(9.95)	(2.64)	(1.43)
Year 4:	28.26	4.67	3.36	5.79
	(15.20)	(6.14)	(3.44)	(5.16)
A Titles:	19.64	5.66	3.33	11.74
	(8.65)	(5.30)	(2.07)	(4.78)
B Titles:	32.59	3.69	1.05	2.41
	(12.55)	(5.37)	(0.98)	(1.06)
C Titles:	32.60	4.64	5.72	3.18
	(18.72)	(7.37)	(4.40)	(1.48)

Notes: Average number of titles of each contract type taken by all active stores in each year. Standard deviations in parentheses.

Table 4: Contracts Taken by Store Size

Contract		Linear Pricing	Revenue Sharing	Full-Line Forcing	Sell-Through Pricing
Ave store tier					
Quintile 1		2.68	5.04	3.77	5.47
Quintile 2		2.95	5.05	2.78	4.65
Quintile 3		3.51	3.63	4.26	3.98
Quintile 4		4.79	2.97	4.25	3.03
Quintile 5		5.46	2.70	4.31	2.27
Quintile	% of quintile				
1	Tier 1-3	1.59	0.43	1.13	0.54
	Tier 7-10	0.53	1.71	1.40	2.99
2	Tier 1-3	1.41	0.41	1.48	0.56
	Tier 7-10	0.31	1.41	0.30	1.20
3	Tier 1-3	1.15	1.19	0.71	0.84
	Tier 7-10	0.65	1.00	0.80	0.54
4	Tier 1-3	0.47	1.40	0.84	1.34
	Tier 7-10	1.11	0.34	1.16	0.15
5	Tier 1-3	0.37	1.57	0.85	1.72
	Tier 7-10	2.39	0.53	1.30	0.12

Notes: Panel 1 breaks the percent of each store's titles adopted under a particular type of contract into quintiles and reports the average store tier in each quintile. Tiers are ranked from 1 to 10 where 10 is largest. Panel 2 reports the percent of stores in each quintile that are in store tiers 1-3 and 7-10 respectively. These percentages are normalized by the percent of all stores that are in the relevant set of tiers. Numbers over 1 indicate that the store type is over-represented in the relevant quintile.

Table 5: Contracts Taken by Chain Size

Contract		Linear Pricing	Revenue Sharing	Full-Line Forcing	Sell-Through Pricing
Ave chain size					
Quintile 1		1.69	2.67	1.68	2.33
Quintile 2		2.01	2.46	2.10	2.32
Quintile 3		2.11	2.16	2.55	2.44
Quintile 4		2.53	1.95	2.52	2.05
Quintile 5		2.49	1.66	2.20	1.71
Quintile	% of quintile				
1	Single stores	1.96	0.25	1.93	0.58
	Large chains	0.47	3.32	0.70	2.09
2	Single stores	1.29	0.36	1.12	0.60
	Large chains	1.36	2.47	1.52	2.09
3	Single stores	0.93	0.88	0.24	0.59
	Large chains	1.46	1.63	2.33	2.61
4	Single stores	0.44	1.34	0.18	1.26
	Large chains	2.95	1.11	2.15	1.51
5	Single stores	0.39	2.00	0.05	1.99
	Large chains	2.72	0.44	0.80	0.66

Notes: Panel 1 breaks the percent of each store's titles adopted under a particular type of contract into quintiles and reports the average store tier in each quintile. We grouped chains into three groups with value 1 for single-store chains, 2 for chains with 2-44 stores, and 3 for chains with 112 - 1652 stores. Panel 2 reports the percent of stores in each quintile that are in chain group 1 (single-store chains) and chain group 3 (112-1652 stores) respectively. These percentages are normalized by the percent of all stores that are in the relevant set of chains. Numbers over 1 indicate that the store type is over-represented in the relevant quintile.

Table 6: Regression Analysis: market-coverage Effect

Dependent variable:	Titles	Tapes per title	Rentals per title
Did FLF?	0.38	2.77	12.71
	(0.13)	(1.16)	(9.30)
Month FE?	Y	Y	Y
Store FE?	Y	Y	Y
Distributor FE?	Y	N	N
Title FE?	N	Y	Y
R^2	0.38	0.52	0.62
Observations	97,444	136,057	136,057

Notes: Regression analyses to investigate the market coverage effect. The regression in Column 1 is at the store-distributor-month level. The dependent variable is the number of titles taken by the store from the relevant distributor-month. The regressions in Columns 2 and 3 are at the store-title level. The dependent variables are the number of tapes per title and the number of rentals per title respectively. In all three regressions the first explanatory variable is an indicator for active FLF contracts for the relevant store-distributor-month triple. Only store-title pairs for which FLF was offered by the distributor and FLF was taken at some point by the store are included. Standard errors are reported in parentheses.

Table 7: Regression Analysis: Leverage Effect

Dependent variable:	Titles	Tapes per title	Rentals per title
Ever FLF?	0.026	0.31	9.36
	(0.007)	(0.25)	(4.33)
Month FE?	Y	Y	Y
Store FE?	Y	Y	Y
Distributor FE?	Y	N	N
Title FE?	N	Y	Y
R^2	0.44	0.58	0.66
Observations	6,053,143	1,146,598	1,146,598

Notes: Regression analyses to investigate the leverage effect. The regression in Column 1 is at the store-distributor-month level. The dependent variable is the number of titles taken by the store from the relevant distributor-month. The regressions in Columns 2 and 3 are at the store-title level. The dependent variables are the number of tapes per title and the number of rentals per title respectively. In all three regressions the first explanatory variable is an indicator for active FLF contracts in that month with some other distributor. Only store-month pairs for which FLF was taken at some point by the store for any distributor are included. Standard errors are reported in parentheses.

Table 8: Demand Results and Elasticity Estimates

	OLS Coef (S.E.)	IV 1 Coef (S.E.)	IV 2 Coef (S.E.)
Price	-0.027 (0.002)	-0.026 (0.003)	-0.024 (0.003)
Month 2	0.132 (0.023)	0.155 (0.024)	0.139 (0.025)
Month 3	-0.136 (0.022)	-0.191 (0.025)	-0.206 (0.025)
Month 4	-0.399 (0.023)	-0.505 (0.025)	-0.512 (0.026)
Month 5+	0.190 (0.024)	0.276 (0.027)	0.283 (0.027)
Inventory	0.019 (0.0003)	0.021 (0.0004)	0.016 (0.0005)
Inv*Month 2	-0.003 (0.0004)	-0.004 (0.0005)	-0.003 (0.0005)
Inv*Month 3	-0.008 (0.0004)	-0.009 (0.0005)	-0.008 (0.0005)
Inv*Month 4	-0.012 (0.0004)	-0.013 (0.0005)	-0.013 (0.0005)
Inv*Month 5	-0.011 (0.0004)	-0.013 (0.0005)	-0.014 (0.0005)
σ	0.632 (0.0018)	0.498 (0.0030)	0.501 (0.0031)
N	407,006	407,006	407,006
R^2	0.82	0.76	0.76

	Month 1	Month 2	Month 3	Month 4	Month 5
All Box Office categories:					
Price elasticity	-0.127	-0.132	-0.139	-0.143	-0.129
Inventory elasticity	0.269	0.224	0.151	0.090	0.058
Box Office Category A:					
Price elasticity	-0.125	-0.132	-0.142	-0.148	-0.138
Inventory elasticity	0.521	0.437	0.294	0.176	0.123
Box Office Category B:					
Price elasticity	-0.125	-0.127	-0.136	-0.140	-0.128
Inventory elasticity	0.234	0.188	0.128	0.078	0.052
Box Office Category C:					
Price elasticity	-0.129	-0.135	-0.139	-0.141	-0.123
Inventory elasticity	0.106	0.089	0.059	0.035	0.022

Notes: In the top panel, IV1 results instrument for the within-group share only; IV2 instruments for within-group share and inventory (region 1). All specifications include title and store fixed effects, interactions between title fixed effects and store characteristics (the percent with kids, the percent single and the percent white) and interactions between month fixed effects and title characteristics (box office category, genre, rating and interactions of these variables). In the bottom panel, demand elasticities with respect to price and inventory are calculated for every store-title-month observation and then averages are taken within each zipcode region - month, and then across regions.

Table 9: INEQUALITIES ANALYSIS RESULTS

	Coefficient	95% CI
Per Tape:		
Constant	-2.66**	[-3.02, -2.14]
Box B title	3.14**	[1.18, 5.46]
Box C title	-7.99**	[-8.72, -7.51]
Linear Pricing	12.14**	[7.31, 17.78]
LP*Box B title	2.65	[-0.19, 4.99]
LP*Box C title	0.04	[-0.67, 0.93]
LP*Medium Chain Size	-46.47**	[-52.90, -41.63]
LP*Large Chain Size	-51.38**	[-57.31, -47.07]
LP*Tiers 4-6	1.57	[-0.08, 4.08]
LP*Tiers 7-10	-6.41**	[-8.17, -3.89]

Notes: In Table 9, coefficients represent predicted costs to the store per tape. "Box B title" and "Box C title" are indicators for titles in Box Office categories B and C: those with theatrical box office revenues $15-40 million and under $15 million respectively. "Medium Chain Size" and "Large Chain Size" are stores in chains containing 2-44 stores and 112-1652 stores respectively. Store tiers rank stores by size, where 1 is smallest and 10 is largest. "Linear Pricing" is an indicator for store-title pairs where the title is taken on a LP contract. **: significant at p=0.05; *: significant at p=0.10.

Table 10: Average Predicted Retailer Choices of Titles by Contract Type

	Number of stores	Focal distributor titles None/LP/RS/FLF	Other distributor titles None/LP/RS/FLF
I. FLF studio 1			
i. FLF stores			
model (no FLF)	294	4.1 / 11.1 / 2.8 / 0	5.5 / 9.2 / 3.7 / 0
model (with FLF)		2.3 / 6.4 / 1.4 / 7.9	5.6 / 9.1 / 3.8 / 0
ii. non-FLF stores			
model (no FLF)	1574	4.7 / 10.1 / 3.2 / 0	1.3 / 2.1 / 0.2 / 0
model (with FLF)		4.0 / 8.7 / 2.4 / 3.0	1.2 / 2.2 / 0.2 / 0
II. FLF studio 2			
i. FLF stores			
model (no FLF)	2093	3.4 / 2.6 / 0.0 / 0	5.7 / 7.8 / 3.6 / 0
model (with FLF)		1.5 / 0.6 / 0.0 / 3.9	5.9 / 7.6 / 3.6 / 0
III. Non-FLF studio 1			
model (no FLF)	2316	5.4 / 13.8 / 1.8 / 0	5.4 / 9.0 / 0.1 / 0
model (with FLF)		3.0 / 6.6 / 0.7 / 10.7	5.4 / 9.1 / 0.1 / 0
IV. Non-FLF studio 2			
model (no FLF)	2316	3.9 / 5.6 / 0.5 / 0	4.3 / 7.9 / 0.3 / 0
model (with FLF)		2.8 / 3.4 / 0.4 / 3.4	4.2 / 8.0 / 0.3 / 0
V. Non-FLF studio 3			
model (no FLF)	2316	2.8 / 6.8 / 9.4 / 0	2.3 / 4.5 / 0.2 / 0
model (with FLF)		0.9 / 1.6 / 1.7 / 14.7	2.2 / 4.6 / 0.2 / 0
VI. Non-FLF studio 4			
model (no FLF)	2316	12.1 / 8.6 / 0.3 / 0	2.2 / 2.7 / 0.1 / 0
model (with FLF)		0.3 / 1.1 / 0.0 / 19.6	2.1 / 2.8 / 0.1 / 0

Notes: Predictions of the counterfactual analysis for average portfolio choices of retailers, by distributor. FLF distributors 1 and 2 offer FLF terms in the data; Non-FLF distributors 1-4 do not. "Non-FLF stores" do not take FLF terms from a FLF studio. "Model (no FLF)" is the model's prediction if FLF is not an option; "Model (with FLF)" is the model's prediction if FLF is an option for the retailer.

Table 11: Average Predicted Change in Retailer Inventory Choices When Full-Line Forcing is Adopted

	Number	Average change in tapes per title		
	of stores	Overall	LP to FLF	RS to FLF
I. FLF studio 1				
i. FLF stores	37	1.45	2.40	0.12
ii. non-FLF stores	293	3.26	4.64	0.91
II. Non-FLF studio 1	1178	2.30	2.76	0.50
III. Non-FLF studio 2	752	4.16	4.48	0.88
IV. Non-FLF studio 3	1736	1.08	2.61	0.43
V. Non-FLF studio 4	2248	3.00	3.20	0.76

Notes: Predictions of the counterfactual analysis for average changes in inventory choices of retailers when titles are taken on FLF, by distributor. Only retailers that the model predicts will take FLF from the focal distributor if it is available, and that take both LP and RS contracts from the focal distributor when FLF is not offered, are included. We consider all titles released by the focal distributor that are taken by the retailer when FLF is not offered. "Overall" column reports the cross-retailer, cross-title average difference between the inventory per title taken under FLF and that taken when FLF is not offered for titles predicted to be taken when FLF is not available. "LP to FLF" reports the analogous results for titles predicted to be taken on LP in the no-FLF scenario. "RS to FLF" reports the results for titles taken on RS when FLF is not available. FLF distributor 1 offers FLF terms in the data; Non-FLF distributors 1-4 do not. FLF distributor 2 is excluded because no retailers that are predicted to take FLF when it is offered also take titles on both LP and RS.

Table 12: Average Predicted Retailer and Distributor Profits, Consumer Surplus and Total Welfare

	Mean store profits	Focal distributor profits / store	Other distributor profits / store	Mean CS per store	Welfare per store
I. FLF studio 1					
i. FLF stores					
No FLF option	$48,151	$5,888	$76,886	$6,245	$137,170
With FLF option	$48,619	$5,910	$76,761	$6,251	$137,541
ii. non-FLF stores					
No FLF option	$52,069	$5,706	$73,356	$4,856	$135,987
With FLF option	$52,262	$5,354	$73,372	$4,857	$135,845
II. FLF studio 2					
i. FLF stores					
No FLF option	$58,988	$749	$98,506	$6,194	$164,437
With FLF option	$59,232	$945	$98,419	$6,199	$164,794
III. Non-FLF studio 1					
No FLF option	$57,251	$7,981	$75,547	$4,498	$145,278
With FLF option	$58,101	$5,996	$75,556	$4,551	$144,205
IV. Non-FLF studio 2					
No FLF option	$57,758	$6,472	$78,146	$4,533	$146,908
With FLF option	$58,120	$5,500	$78,203	$4,534	$146,356
V. Non-FLF studio 3					
No FLF option	$56,833	$5,033	$82,333	$4,659	$148,857
With FLF option	$57,638	$3,151	$82,399	$4,667	$147,854
VI. Non-FLF studio 4					
No FLF option	$57,402	$4,400	$79,334	$4,623	$145,759
With FLF option	$61,194	$954	$79,330	$4,700	$146,178

Notes: Predictions of simulations using model set out in Ho, Ho and Mortimer (2010). Column 1 reports mean store profits, column 2 reports average focal distributor profits per retailer, column 3 reports total non-focal distributor profits per retailer (summed over all non-focal distributors), column 4 reports average consumer surplus per retailer and column 5 reports average total welfare per retailer. For each focal distributor the first row reports the model's predictions when the option of taking FLF is not available. The second row reports predictions when FLF is available.