Retailer-Driven Product Bundling in a Distribution Channel

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May 2, 2012

Abstract

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This paper studies product bundling in a distribution channel where a downstream retailer combines component goods produced by separate manufacturers acting independently. Past literature offers deep insights about bundling by a single firm whose unit costs are not impacted by choice of selling strategy. But, when the retailer bundles goods from separate manufacturers, unit costs for the bundler (retailer) are, being the prices set by the manufacturers, no longer exogenous. This alters the economic balance with respect to bundling. I show that channel conflicts weaken the case for bundling. While bundling is better than component-selling for the integrated firm, it is no longer so in the decentralized channel. The culprit is a combination of vertical channel conflict (incentive misalignment with respect to bundle vs. component sales) and horizontal conflict (each manufacturer wants a higher share of profits from bundle sales), with the latter playing a dominant role. They cause manufacturers to overprice component goods, weakening the retailer's incentives to bundle. The competitive interplay between firms when one (retailer) merges the prices of several (manufacturers) leads to lower profits for all. Price coordination between the firms could partially restore the role of bundling, and improve the firms' profits as well as consumer surplus.

1 Introduction

Product bundling involves grouping two or more component goods and selling them at a discount relative to the sum of the component prices. For example, Microsoft packages multiple office productivity applications that have stand-alone value into the "Office" suite, and fast-food restaurants sell "Happy Meals" bundles. Bundling raises the firm's profit because consumer valuations for the bundle have less dispersion (relative to the mean) than valuations for component products (Stigler, 1963; Adams and Yellen, 1976). This demand smoothing force is stronger when many goods are being bundled and when the distributions of consumer valuations for component goods are negatively correlated, but bundling can also be profitable under positive correlation and is most effective when unit marginal costs are low relative to value (Schmalensee, 1984; McAfee et al., 1989; Bakos and Brynjolfsson, 1999). Recent extensions to bundling theory have covered facets such as customized bundling (Wu et al., 2008) and bundling under competition (Bakos and Brynjolfsson, 2000). Venkatesh and Mahajan (2009) provide an excellent recent survey of the literature and practice.

This paper studies product bundling in a distribution channel. I examine the practice where a downstream firm (Retailer) sells a bundle of component goods made by multiple and independent upstream firms (Manufacturers), schematically shown in the first panel of Fig. 1. This practice occurs widely, including in the travel, technology, media, dining and entertainment industries. For example, theaters bundle multiple entertainment events from independent artists and entertainers into season passes. Travel sites such as Expedia bundle products (air transport, car rental, hotel, shows, etc.) from multiple providers. Firms that specialize in assembling products (e.g., PCs) bundle components from multiple manufacturers, as do system integrators (e.g., defense industry firms such as Raytheon) and information aggregators (e.g., Yahoo!). Bundling strategy can involve either pure bundling (selling just the bundle and not the component goods) or mixed bundling.

Unlike the channel structure identified above, extant bundling literature has studied the case where a single firm makes the component goods and designs a bundling strategy, and

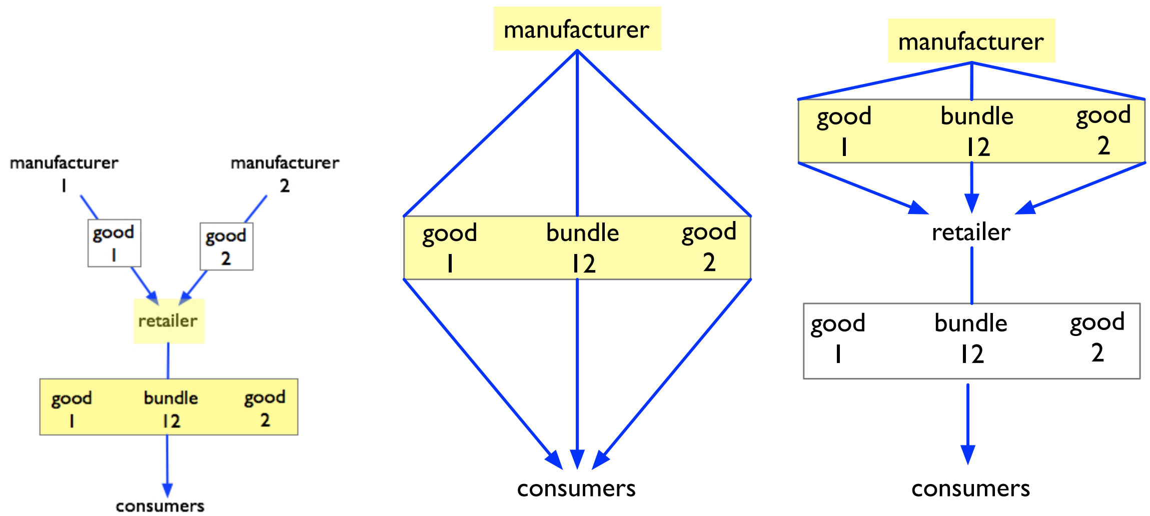

Figure 1: Different distribution structures for product bundling. The shaded boxes represent the firm making the bundling decision. The c_i's are unit costs of component goods.

sells directly to consumers (as reflected in the second panel of Figure 1). There are critical economic differences between the two settings. For the single integrated firm, unit costs of the component goods are exogenous and not impacted by the choice of selling strategy. In the vertical channel, however, the unit costs for the firm (retailer) making the bundling decision are, being the prices set by the manufacturers, no longer exogenous. This separation of manufacturing and retailing functions leads to *double marginalization* (Spengler, 1950), a manifestation of *vertical channel conflict* which raises the unit costs underlying the retail-level bundling decision. The cost increase is even greater under bundling because the potential to extract more surplus entices manufacturers into seeking a higher share of the gains from bundling. Finally, component prices are driven additionally higher by *horizontal channel conflict* which occurs because of independent price-setting by manufacturers whose goods are eventually combined into a composite product.[1] These two types of channel conflicts raise the retailer's unit costs, weakening the case for bundling.

Still, bundling has appeal to all firms. The retailer desires bundling because the lower

[1]This conflict was recognized by (Cournot, 1929), who considered two component goods made by different firms, and combined to create utility (e.g., "zinc + copper = brass"). While his example was about strong complements, the insight that independent manufacturers would overprice their components carries over more generally.

dispersion in consumer valuations enables it to extract more surplus. Manufacturers desire bundling because it leads to higher sales of their products. I formally investigate the balance between these positive and negative forces by modeling a decentralized channel with two manufacturers, each making a single component good which may then be packaged into a bundle by a retailer. I compare outcomes under the decentralized channel against those for an integrated firm which combines the manufacturing and retail functions, as also against a *bilateral monopoly* (depicted in the third panel of Fig. 1) where the retailer sells a bundle of multiple goods from a single manufacturer. I show that the basic demand-side force—which makes bundling attractive to the integrated firm, as well as in a bilateral monopoly—is defeated when production of component goods is disaggregated into multiple manufacturers and subjected to the mix of horizontal and vertical channel conflicts. It is, however, possible for firms to employ bundling in a profit-enhancing way if the manufacturers could coordinate prices. Such coordination would keep component prices low, and increase manufacturers' profits, the retailer's profit, and consumer surplus.

This paper is novel in its combination of bundle selling strategy and distribution channel structure, and sits at the intersection of three separate literatures. Past literature on bundling studies a direct producer-buyer distribution structure (e.g., a restaurant that packages a burger, chips and a drink; or a software firm that bundles multiple components). The literature on vertical channels and double marginalization models a retailer who essentially passes through the products of one or more manufacturers to the consumer, without considering the strategic lever of bundling these products. The literature on composite goods does not consider an active bundling decision by an intermediate firm such as a retailer.[2] While the paper combines these three literature streams, as a first model of bundling in a decentralized distribution channel, it is neither perfect nor complete. These limitations and the consequent research opportunities are discussed in §4.

[2]Bakos and Brynjolfsson (2000) study a vertical channel with both upstream competition for content (between bundlers who compete for a single additional good) and downstream competition for consumers but these two processes are modeled separately of each other and avoid the complexity caused by multiple manufacturers.

2 Model

Consider a retailer who sells a bundle B of two component products $i = 1, 2$ made by independent manufacturers (M1 and M2) who face unit costs c_1 and c_2 respectively. Let v_i denote consumer valuations for product i. A consumer v's valuation for the bundle is the sum of her valuation for the two components, $z = v_1 + v_2$.

Assumption 1 *Valuations for each product are distributed uniformly on* $[0, 1]$ *and are independent of the other. Equivalently, component goods* $i = 1, 2$ *have linear demand* $D_i(p) = 1 - p$.

Let p_1, p_2, p_B represent the per-unit prices set by the retailer for products $i = 1, 2$ and the bundle B in response to input costs w_1, w_2 (the prices set by the manufacturer). Let $Q_i = Q_i(p_1, p_2, p_B)$ be the sales of each product given the retail prices (p_1, p_2, p_B), computed for the pure component and pure bundle strategies as

$$\textbf{pure components} \qquad \begin{cases} Q_1 = (1 - p_1) \\ Q_2 = (1 - p_2) \end{cases} \tag{1}$$

$$\textbf{pure bundling} \qquad Q_1 = Q_2 = Q_B = D_B(p) = \begin{cases} \frac{1}{2}\left(2 - p^2\right) & \text{if } p \leq 1 \\ \frac{1}{2}\left(2 - p\right)^2 & \text{o/w.} \end{cases} \tag{2}$$

The superscript ^{C} denotes firms' equilibrium sales and profit when the retailer pursues a pure components selling strategy (i.e., $Q_B = 0$, or $p_B \geq p_1 + p_2$). A pure bundle strategy is denoted with the superscript ^{B} and corresponds to $Q_1 = Q_2 = 0$ (i.e., $p_i > p_B$). The retailer's profit Π_R and manufacturers' profits π_i are

$$\Pi_R = (p_1 - w_1)Q_1 + (p_2 - w_2)Q_2 + (p_B - w_1 - w_2)^+ Q_B \tag{3a}$$

$$\pi_1 = (w_1 - c_1)(Q_1 + Q_B) \tag{3b}$$

$$\pi_2 = (w_2 - c_2)(Q_2 + Q_B). \tag{3c}$$

This 2-goods setting is frequently employed to expose insights about bundling, including in the early work on bundling (Adams and Yellen, 1976; Schmalensee, 1984; Salinger, 1995) and later explorations into the effect of correlation in product valuations (McAfee et al., 1989) and network effects (Prasad et al., 2010). For the classic case of a single integrated firm (one that produces the two goods and makes the bundling decision, hence $w_i = c_i$), McAfee et al. (1989) and others have demonstrated that bundling is attractive and maximizes profits when costs are relatively low; profit increases because the bundle demand curve, being flatter in the middle region, enables extraction of more of the total surplus. For easy reference, Lemma 1 summarizes the result for the integrated firm, and Table 1 illustrates it for the special case of zero marginal costs, $c_1 = c_2 = 0$. All proofs are in the Electronic Companion.

Lemma 1 (Integrated firm) *The optimal prices under the three selling strategies are*

(a) **Pure Components**

$$p_i^C = \frac{1+c_i}{2} \quad (i = 1, 2)$$

(b) **Pure Bundle**

$$p^B = \begin{cases} \frac{1}{3}(c_1 + c_2 + \sqrt{6 + (c_1+c_2)^2}) & \text{if } c_1 + c_2 < \frac{1}{2} \\ \frac{2}{3}(1 + c_1 + c_2) & o/w. \end{cases}$$

Pure bundling is better than pure components when costs are low, specifically when $(c_1, c_2) \in \Theta_1 \cup \Theta_2$, *where*

$$\Theta_1 = \left\{(c_1, c_2) : (c_1 + c_2 \le \frac{1}{2}) \ AND \ \frac{(c_1+c_2)^3 + (6 + (c_1+c_2)^2)^{\frac{3}{2}} - 18(c_1+c_2)}{27} \ge \sum_{i=1}^{2} \frac{(1-c_i)^2}{4}\right\}$$

$$\Theta_2 = \left\{(c_1, c_2) : (c_1 + c_2 \ge \frac{1}{2}) \ AND \ \left(2\left(\frac{2-(c_1+c_2)}{3}\right)^3 \ge \sum_{i=1}^{2} \frac{(1-c_i)^2}{4}\right)\right\}.$$

	p_1	p_2	p_B	Q_1	Q_2	Q_B	Π	CS
pure components	0.5	0.5	NA	0.5	0.5	NA	0.5	0.25
pure bundle	NA	NA	$\sqrt{\frac{2}{3}}$	NA	NA	$\frac{2}{3}$	0.5443	0.2742

Table 1: Bundle selling dominates component selling for an integrated firm under Assumption 1 and zero marginal costs.

The total surplus (or social welfare, SW) under component sales is $\int_{p_1}^{1} x\,\mathrm{d}x + \int_{p_2}^{1} y\,\mathrm{d}y$. Under pure bundling, SW is $1 - \int_0^{p_B} \int_0^{p_B - x} (x+y)\,\mathrm{d}y\,\mathrm{d}x$ for $p_B \leq 1$, and $\int_{p_B-1}^{1} \int_{p_B-x}^{1} (x+y)\,\mathrm{d}y\,\mathrm{d}x$ for $p_B \geq 1$. Consumer surplus (CS) is SW - $\Pi_1 - \Pi_2 - \Pi_R$.

3 Bundling in Decentralized Channel

	Manufacturers	Retailer
Prices	$w_i = \frac{1+c_i}{2}$	$p_i = \frac{3+c_i}{4}$
Firm's profit	$\Pi_i = \frac{1}{8}(1-c_i)^2$	$\Pi_R = \frac{1}{16}((1-c_1)^2 + (1-c_2)^2)$
Industry profit	$\Pi_1 + \Pi_2 + \Pi_R = \frac{3}{16}((1-c_1)^2 + (1-c_2)^2)$	

Table 2: Pure component-selling solution in vertical channel.

This section evaluates pure bundle vs. pure component selling in a decentralized channel and compares these outcomes with those for an integrated firm and a bilateral monopoly. While there is an additional selling strategy—mixed bundling, which is optimal in theory—comparing the two extreme cases produces sharper insights (I comment on mixed bundling in §4). §3.1 examines a retailer who is restricted to pure bundling (e.g., Netflix, see below), while §3.3 describes a retailer who observes manufacturer prices and then determines whether to bundle or not. To facilitate the comparison of component-selling and bundling, Table 2 provides a pure component-selling benchmark in the vertical channel. This solution is derived by aggregating the solution of two separate two-stage pricing games, each of which features one manufacturer (stage 1) and retailer (stage 2).

A retailer's selling strategy may be restricted to pure bundling when it can be predicted from historical actions, is necessary to induce manufacturer participation, or because this is the only reasonable business practice. An example is the movie distribution firm Netflix which offers rental access at a flat price to its entire library which comprises movies from several different studios (the component-selling alternative would be a separate price for access to movies from each studio). Content providers are aware of the stickiness of this allyou-can-eat business model when they price their content. Other information aggregators such as news services also have this characteristic. The limitation to pure bundling can also occur in practice when technological challenges make mixed bundling infeasible, or when firms anticipate antitrust concerns (under mixed bundling) regarding the bundle discount relative to component prices (Fang and Norman, 2006). Pure bundling avoids these concerns because there are no component prices to compare with.

3.1 Retailer Committed to Pure Bundling

The sequence of events in this game is that first the retailer conveys a pre-commitment to bundling, then manufacturers set their component prices, and finally the retailer sets the price for the bundle. In the final stage, the retailer's optimal pricing rule p^B is obtained by replacing the c's with w's in Lemma 1. Each firm sells Q^B units (see Eq. **??** in Electronic Companion), obtained by substituting p^B into Eq. 2. In the first stage, manufacturers set their prices while taking into account the retailer's pricing rule and their own sales volume Q^B. The Nash Equilibrium for manufacturer prices is obtained by solving

$$\left\{ \begin{array}{l} w_1^B = \arg\max_{w_1} \left(\Pi_1(w_1, w_2) = (w_1 - c_1)\ Q_B(p_B^B(w_1, w_2^B))\right) \\ w_2^B = \arg\max_{w_1} \left(\Pi_2(w_1, w_2) = (w_2 - c_2)\ Q_B(p_B^B(w_1^B, w_2))\right) \end{array} \right\} \tag{4}$$

where each manufacturer's best-response price (with respect to the other manufacturer's price) is the better of the optimal values within the two sub-intervals given by $(w_1 + w_2) \gtrless \frac{1}{2}$.

Proposition 1 (Pure Bundling Regime) *The equilibrium outcome when the retailer pre-commits to bundling products $i = 1, 2$ from independent firms $M1, M2$, is*

	Manufacturer		*Retailer*
Prices	$w_i^B = \frac{1}{2} + \frac{3c_i - c_j}{4}$		$p_R^B = \frac{4+c_1+c_2}{3}$
Units Sold		$Q^B = \frac{1}{18}(2 - c_1 - c_2)^2$	
Profit	$\Pi_1^B = \Pi_2^B = \frac{1}{72}(2 - c_1 - c_2)^3$		$\Pi_R^B = \frac{1}{108}(2 - c_1 - c_2)^3.$

Each manufacturer's optimal price response is a decreasing function of its competitor's price

$(w_i^B = \frac{2(1+c_i)-w_j}{3})$. *Both the retailer and manufacturers earn lower profit than under component selling.*

Because the retailer's bundle combines products from multiple manufacturers, each manufacturer's price has only a partial impact on its own sales. This induces overpricing by manufacturers, and then the retailer sets a higher retail price, leading to lower sales level and lower profits for all. These inter-firm effects are illustrated by the recent market evolution of Netflix, which experienced massive growth in movie subscribers and profits during 2007-2010, following consumers' rapid acceptance of Internet-based movie streaming (and after Netflix had acquired multi-year streaming rights from studios, at very low prices, when streaming was a rarity). With Netflix's content contracts set for renewal around 2011, it became evident that studios would demand substantially higher fees from Netflix. Indeed, during 2010-2011, Netflix cited potential price increases by movie studios as one of the big risks facing its movie streaming business.[3] Subsequently, Netflix faced higher costs from content providers (and even lost some, such as Starz Play) and experienced a dip in both subscribers and profitability after raising subscription prices.

3.2 Relative Role of Vertical vs. Horizontal Conflict

Proposition 1 demonstrated that the channel structure negatively affects the attractiveness of bundling. Although demand smoothing creates a large pool of relatively high-value buyers in the retail market, the presence of this pool is exploited by manufacturers who set higher wholesale prices and raise the bundler's (i.e., retailer's) unit costs, making bundling less attractive. These outcomes are driven jointly by two types of channel conflict, vertical (between the manufacturers and retailer, which increases retailer's costs due to double marginalization) and horizontal (among manufacturers, which also raises retailer's costs because of each firm's greed). The relative influence of these two types of conflict can be isolated by evaluating an intermediate structure, a bilateral monopoly in which a single manufacturer makes

[3] Based on analysis of 2011 SEC filings. Movie consumption costs presently account for about 10% of Netflix's cost to serve an average subscriber.

goods 1 and 2 which are sold separately or as a bundle by the retailer. Because there is no horizontal conflict in the bilateral monopoly, any difference in outcomes (over the integrated firm) must be on account of vertical conflict.

	w_i	p	Q_i	Π_M	Π_R	$\Pi = \Pi_M + \Pi_R$	CS
components	$\frac{1}{2}, \frac{1}{2}$	$\frac{3}{4}, \frac{3}{4}$	$\frac{1}{4}, \frac{1}{4}$	$\frac{1}{8} + \frac{1}{8}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{1}{16}$
bundle	$\frac{1}{3}, \frac{1}{3}$	$\frac{10}{9}$	$\frac{32}{81}, \frac{32}{81}$	$\frac{64}{243}$	$\frac{128}{729}$	$\frac{320}{729}$	$\frac{85.3333}{729}$

Table 3: Bundle selling dominates component selling for a bilateral monopoly.

Bilateral monopoly applications in practice include the Microsoft Office bundle and home-theater systems, where component goods are designed by the same firm but the bundle is sold through retailers. I illustrate the analysis for the special case of $c_1 = c_2 = 0$ for which bundling beats component-selling for the integrated firm but not in the decentralized channel. We see that vertical conflict, alone, does not negate the demand-side motivation for bundling (Proposition 2 below). While double marginalization in the vertical channel does lower the firms' profits relative to an integrated firm, bundle selling nevertheless *increases* profit for both the manufacturer and retailer compared with component sales. Moreover, the profit increase (about 17%, under $c_i = 0$) is higher than that for the integration firm (about 9%), suggesting that bundling actually helps coordinate the channel. This analysis attests that horizontal conflict was the primary culprit behind the failure of bundling in the decentralized channel.

Proposition 2 (Bilateral Monopoly) *The component-selling and bundle-selling equilibria in a bilateral monopoly are as given in Table 3. Total manufacturer profit ($\frac{64}{243}$) and the retailer's profit ($\frac{128}{729}$) are higher with bundle selling than under the component selling regime.*

3.3 Strategic Choice of Bundle or Component Sales

§3.1 described the impact of the channel structure on a retailer whose only product is a bundle of component goods from multiple manufacturers. With this single-product design, the retailer was vulnerable to overpricing by manufacturers, and the potential of bundling to raise firms' profits was wasted. Might this potential be restored if the retailer were to *choose* whether to sell a bundle or the components after observing manufacturers' prices? The expectation in this analysis is that (i) the retailer would choose bundling only if manufacturers set prices low enough, and (ii) knowledge of this selection rule would steer manufacturers towards lower prices in order to realize the bundling (i.e., surplus-maximizing) outcome.

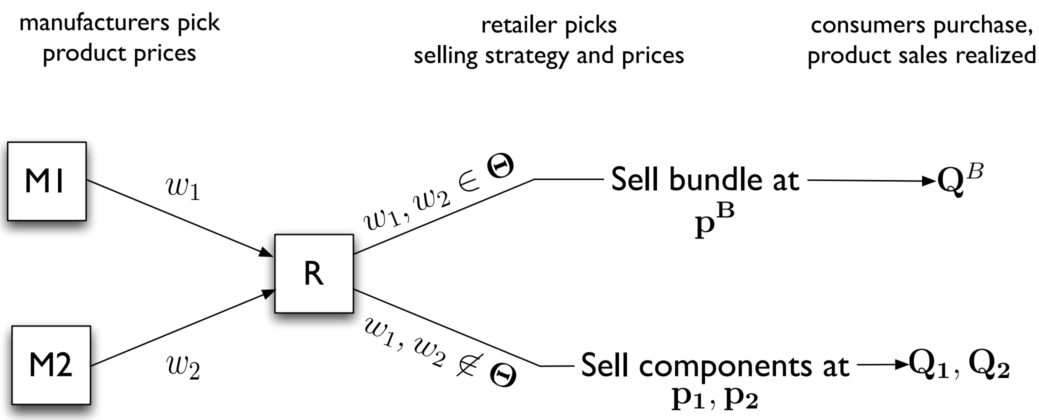

Figure 2: Price and bundling strategy game with two manufacturers and one retailer.

Let Θ be the low-price region of (w_1, w_2)'s for which the retailer prefers to bundle the products. Figure 2 provides a visual depiction of the sequence of decisions made by the manufacturers and retailer. An equilibrium outcome in the overall game is a strategy profile $\langle w_1, w_2, BC, p_1, p_2, p_B \rangle$ where BC is B or C representing the retailer's choice of Bundling or Components, respectively. By convention, p_1 and p_2 are null (sufficiently high) when the retailer picks B while p_B is null when the retailer picks C. Since the retailer deterministically sets prices and strategy after observing w_1 and w_2, any outcome of the game is fully described by the pair of manufacturer prices (w_1, w_2). Analysis of this game reveals that the equilibrium outcome is component-selling rather than bundling.

Proposition 3 (Equilibrium features Component-selling) *The two-stage game has a unique equilibrium solution in which the manufacturers set prices $w_1 = w_2 = \frac{1}{2}$, and the retailer sells the component products at prices $p_1 = p_2 = \frac{3}{4}$. Each firm earns $\frac{1}{8}$, the total profit across all three firms is $\frac{3}{8}$, and total consumer surplus is $\frac{1}{16}$, with total system surplus $\frac{7}{16}$ (of a possible 1).*

As with the pre-committed retailer (Proposition 1), the decentralized structure negates the demand-side motivation for bundling. Even though the retailer holds the threat of switching to the component-selling regime, manufacturers set their prices higher than the level needed to induce the retailer to bundle. When manufacturers set their prices low enough to induce the retailer to bundle ($(w_1, w_2) \in \Theta_2$), the retailer's bundle pricing rule awards them a lower profit than under their optimal component sales price. And if manufacturers price high enough to make bundling attractive to them, then the retailer earns higher profit from selling the component goods separately. This misalignment of incentives prevents the emergence of a bundling equilibrium even though bundling has the potential to increase all firms' profit.

3.4 Extensions

The weakness of pure bundling in the decentralized channel raises the following question: If the demand-side motivation for bundling were stronger, would it make bundling more likely, or would it simply precipitate the efforts of each firm to garner greater profits? I consider this question by examining two factors that strengthen this motivation: negative correlation in valuations for components and a larger number of component goods being bundled.

The demand smoothing effect becomes stronger when demands are anti-correlated ($\rho < 0$), creating a greater pool of consumers willing to buy the bundle at relatively high price. Will manufacturers exploit these higher reservation prices and set even higher prices for their individual components, thereby destroying the retailer's incentives to sell a bundle? For the general case of dependent demand, there are no explicit forms for optimal bundle prices (McAfee et al., 1989) due to lack of closed-form terms for the sum of two dependent random variables (Makarov, 1981; Arbenz et al., 2011). I follow McCardle et al. (2007)'s approach of evaluating the extreme case of $\rho = -1$. Then, all consumers value the bundle at 1 (and the retailer sets this price), hence the retailer prefers bundling when $(1 - w_1 - w_2) \geq \left(\frac{1-w_1}{2}\right)^2 + (\frac{1-w_2}{2})^2$, i.e., $w_i \leq \sqrt{2} - 1$ (≈ 0.4142). And, indeed, manufacturers will prefer to set this price and induce a bundling equilibrium than deviate and earn the component selling profit. Because the incremental profit from bundling is monotonic (decreasing) in correlation ρ (Gürler et al., 2009), we conclude the following.

Proposition 4 *Let ρ be the correlation in consumer valuations for component goods 1 and 2. Then there exists $\tilde{\rho} \in (-1, 0)$ such that a bundling equilibrium emerges whenever $\rho < \tilde{\rho}$.*

Next, consider the case where the retailer bundles components from $N > 2$ manufacturers. Several authors have examined bundling of large numbers of goods, including Bakos and Brynjolfsson (1999) who employ limit analysis, and Fang and Norman (2006) who study finite number of goods by applying peakedness of distributions (Proschan, 1965). With independent product valuations, each consumer's valuation of the bundle gets arbitrarily close to $\frac{N}{2}$ as N increases. In a bundling regime, the retailer would set bundle price at $\approx \frac{N}{2}$, and pick the bundling strategy when

$$\left(\frac{N}{2} - \sum_{i=1}^{N} w_i\right) \times 1 \geq \sum_{i=1}^{N} \left(\frac{1 - w_i}{2}\right)^2$$

which yields $w_i \leq -1 + \sqrt{2} \approx 0.4142$. And, indeed, each manufacturer earns a higher profit (0.4142×1) than the component-selling profit they would earn on deviating from this price.

Proposition 5 *There exists $\hat{N}$ such that for all $N > \hat{N}$, there is a bundling equilibrium when the retailer has an opportunity to bundle N components from different manufacturers.*

4 Conclusion

This paper has analyzed bundling in a decentralized channel in which production and price-setting of component goods is managed by separate manufacturers acting independently of each other, and the selling strategy (bundle or components) is determined by a down-stream retailer. Industry outcomes under this structure follow from a complex intertwining of two horizontal and vertical channel conflicts with the economic motivation for bundling. I show that a combination of horizontal and vertical channel conflicts in the decentralized

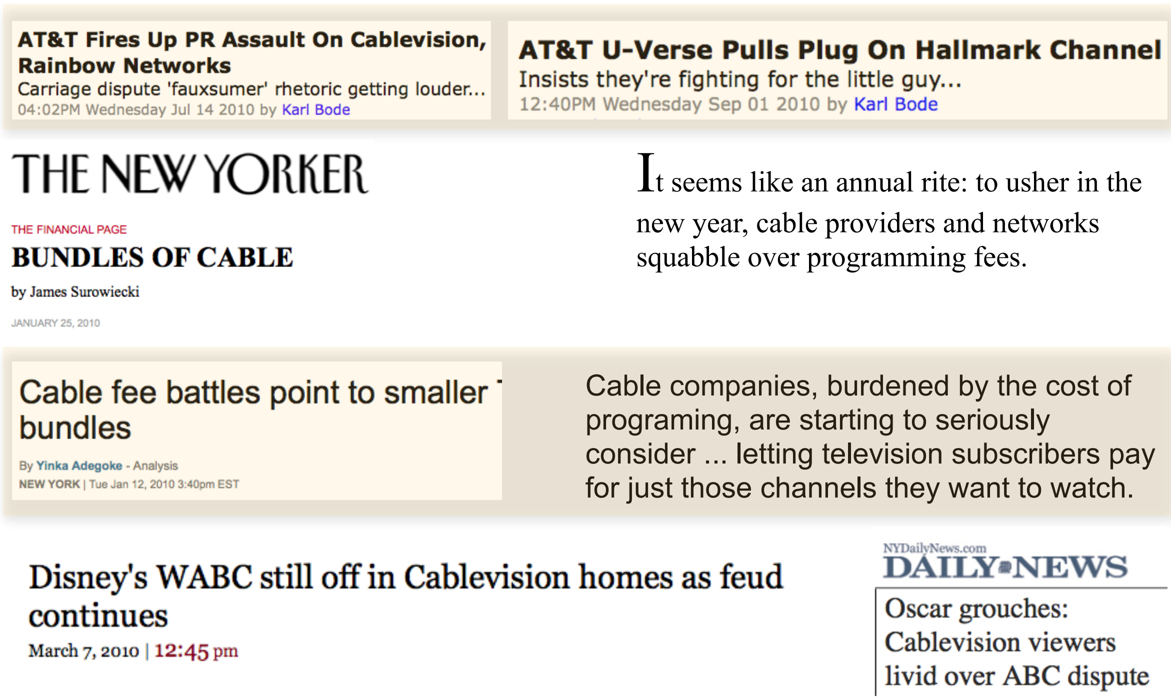

Figure 3: A few examples of carriage disputes in the TV industry (Jan-Sep 2010).

channel weakens the firms' incentives for bundling. Bundle selling reduces profits compared to component-selling in the base case of two component goods with independent demand. Consistent with past literature, bundle selling can become favorable when the component demands are negatively correlated or when the firm can form large-N bundles, though the gains from bundling are still lower than for the integrated firm. Similarly, bundle sales would be observed when the firm practices mixed bundling (for which closed-form solutions are not available) because the lure of component sales would mitigate manufacturers' inclination to overprice. However, because cross-manufacturer bundle pricing still masks the effect of each manufacturer's price increase on its own sales, mixed bundling should generate a smaller increase in profit (compared with component-selling) in the decentralized channel than it would for the integrated firm.

The participating firms in this bundling game face a Prisoner's Dilemma in pricing: all would earn higher profits if manufacturers set prices lower than their component-selling optimal and the retailer priced below the level that maximized its own profit. Indeed, a bundling outcome does emerge in some industries (e.g., in the TV industry). However, this outcome also exhibits price and revenue-sharing tensions among participants who perceive an opportunity to raise prices and attain higher profits in the short-term. Such conflicts are conspicuous in the TV industry in the form of carriage fee disputes, as illustrated by recent news headlines in Figure 3. The lack of a stable bundling solution has motivated firms in this industry to integrate vertically by moving either up or down the value chain (e.g., Comcast's acquisition of NBC, and Amazon's effort to make movies through Amazon Studios).

There are many additional directions that have been investigated in the direct-selling setting which could be pursued in future work on bundling in a vertical channel. These include bundling of vertically differentiated products (Banciu et al., 2010), bundling of complements and substitutes (Venkatesh and Kamakura, 2003), and bundling under competition either between retailers or between manufacturers making components that are substitutes for each other. It would also be useful to study formal incentive-compatible revenue-sharing mechanisms that can improve profits for all parties (and possibly consumer surplus) by achieving better price coordination in the decentralized channel. Industry-specific arrangements may also be relevant, such as, in the TV industry, advertising. Since ad revenue accrues primarily to the manufacturers (content owners) they have an increased incentive to maximize subscribers rather than margins, pushing the outcome towards lower component prices and lower bundle price.

Finally, industry structure is often more complex than assumed in the simple model with two single-product manufacturers. TV bundles feature hundreds of channels, not just two, though most of them from about 6-10 programming networks and studios. Many of the big studios pre-bundle more than a dozen channels in their negotiations with the retailers. For example, Disney executives negotiate for the inclusion of certain less-popular channels in exchange for the right to carry ESPN, similarly News Corp. charges a bundle price for the collection of FOX channels. The model employed in this paper abstracted these "stage 1 bundles" into a single product offered by the manufacturer to the retailer, however a complete analysis might provide a better understanding of this practice. Another complicating factor is that some retailers are also manufacturers who provide their own content (e.g., Netflix has begun producing original TV series and movies, and Comcast owns several networks including E! The Style Network, G4, and the Golf Channel).[4] Incorporating any of these features into the model would be challenging but would highly enrich the analysis. The analysis framework presented in this paper is a useful starting point, one that is computationally tractable and insightful. I hope that it will spur substantial new work in this exciting area.

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