Dividing Bundled Surplus: The Case of the Cable Television Industry

Nodir Adilov, Indiana University Purdue University Fort Wayne
Peter J. Alexander, Federal Communications Commission
Brendan M. Cunningham, United States Naval Academy

Abstract

A cable operator chooses to bundle or provide programs *à la carte* by striking a balance between the incentive to maximize total surplus and minimize transfer payments to program providers. Importantly, a cable operator's decision to bundle or provide programs *à la carte* maximizes total producer surplus if the cable operator's bargaining power (i.e., capacity to extract a greater share of surplus in negotiations with program suppliers) is sufficiently high. However, a cable operator in a weak bargaining position might strategically choose to bundle or unbundle viewer channels in order to enhance its bargaining position with individual program suppliers, even when this decision reduces total surplus. Thus, it is plausible that regulations which cap the market share or impose *à la carte* on cable operators may reduce total surplus.

Keywords: Bundling, division of surplus, Nash bargaining

*Contact author: Nodir Adilov, Department of Economics, Indiana University Purdue University, 2101 E. Coliseum Blvd., Fort Wayne, IN 46805; adilovn@ipfw.edu. The views presented here reflect the views of the authors alone, and do not necessarily reflect the views of the Federal Communications Commission. We are grateful to David Sappington and participants at the 6th Annual International Industrial Organization Conference for their many helpful comments and observations.

1 Introduction

Product bundling is widespread in markets where sellers have market power, and firms routinely utilize bundling to facilitate consumer price discrimination and possibly deter entry.[1] Less explored and less understood however, is the role of negotiations and the division of the surplus between upstream and downstream firms in conditioning a downstream firms decision to bundle. This paper attempts to fill that gap.

Our approach explores the surplus division among downstream and upsteam producers when a downstream producer can bundle its products. In particular, we model bundling in the cable television industry, where a cable operator (such as Comcast or Time Warner Cable) purchases programming from program suppliers (such as CNN or ESPN).[2] Our analysis suggests that when a cable operator's bargaining power is sufficiently high, the operator will choose to either bundle or provide programs *à la carte*, such that the total surplus available to the cable operator and program suppliers is maximized. Intuitively, greater bargaining power implies a greater share of the surplus, and hence a greater incentive to maximize the surplus.[3]

[1] In an early article, Adams and Yellen (1976) identified two types of bundling, pure and mixed, and developed a two-product monopoly bundling model that demonstrated firms could benefit from mixed bundling, i.e., products sold in combination or separately. McAfee et al. (1989) and Salinger (1995) have provided useful extensions of this early model. Nalebuff (2002) has explored the possible use of bundling to deter entry.

[2] In the cable television industry, the cable operator has valuable private information regarding the actual value of programs which may enhance their bargaining position vis-a-vis program suppliers.

[3] In one sense, our analysis is analogous to the classic double marginalization issue, but with important differences. As is well known, double marginalization is resolved by merger; in our model, however, a single downstream firm in a vertical relationship with sufficient bargaining power is more likely to choose the prices and quantities that maximize total surplus, without

We observe, however, that the total surplus available to firms may not be maximized by a choice to bundle or provide programs *à la carte* if buyer-side bargaining power is not sufficiently high. Since a cable operator pays each program supplier a share of the supplier's marginal contribution to total surplus, the cable operator has an incentive to bundle or to unbundle programs in such a way that it reduces program suppliers' marginal contributions to total surplus, which, in turn, decreases the total amount of transfer payments paid by the cable operator. On the other hand, a higher total surplus increases the amount of surplus available to the cable operator. Thus, the cable operator chooses to bundle or to provide programs *à la carte* by comparing the effects of its decision on both the amount of transfer payments paid to suppliers and on total surplus. If the cable operator keeps a relatively small portion of total surplus, then transfer payment minimization has a larger impact on profitability. Therefore, when the cable operator's bargaining power is sufficiently limited, the cable operator might find it profitable to bundle or unbundle programs even when such behavior reduces total surplus.

This discussion suggests that the cable operator strategically uses bundling or unbundling in order to enhance its bargaining position with program suppliers, which implies that the cable operator's decision to bundle viewer channels is influenced by factors other than economies of scale or consumer price discrimination. Perhaps counter-intuitively, the cable operator might want to include a popular channel in a bundle if it reduces the consumer's marginal willingness to pay for that channel, and thus reduces the transfer payment paid by the cable operator to the content provider.

From a policy perspective this work is important since the Federal Communica-

---

availing itself of merger. We note, however, that maximizing total surplus available does not imply social optimality because it does not guarantee socially optimal consumer pricing by a cable operator. Thus, our results are second-best.

tions Commission (FCC) is contemplating capping a single cable operator's market share at 30 percent of the total market. To the extent that overall bargaining position may be influenced by firm size within the market, this may influence a cable operators packaging decision. Moreover, the FCC has recently sought to impose some form of *à la carte* on cable operators. As we suggest, either proposal may in fact induce a reduction in total producer surplus. The implications of this result may be useful for policymakers and the courts, in particular as they relate to efforts to cap the market share of cable operators.

In the next section, we present our model. After we present the basic model, we explore the implications of horizontal merger between program providers, and vertical merger between a cable operator and a program provider. We then make some concluding remarks, including directions for future research.

2 Model and Results

2.1 Model

The modelling approach here is similar to Adilov and Alexander (2006) with several important differences. For example, in the Adilov and Alexander model, there was a single program provider and many buyers. In our model, there are n program suppliers (upstream firms), indexed $i = 1, ..., n$, and a single cable operator (downstream firm) that purchases programs from suppliers and provides programming to consumers in its franchise area. Moreover, the cable operator also decides whether to bundle its programs or to provide programming to consumers *à la carte.* Specifically, the model assumes a two-stage game. In stage one, the cable operator decides whether to bundle the programs or to provide programs to consumers *à la carte*. In stage two, the cable operator enters into simultaneous negotiations with each program supplier separately. Each negotiation determines the transfer payment, T_i, the cable operator pays to program provider i. The transfer payment can be made in terms of direct payments, a share of advertising time/revenue, or a combination of both direct payments and advertising time. Thus, the transfer payment here denotes the total expected value of the revenue received by a program supplier.

Let P^j denote the programming package offered by the cable operator, where $j \in \{bundle, unbundle\}$.[4] Then, the total revenue generated from this programming package is $R(P^j)$. The revenue here denotes the sum of total advertising and subscription revenue from offering programming package $R(P^j)$. Further, let i denote supplier *i's* program that is included in programming package P^j. Then, the marginal revenue generated from including supplier *i's* program in programming package P^j is denoted by $R(P^j) - R(P^j_{-i})$, where P^j_{-i} is a programming package that does not include supplier *i's* program but includes all other programs that were in programming package P^j.

The cable operator's cost of providing programming package P^j is denoted by $\gamma(P^j)$ and the cable operator's marginal cost of including program i into programming package P^j is denoted by $\gamma(P^j) - \gamma(P^j_{-i})$. Similarly, supplier *i's* cost of producing program i is denoted by c_i. For simplicity, it is assumed that c_i is specific to firm i and does not depend upon the whole programming package. Without loss of generality, the cable operator's cost of not providing any programs and a supplier's cost of not producing a program are normalized to zero. In other words, the cable operator's and supplier's costs here denote incremental costs not absolute costs.

Total producer surplus created from programming package P^j is defined as the difference between total revenue and total costs of the cable operator and program suppliers. This surplus can be expressed as $v(P^j) = R(P^j) - \gamma(P^j) - \sum c_i$. Then,

[4] For simplicity, we omit the possibility of mixed bundling.

the marginal surplus created from including program i into programming package P^j is $v(P^j) - v(P^j_{-i})$. Further, the cable operator's profit from programming package P^j is $\pi(P^j) = R(P^j) - \gamma(P^j) - \sum_{i \in P} T_i$ and supplier *i's* profit is $\pi_i(P^j) = T_i - c_i$.

It is assumed that the outcome from negotiations between a program supplier and the cable operator is determined by the asymmetric Nash bargaining solution. Specifically, it is assumed that the cable operator keeps α_i share of marginal surplus created from including program i into programming package P^j. Supplier i keeps the remaining $1 - \alpha_i$ share of the marginal surplus. In other words, $\alpha_i \in [0, 1]$ is the cable operator's bargaining power when negotiating with supplier i. Correspondingly, supplier *i's* bargaining power is $\beta_i = 1 - \alpha_i$.[5]

An *equilibrium* in this model is defined as follows. In stage one, the cable operator chooses (commits to a decision) to bundle or unbundle programs in order to maximize its profit given the cable operator's optimal behavior in stage two. In stage two, the cable operator chooses a programming package that maximizes its profit given that the transfer payments paid to program suppliers are determined by the asymmetric Nash bargaining solution and keeping the cable operator's decision to bundle or unbundle programs fixed. In equilibrium, the cable operator's

[5] Explicitly, one can model the Nash bargaining outcome between supplier i and the cable operator as a solution to the following maximization problem (keeping the transfer payments from other suppliers fixed):

$$\max_{T_i} (\pi - d)^{\alpha_i} (\pi_i - d_i)^{1-\alpha_i} \tag{1}$$

where d and d_i are the disagreement profits of the cable operator and program supplier i. Because only the bargaining welfare gains in excess of the disagreement values are relevant, supplier i's disagreement profits can be normalized to zero. The cable operator's disagreement profit when negotiating with supplier i to include program i into the programming package P^j is $R(P^j_{-i}) - \gamma(P^j_{-i}) - \sum_{-i} T_k$. Then, the transfer payment to supplier i is $T_i = (1 - \alpha_i)(R(P^j) - \gamma(P^j) - \sum_{-i} T_k - R(P^j_{-i}) + \gamma(P^j_{-i}) + \sum_{-i} T_k) + \alpha_i c_i = (1 - \alpha_i)(R(P^j) - \gamma(P^j) - R(P^j_{-i}) + \gamma(P^j_{-i}) - \sum c_k + \sum_{-i} c_k) = (1 - \alpha_i)(v(P^j) - v(P^j_{-i})) + c_i(P^j)$.

choices maximize its profit in each stage of the game.

2.2 Characterization of Equilibrium

Before characterizing the equilibrium transfer payments, we assume that adding new programs into a programming package does not decrease total producer surplus keeping the cable operator's program packaging decision unchanged. Equivalently, one can interpret this assumption as a "more is better" assumption, or that the analysis is restricted to the program suppliers that generate non-negative levels of marginal total producer surplus. Formally, this assumption is characterized as:

Assumption 1: $v(P^j) \geq v(P^j/S^j)$ for all $S^j \subset P^j$ and $j \in \{bundle, unbundle\}$.

Next, we introduce an assumption of weakly diminishing marginal producer surplus. This assumption implies that the marginal producer surplus from adding program i is weakly diminishing as more programs are added into the existing programming package, assuming the cable operator's program packaging decision is unchanged. A formal description of this assumption is given as:

Assumption 2: $v(P^j) - v(P^j_{-i}) \leq v(P^j_{-k}) - v(P^j_{-i,-k})$ for all $i, k \in P$ and $j \in \{bundle, unbundle\}$.

In order to calculate the equilibrium, we must first characterize transfer payments received by program suppliers and the cable operator's profit for each particular choice of a programming package (keeping the cable operator's program packaging choice unchanged). These transfer payment levels and the cable operator's profit are summarized in Proposition 1:

Proposition 1. The transfer payment T_i to supplier i for inclusion of its program into programming package P^j is $T_i = (1-\alpha_i)(v(P^j) - v(P^j_{-i})) + c_i(P^j)$, and supplier *i's* profit is $(1-\alpha_i)(v(P^j) - v(P^j_{-i}))$. The cable operator's profit from programming package P^j is $v(P^j) - \sum_{i \in P}(1-\alpha_i)(v(P^j) - v(P^j_{-i}))$.

Proof of Proposition 1. Take any P and any j. The solution to the Nash bargaining problem implies that the cable operator's share of the marginal producer surplus from including program i into programming package P^j is α_i and supplier *i's* share of the marginal producer surplus is $1-\alpha_i$. Thus, the cable operator keeps $\alpha_i(v(P^j)-v(P^j_{-i}))$ and supplier i keeps $(1-\alpha_i)(v(P^j)-v(P^j_{-i}))$. This implies that the transfer payment received by supplier i is $T_i = (1-\alpha_i)(v(P^j)-v(P^j_{-i}))+c_i(P^j)$. Supplier i's profit is $\pi_i = T_i - c_i(P^j) = (1-\alpha_i)(v(P^j) - v(P^j_{-i}))$. The cable operator's profit is $\pi = R(P^j) - \gamma(P^j) - \sum_{i \in P} T_i = v(P^j) - \sum_{i \in P}(1-\alpha_i)(v(P^j) - v(P^j_{-i}))$. This completes the proof of the proposition. ■

As α_i approaches 1, the transfer payment to supplier i approaches the supplier's cost and the supplier's profit from selling its program to the cable operator approaches zero (i.e., normal economic profit). With perfect bargaining power on the part of the cable operator, programmers are indifferent between agreeing to the transfer arrangement or disagreeing and walking away from the bargain. On the other hand, as α_i approaches 0, the transfer payment to supplier i approaches the sum of the supplier's cost and the marginal producer surplus generated from program i. With perfect bargaining power on the part of supplier i, the cable operator is indifferent between including and not including program i into the programming package P^j. Proposition 2, given next, shows that the cable operator's choice of programming package in the second stage maximizes total producer surplus.

Proposition 2. Suppose assumptions 1 and 2 hold and fix $j \in \{bundle, unbundle\}$. Then, the cable operator's profit is maximized when producer surplus is maximized.

Proof of Proposition 2. The proof is by induction. Suppose assumptions 1 and 2 hold and fix $j \in \{bundle, unbundle\}$. Assumption 1 implies that for any given j producer surplus is maximized when all programs are included in the programming package. Note that proposition 2 holds for $n = 1$ and suppose that the proposition holds for $n = k$. We then need to show that the proposition holds for $n = k + 1$ as well. Let $S = \{1, ..., n + 1\}$. For proposition 2 to hold for $n = k + 1$, we need to show that $\pi(S) - \pi(S_{-(n+1)}) \geq 0$.

$$\pi(S) - \pi(S_{-(n+1)}) =$$
$$v(S) - \sum_{i \in S}(1 - \alpha_i)(v(S) - v(S_{-i})) - v(S_{-(n+1)}) +$$
$$\sum_{i \in S_{-(n+1)}} (1 - \alpha_i)(v(S_{-(n+1)}) - v(S_{-i,-(n+1)})) =$$
$$\sum_{i \in S_{-(n+1)}} \beta_i(v(S_{-i}) - v(S_{-i,-(n+1)})) + (1 - \sum_{i \in S} \beta_i)(v(S) - v(S_{-(n+1)})) =$$
$$\sum_{i \in S_{-(n+1)}} \beta_i(v(S_{-i}) - v(S_{-i,-(n+1)}) - (v(S) - v(S_{-(n+1)}))) + \alpha_{n+1}(v(S) - v(S_{-(n+1)})) \tag{2}$$

Assumption 2 implies that $(v(S_{-i}) - v(S_{-i,-(n+1)}) - (v(S) - v(S_{-(n+1)}))) \geq 0$, and assumption 1 implies that $v(S) - v(S_{-(n+1)}) \geq 0$. Therefore, $\pi(S) - \pi(S_{-(n+1)}) \geq 0$. This completes the proof of proposition 2. ■

Proposition 2 shows that a cable operator chooses a programming package that maximizes producer surplus, keeping the cable operator's bundling decision unchanged. This result is an implication of the assumption of diminishing marginal producer surplus. As the cable operator incorporates more programs into the programming package, the amount of surplus transferred to a particular seller tends to diminish because the seller's marginal contribution to surplus tends to diminish as more programs are added to the package. Thus, the cable operator has an incentive to increase the number of programs until maximum producer surplus is obtained. It is important to note, however, that the assumption of diminishing marginal producer surplus is a sufficient but not a necessary condition for Proposition 2. The following example clarifies this point.

> **Example 1.** Fix j, and suppose $n = 2$, $v(\{1,2\}) = 10$, $v(\{1\}) = v(\{2\}) = 2$, and $\alpha_1 = \alpha_2 = 0.25$. Clearly, assumption 2 is violated because $v(\{1,2\}) - v(\{2\}) = 8 > v(\{1\}) - v(\emptyset) = 2$. The cable operator's profit from airing only one program is $\pi(\{1\}) = \pi(\{2\}) = 2 - 0.75(2 - 0) = 0.5$. The cable operator's profit from airing both programs is $\pi(\{1,2\}) = 10 - 0.75(2)(10 - 2) = -2$. Under these conditions, the cable operator prefers to air only one program even though producer surplus is maximized when both programs are aired.
>
> Now, modify the example by increasing the cable operator's bargaining power from 25% to 50%. Then, the cable operator's profit from airing only one program is $\pi(\{1\}) = \pi(\{2\}) = 2 - 0.5(2 - 0) = 1$. The cable operator's profit from airing both programs is $\pi(\{1,2\}) = 10 - 0.5(2)(10 - 2) = 2$. Under these conditions, the cable operator prefers to air both programs and thus maximizes total producer surplus even though the conditions of Proposition 2 are violated.

2.3 Bargaining Power and Producer Surplus

This subsection considers the relationship between the cable operator's bargaining power and the cable operator's choice to bundle or unbundle programs. First, the following definitions are used to denote whether producer surplus is maximized by bundling programs or by providing programs *à la carte*.

Definition 1. Bundling is *globally dominant* if $v(P^{bundle}) \geq v(P^{unbundle})$ for all programming packages P. Unbundling or *à la carte* is *globally dominant* if $v(P^{unbundle}) \geq v(P^{bundle})$ for all programming packages P.

First, consider the case with two program suppliers.

Proposition 3. Suppose $n = 2$ and assumptions 1 and 2 hold.

a) Suppose bundling is globally dominant. Then, the cable operator chooses to bundle programs and maximizes total producer surplus if $\alpha_1 + \alpha_2 > 1$, and the cable operator chooses to unbundle programs and does not maximize total producer surplus if $\alpha_1 + \alpha_2 < 1$.

b) Suppose unbundling is globally dominant. Then, the cable operator chooses to unbundle programs and maximizes total producer surplus if $\alpha_1 + \alpha_2 > 1$, and the cable operator chooses to bundle programs and does not maximize total producer surplus if $\alpha_1 + \alpha_2 < 1$.

Proof of Proposition 3. Suppose bundling is globally dominant. Then, for the cable provider to strictly prefer to bundle programs in equilibrium, it must be the case that the cable operator's profit is larger with bundling than with *à la carte*, i.e., $\pi(\{1,2\}^{bundle}) > \pi(\{1,2\}^{unbundle})$. This condition can be re-written as:

$$(\alpha_1 + \alpha_2 - 1)v(\{1,2\}^b) + (1 - \alpha_1)v(\{1\}) + (1 - \alpha_2)v(\{2\}) >$$

$$(\alpha_1 + \alpha_2 - 1)v(\{1,2\}^u) + (1 - \alpha_1)v(\{1\}) + (1 - \alpha_2)v(\{2\})$$

$$\Leftrightarrow (\alpha_1 + \alpha_2 - 1)(v(\{1,2\}^b) - v(\{1,2\}^u)) > 0 \quad (3)$$

Note that inequality (3) holds if $\alpha_1 + \alpha_2 > 1$. Therefore, the cable operator chooses to bundle programs, and thus maximizes producer surplus when $\alpha_1 + \alpha_2 > 1$. On the other hand, the cable operator chooses to provide programs *à la carte* if $\alpha_1 + \alpha_2 < 1$, and thus does not maximize producer surplus. This completes the proof of part a. The proof of part b is parallel to the proof of part a. ■

Proposition 3 implies that when the cable operator's bargaining power is high enough, the cable operator's decision to bundle or unbundle programs maximizes total producer surplus. Maximizing total producer surplus does not necessarily imply the socially optimal level of surplus because it does not guarantee that the cable operator's pricing policy is socially optimal.[6]

The intuition behind Proposition 3 is that greater bargaining power implies that the cable operator keeps a larger portion of producer surplus, and thus, the cable operator's incentives are more aligned with an incentive to maximize producer surplus. Note that the cable operator also has an incentive to minimize the sum of infra-marginal surplus from program suppliers in order to minimize its transfer payments to suppliers. Thus, the cable operator chooses to bundle or to unbundle programs by striking a balance between the incentives to maximize surplus and to minimize transfer payments. The following example further elaborates this intuition.

[6]Note that we did not explicitly model consumer preferences and thus we cannot infer how consumer surplus is affected by the cable operator's decision to bundle programs.

Example 2. Suppose $n = 2$, $v(\{1,2\}^{bundle}) = 6$, $v(\{1,2\}^{unbundle}) = 5$, $v(\{1\}) = 4$, $v(\{2\}) = 3$, and $\alpha_1 = \alpha_2 = 1/3$.[7] Then, the cable operator's profit from bundling programs is $\pi(\{1,2\}^{bundle}) = 6 - (2(6-3)/3 + 2(6-4)/3) = 8/3$. The cable operator's profit from unbundling programs is $\pi(\{1,2\}^{unbundle}) = 5-(2(5-3)/3+2(5-4)/3) = 3$. Under these conditions, the cable operator prefers to unbundle programs even though producer surplus is maximized by bundling programs. The reason is as follows. If the cable operator decides to bundle programs instead of providing programs *à la carte*, total producer surplus increases by one $(6 - 5 = 1)$. At the same time, each seller's marginal contribution to producer surplus goes up by one unit as well. Since the cable operator keeps only one-third of sellers' marginal contributions, the cable operator's transfer payment to each seller increases by 2/3. Thus, bundling decreases the cable operator's profit by $1 - 2/3 - 2/3 = 1/3$.

Now, suppose that $\alpha_1 = \alpha_2 = 2/3$ so that condition $\alpha_1 + \alpha_2 > 1$ is satisfied. Then, the cable operator prefers to bundle programs and thus maximizes total producer surplus. The reason is as follows. If the cable operator decides to bundle programs instead of providing programs *à la carte*, total producer surplus increases by one $(6-5 = 1)$. At the same time, each seller's marginal contribution to producer surplus goes up by one unit as well. Since the cable operator keeps two-thirds of sellers' marginal contributions, the cable operator's transfer payment to each seller increases only by 1/3. Therefore, bundling inceases the cable operator's profit by $1-1/3-1/3 = 1/3$. Thus, greater bargaining power increases the cable operator's incentive to maximize total producer

[7]Clearly, assumptions 1 and 2 hold and there is global dominance of bundling because total producer surplus is maximized when programs are bundled.

surplus because the cable operator keeps a higher portion of the surplus.

A two supplier case is a special case because the cable operator's disagreement surplus is the same whether the cable operator bundles or unbundles programs, i.e., $v(\{1,2\}_{-i}^{bundle}) = v(\{1,2\}_{-i}^{unbundle})$. Proposition 4 generalizes Proposition 3 to the case with an arbitrary n number of program suppliers.

Proposition 4. Suppose assumptions 1 and 2 hold and that $v(\{1,...,n\}^b) \neq v(\{1,...,n\}^u)$.

a) Suppose bundling is globally dominant. Then the cable operator chooses to bundle programs (and thus maximizes total producer surplus) if $\sum \alpha_i > n-1$.

b) Suppose unbundling is globally dominant. Then the cable operator chooses to unbundle programs (and thus maximizes total producer surplus) if $\sum \alpha_i > n-1$.

Proof of Proposition 4. Let $S = \{1,...,n\}$. Suppose bundling is globally dominant and that $v(S^b) \neq v(S^u)$. Then, the cable operator chooses to bundle programs in stage one if $\pi(S^b) > \pi(S^u)$. This condition can be rewritten as:

$$v(S^b) - \sum(1-\alpha_i)(v(S^b) - v(S^b_{-i})) > v(S^u) - \sum(1-\alpha_i)(v(S^u) - v(S^u_{-i}))$$

$$\Leftrightarrow \sum(1-\alpha_i)(v(S^b_{-i}) - v(S^u_{-i})) > (n-1-\sum \alpha_i)(v(S^b) - v(S^u)) \quad (4)$$

The left-hand side of condition (4) is nonnegative. Since $v(S^b) - v(S^u) > 0$, the condition holds if $n-1-\sum \alpha_i < 0$. This proves part a of the proposition. Similarly, one can show that $\pi(S^u) > \pi(S^b)$ if unbundling is globally dominant and $n-1-\sum \alpha_i > 0$. ■

The intuition behind Proposition 4 is similar to Proposition 3 intuition. Greater bargaining power on the part of the cable operator implies that the cable operator is more likely to make a program packaging decision that maximizes total producer surplus. In Proposition 4, however, the condition that $\sum \alpha_i > n - 1$ is sufficient for producer surplus maximization but not necessary. Thus, it is possible that the cable operator's decision to bundle or unbundle programs could maximize total producer surplus even when condition $\sum \alpha_i > n - 1$ is violated.

3 Merger Analysis

This section investigates the implications of horizontal and vertical mergers on transfer payments and the cable operator's decision to bundle programs. Throughout this section it is assumed that assumptions 1 and 2 are satisfied.

3.1 Horizontal Merger

In this subsection, we consider the effects of a merger between two program suppliers, A and B, and show how this merger affects the merged firm's bargaining position. Let S^t be a programming package before the merger and S^k be a programming package after the merger. Suppliers A and B merge if their joint profit before the merger is less than the post-merger profit, i.e., if $\pi_A^p(S^t) + \pi_B^p(S^t) < \pi_{AB}^m(S^k)$. Superscripts m and p denote the post- and pre-merger equilibrium, respectively. This condition can be rewritten as:

$$(\pi_{AB}^m(S^t) - \pi_A^p(S^t) - \pi_B^p(S^t)) + (\pi_{AB}^m(S^k) - \pi_{AB}^m(S^t)) > 0 \tag{5}$$

Dividing inequality (5) by β_{AB}, the merged firm's bargaining power, and decomposing the terms yield the following:[8]

$$\begin{aligned}(v^p(S^t_{-A}) + v^p(S^t_{-B}) - v^p(S^t) - v^p(S^t_{-AB})) + (c^p_A + c^p_B - c^m_{AB}) + \\ ((R^m(S^t) - R^m(S^t_{-AB}) - \gamma^m(S^t) + \gamma^m(S^t_{-AB})) - \\ (R^p(S^t) - R^p(S^t_{-AB}) - \gamma^p(S^t) + \gamma^p(S^t_{-AB}))) + \\ \frac{\beta_{AB} - \beta_A}{\beta_{AB}}(v^p(S^t) - v^p(S^t_{-A})) + \frac{\beta_{AB} - \beta_B}{\beta_{AB}}(v^p(S^t) - v^p(S^t_{-B})) + \\ ((v^m(S^k) - v^m(S^k_{-AB})) - (v^m(S^t) - v^m(S^t_{-AB}))) > 0 \end{aligned} \tag{6}$$

In condition (6), the first term $v^p(S^t_{-A})+v^p(S^t_{-B})-v^p(S^t)-v^p(S^t_{-AB})$ denotes a *relative size effect* (RSE) of the merger on the merged firm's bargaining position. The sign of this effect depends on the curvature of the total producer surplus function. Since total producer surplus exhibits diminishing marginal returns, the sign of the relative size effect is non-negative.[9]

Next, $c^p_A+c^p_B-c^m_{AB}$ denotes the merger's effect on *upstream efficiency* (UE), i.e., the merger's effect on the suppliers' production costs. This term is positive if the merger decreases the merged suppliers' combined programming costs. Similarly, $(R^m(S^t) - R^m(S^t_{-AB}) - \gamma^m(S^t) + \gamma^m(S^t_{-AB})) - (R^p(S^t) - R^p(S^t_{-AB}) - \gamma^p(S^t) + \gamma^p(S^t_{-AB}))$ denotes *downstream efficiency* (DE). Downstream efficiency measures the cable operator's efficiency gains due to the merger.

As identified in Adilov and Alexander (2006), $\frac{\beta_{AB}-\beta_A}{\beta_{AB}}(v^p(S^t) - v^p(S^t_{-A})) + \frac{\beta_{AB}-\beta_B}{\beta_{AB}}(v^p(S^t) - v^p(S^t_{-B}))$ denotes a *bargaining power effect* (BPE) of the merger on the bargaining position of the merged firm. The sign of this effect depends on the merged supplier's ability to extract a greater share of marginal producer surplus from the cable operator. The BPE is non-negative when the merged firm's

[8]Note that the merger condition does not hold if $\beta_{AB} = 0$ because the post-merger profit would equal to zero.

[9]Note that the assumption of diminishing marginal producer surplus corresponds to the concavity assumption. See Chipty and Snyder (1999) for further discussion of this point.

bargaining power is greater than the pre-merger bargaining power of each supplier, i.e., if $\beta_{AB} \geq \beta_A$ and $\beta_{AB} \geq \beta_B$.

Finally, the last term $(v^m(S^k) - v^m(S^k_{-AB})) - (v^m(S^t) - v^m(S^t_{-AB}))$ denotes a *packaging effect* (PE) of the merger, i.e., how the merged firm's profit is affected by the cable operator's decision to package programs. This term is zero if the cable operator's decision to bundle programs or to provide programs *à la carte* is not affected by the merger. The PE is positive (negative) if the merger alters the cable operator's program bundling decision so that the marginal producer surplus from adding programs A and B increases (decreases) post merger. Until now, the packaging effect of a merger on bargaining position had not been identified in the literature.

Summarizing these five effects discussed above, firms A and B have an incentive to merge if:

$$RSE + UE + DE + BPE + PE > 0 \tag{7}$$

Condition (7) has an intuitive interpretation. Suppose the merger increases upstream or downstream efficiency. Then, the suppliers have greater incentive to merge. Similarly, if the merger increases the merged firm's ability to extract greater surplus in negotiations, the suppliers will have a greater incentive to merge.

Next, consider how a horizontal merger affects transfer payments received by the merged firm. The merger increases the post-merger transfer payment to the merged firm if $T^m_{AB}(S^k) - T^p_A(S^t) - T^p_B(S^t) > 0$. This condition can be rewritten as:

$$\pi^m_{AB}(S^k) - \pi^p_A(S^t) - \pi^p_B(S^t) + c^m_{AB} - c^p_A - c^p_B > 0 \tag{8}$$

Dividing inequality (8) by β_{AB} and simplifying yields:

$$RSE + DE + BPE + PE - \frac{1 - \beta_{AB}}{\beta_{AB}} UE > 0 \tag{9}$$

Condition (9) implies that higher upstream efficiency decreases the transfer payment paid to the merged firm. Intuitively, this implies that the merged firm shares with the cable operator an increase in marginal producer surplus achieved through upstream efficiency gains. However, if the merger increases downstream efficiency, the cable operator shares this increase in producer surplus with the merged firm. Thus, an increase in downstream efficiency increases the transfer payment received by the merged firm. The merger analysis results are summarized in Proposition 5.

> **Proposition 5.** Program suppliers A and B have a strict incentive to merge if and only if $RSE + BPE + PE + DE + UE > 0$. Transfer payments to the merged firm strictly increase if $RSE + BPE + PE + DE - \frac{1-\beta_{AB}}{\beta_{AB}} UE > 0$.

Even though a horizontal merger analysis here can be interpreted as a merger between two network providers, this is not the only interpretation of the results. Suppose, ESPN, Inc. is deciding whether to negotiate the programming price for ESPN and ESPN2 channels separately with a cable operator or to negotiate the price by combining these two channels into a bundle. Then, we can use proposition 5 results to figure out whether it is more profitable to sell programs to a cable operator as a bundle.

3.2 Vertical Merger

This subsection considers the effects of a vertical merger, i.e., a merger between a cable operator and a program supplier. Without loss of generality, suppose the cable operator merges with program supplier 1. Let S^t be a programming package before the merger and S^k be a programming package after the merger. The cable operator and supplier 1 merge if their joint profits increase as a result of the merger, i.e., if $\pi^m_{Cable}(S^k) > \pi^p_{Cable}(S^t) + \pi^p_1(S^t)$, where superscripts m and p denote the post- and pre-merger equilibrium, respectively. This condition can be rewritten as:

$$(\pi^m_{Cable}(S^t) - \pi^p_{Cable}(S^t) - \pi^p_1(S^t)) + (\pi^m_{Cable}(S^k) - \pi^m_{Cable}(S^t)) > 0 \tag{10}$$

In condition (10), term $\pi^m_{Cable}(S^k) - \pi^m_{Cable}(S^t)$ denotes the *packaging effect* (PE) of the merger on the merged firm's profit. This term is zero if the cable operator's decision to bundle programs or to provide programs *à la carte* is unchanged as a result of the merger. The PE is nonzero if the merger alters the cable operator's program bundling decision.

The term $\pi^m_{Cable}(S^t) - \pi^p_{Cable}(S^t) - \pi^p_1(S^t)$ can be rewritten as:

$$v^m(S^t) - \sum_{i \neq 1} \beta^m_i (v^m(S^t) - v^m(S^t_{-i})) - v^p(S^t) + \sum_{i \neq 1} \beta^p_i (v^p(S^t) - v^p(S^t_{-i})) =$$

$$(v^m(S^t) - v^p(S^t)) + \sum_{i \neq 1} \beta^m_i (v^p(S^t) - v^p(S^t_{-i}) - v^m(S^t) + v^m(S^t_{-i})) +$$

$$\sum_{i \neq 1} (\beta^p_i - \beta^m_i)(v^p(S^t) - v^p(S^t_{-i})) =$$

$$(R^m(S^t) - \gamma^m(S^t) - R^p(S^t) + \gamma^p(S^t)) + \sum_{i \in S} (c^p_i - c^m_i) -$$

$$\sum_{i \neq 1} \beta^m_i (R^m(S^t) - R^m(S^t_{-i}) - \gamma^m(S^t) + \gamma^m(S^t_{-i}) - R^p(S^t) + R^p(S^t_{-i}) + \gamma^p(S^t) - \gamma^p(S^t_{-i}))$$

$$- \sum_{i \neq 1} \beta^m_i (c^p_i - c^m_i) + \sum_{i \neq 1} (\beta^p_i - \beta^m_i)(v^p(S^t) - v^p(S^t_{-i})) \tag{11}$$

In expression (11), the term $R^m(S^t) - \gamma^m(S^t) - R^p(S^t) + \gamma^p(S^t)$ denotes the merger's effect on *total downstream efficiency* (TDE). Total downstream efficiency measures the change in net surplus generated by the cable operator due to the merger. This term is positive if the merger increases total revenues or decreases the cable operator's costs. The term $\sum_{i \in S} (c^p_i - c^m_i)$ denotes the merger's effect on *total upstream efficiency* (TUE), i.e., the change in program suppliers' costs due to the merger. This term is positive if the merger reduces the sum of suppliers' programming costs.

Further, $R^m(S^t) - R^m(S^t_{-i}) - \gamma^m(S^t) + \gamma^m(S^t_{-i}) - R^p(S^t) + R^p(S^t_{-i}) + \gamma^p(S^t) - \gamma^p(S^t_{-i})$ is supplier $i's$ marginal contribution to downstream efficiency or *marginal downstream efficiency* (MDE), while $c_i^p - c_i^m$ is supplier's i's efficiency gains due to the merger or *marginal upstream efficiency* (MUE). The sum of MDE and MUE for supplier i is positive if the merger increases supplier $i's$ marginal contribution to total surplus.

The term $\sum_{i \neq 1}(\beta_i^p - \beta_i^m)(v^p(S^t) - v^p(S^t_{-i}))$ denotes the change in the cable operator's bargaining position due to the change in the cable operator's bargaining power. In other words, this is a *bargaining power effect* or BPE. The BPE is nonnegative if the merger does not worsen the cable operator's bargaining power when negotiating with program suppliers, i.e., if $\alpha_i^m \geq \alpha_i^p$ for all i.

Summarizing the above findings, the cable operator and supplier 1 find it profitable to merge if:

$$TDE + TUE - \sum_{i \neq 1} \beta_i^m MDE_i - \sum_{i \neq 1} \beta_i^m MUE_i + BPE + PE > 0 \qquad (12)$$

Condition (12) has an intuitive interpretation. A vertical merger increases the merging firms' profits if total upstream or downstream efficiency improves as a result of the merger, *ceteris paribus*. The merger decreases the merging firms' profits if it increases suppliers' marginal contributions to total surplus because supplier transfer payments are proportional to suppliers' marginal contributions. On the other hand, the merger increases the merging firms' profits if the cable operator's ability to extract a greater share of marginal surplus (the cable operator's bargaining power) is enhanced as a result of the merger, *ceteris paribus*. The merger improves total producer surplus if $TDE + TUE > 0$, keeping the cable operators bundling (unbundling) decision unchanged. Condition (12), however, implies that the cable operator might decide to merge with a supplier even when $TDE + TUE < 0$ if, for example, the BPE is sufficiently large.

Next, consider the merger's effect on transfer payments received by program suppliers. The sum of transfer payments to non-merging program suppliers decreases post-merger if $\sum_{i \neq 1} T_i^p(S^t) - \sum_{i \neq 1} T_i^m(S^k) > 0$. This difference in transfer payments can be further decomposed:

$$
\begin{aligned}
&\sum_{i \neq 1} T_i^p(S^t) - \sum_{i \neq 1} T_i^m(S^k) = \\
&\sum_{i \neq 1} \beta_i^p(v^p(S^t) - v^p(S_{-i}^t)) - \sum_{i \neq 1} \beta_i^m(v^m(S^k) - v^m(S_{-i}^k)) + \sum_{i \neq 1}(c_i^p - c_i^m) = \\
&[v^m(S^k) - \sum_{i \neq 1} \beta_i^m(v^m(S^k) - v^m(S_{-i}^k)) - v^p(S^t) + \sum_{i \neq 1} \beta_i^p(v^p(S^t) - v^p(S_{-i}^t))] + \\
&[v^p(S^t) - v^m(S^t)] + [v^m(S^t) - v^m(S^k) + \sum_{i \neq 1}(c_i^p - c_i^m)] = \\
&[TDE + TUE - \sum_{i \neq 1} \beta_i^m MDE_i - \sum_{i \neq 1} \beta_i^m MUE_i + BPE + PE] - \\
&[TDE + TUE] + [v^m(S^t) - v^m(S^k) + \sum_{i \neq 1}(c_i^p - c_i^m)] = \\
&BPE - \sum_{i \neq 1} \beta_i^m MDE_i + \sum_{i \neq 1}(1 - \beta_i^m) MUE_i + \\
&\sum_{i \neq 1}(\beta_i^m(v^m(S^k) - v^m(S_{-i}^k)) - \beta_i^m(v^m(S^t) - v^m(S_{-i}^t))) \qquad (13)
\end{aligned}
$$

In (13), $\beta_i^m(v^m(S^k) - v^m(S_{-i}^k)) - \beta_i^m(v^m(S^t) - v^m(S_{-i}^t))$ denotes a *marginal packaging effect* (MPE) of the merger on supplier i. The MPE is zero if the merger does not alter the cable operator's decision to bundle or unbundle programs. The above discussion regarding the effects of a vertical merger is summarized in Proposition 6.

Proposition 6. A cable operator and program supplier have a strict incentive to merge if and only if $TDE + TUE - \sum_{i \neq 1} \beta_i^m MDE_i - \sum_{i \neq 1} \beta_i^m MUE_i + BPE + PE > 0$. The sum of transfer payments to non-merging program suppliers strictly decreases as a result of the merger if $BPE - \sum_{i \neq 1} \beta_i^m MDE_i + \sum_{i \neq 1}(1 - \beta_i^m) MUE_i + \sum_{i \neq 1} MPE_i > 0$.

In Proposition 6, an increase in total downstream efficiency or total upstream efficiency increases the incentive to merge. However, total upstream or downstream efficiency does not affect the amount of transfer payments to non-merging program suppliers. The reason is that each program supplier's transfer payment is determined by the supplier's *marginal* contribution to total producer surplus and by how this marginal surplus is divided between the cable operator and the program supplier.

The merger improves the sum of cable operator and program suppliers' profits if the post-merger total producer surplus is above the pre-merger total producer surplus, i.e., if $v^m(S^k) > v^p(S^t)$. We define *net transfer payment* (NT) to program supplier i as $NT_i = T_i - c_i$ and describe the relationship between transfer payments and total producer surplus in the following proposition:

Proposition 7. A merger between a cable operator and a program supplier improves total producer surplus if the merger increases total net transfer payments to non-merging program suppliers.

Proof of Proposition 7. Note that the cable operator and program supplier 1 decide to merge if $\pi^m_{Cable}(S^k) - \pi^p_{Cable}(S^t) - \pi^p_1(S^t) > 0$. This condition can be rewritten as:

$$\pi^m_{Cable}(S^k) - \pi^p_{Cable}(S^t) - \pi^p_1(S^t) > 0$$

$$\Leftrightarrow v^m(S^k) - \sum_{i\neq 1} NT_i^m(S^k) - v^p(S^t) + \sum_{i\neq 1} NT_i^p(S^t) > 0$$

$$\Leftrightarrow v^m(S^k) - v^p(S^t) > \sum_{i\neq 1} NT_i^m(S^k) - \sum_{i\neq 1} NT_i^p(S^t) \qquad (14)$$

$\sum_{i\neq 1} NT_i^m(S^k) - \sum_{i\neq 1} NT_i^p(S^t) > 0$ if the merger increases total net transfer payments to non-merging program suppliers, and therefore $v^m(S^k) > v^p(S^t)$. ■

Proposition 7 has a straightforward interpretation. If the merger increases total net transfer payments to program suppliers, then the program suppliers are receiving a larger *absolute* amount of the total producer surplus. Because the cable operator's profit is equal to total producer surplus minus total net transfer payments, the cable operator decides to merge with a program provider only if the increase in total producer surplus is greater than the increase in total net transfer payments to non-merging program suppliers. Therefore, a merger that increases total net transfer payments should increase total producer surplus as well.

4 Discussion

Cable operators choose to bundle or unbundle programs by striking a balance between the incentives to maximize surplus and minimize transfer payments. Greater bargaining power on the part of a cable operator implies that a cable operator is more likely to make a program packaging decision that maximizes total producer surplus. Regulatory efforts to limit the market share of cable operators or force cable operators to provide programs *à la carte* may indeed reduce total producer surplus. Absent offsetting increases in consumer welfare, such policy measures may reduce total welfare.

We have identified a heretofore undocumented implication of horizontal merger between two program providers or a vertical merger between a cable operator and a program provider: the *packaging effect*. The packaging effect is an important factor in determining overall bargaining position, and identifies how the merged firm's profit is affected by the cable operator's decision to package programs. The packaging effect might usefully be taken into consideration when contemplating horizontal or vertical mergers in the industry.

One obvious extension of this work would be inclusion of consumer preferences, which would shed light on how consumer welfare is affected by a cable operator's bundling or unbundling decisions. Incorporation of consumer preferences is, however, unlikely to change our findings regarding the division of producer surplus and merger analysis. In addition, one might extend the model to investigate how the implications of the model could change if cable operators and program suppliers are allowed to bargain over the bundling decision as well.

Another potentially useful extension of the present work is to allow for mixed bundling. This extension might yield some additional insights regarding the bundling decision of a cable operator. Further, future research might relax the assumption that a cable operator can pre-commit to a bundling (unbundling) decision before engaging in negotiations with program suppliers, although anecdotal evidence suggests that it is unlikely that the cable operator would unbundle all programs when a negotiation with one of the suppliers fails. In fact, allowing the cable operator to repackage its programs depending on the outcome of negotiations with program suppliers and allowing the cable operator to engage in mixed bundling are closely related extensions. Both extensions expand the cable operator's strategy set.

References

[1] Adams, W.A. and Yellen, J.L. 1976. "Commodity Bundling and the Burden of Monopoly," *Quarterly Journal of Economics* 91, pp. 475-498.

[2] Adilov, N. and Alexander, P. 2006. "Horizontal Merger: Pivotal Buyers and Bargaining Power," *Economics Letters*, 91(3), pp. 307-311.

[3] Chipty, T. and Snyder, M. 1999. "The Role of Firm Size in Bilateral Bargaining: A Study of the Cable Television Industry," *The Review of Economics and Statistics*, 81(2), pp. 326-340.

[4] McAfee, R.P., McMillan J., and Whinston, M.D. 1989. "Multiproduct Monopoly, Commodity Bundling and Correlation of Values," *Quarterly Journal of Economics* 104, pp. 371-383.

[5] Nalebuff, B., 2004 "Bundling as an Entry Barrier," *The Quarterly Journal of Economics*, 119, pp. 159-187.

[6] Salinger, M.A., 1995. "A Graphical Analysis of Bundling," *Journal of Business*, Volume 68, Number 1, pp. 85-98.