

Pivotal Buyers, Vertical Ownership, and Endogenous Most-Favored-Nation Clauses in the Cable Industry

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ABSTRACT

In this paper, we analyze pivotal buyers, vertical ownership, and endogenous most-favored-nation clauses, using the cable industry as an illustrative case. We suggest that most-favored-nation clauses emerge to align the incentives of program sellers to more closely match those of large, pivotal program buyers, and show how most-favored-nation clauses and vertical ownership compensate a pivotal buyer for a seller's bias toward risky projects. We show that in the absence of most-favored-customers clauses, vertical ownership is unambiguously Pareto improving. However, the combined effects of most-favored-nation clauses and vertical ownership on sellers and non-pivotal buyers are ambiguous. Importantly, all of our results hold under conditions of risk neutrality.

I Introduction

In this paper, we analyze the implications of pivotal buyers, vertical ownership, and endogenous most-favored-nation clauses (hereafter, MFN), using the cable industry as an illustrative case. We find, among other things, that MFN clauses emerge to induce program sellers to select projects that benefit large, pivotal program buyers. However, even if the MFN clause fails to alter a seller's product selection, the large pivotal buyer is compensated via vertical ownership and other transfer payments from the seller. We demonstrate that both vertical ownership and MFN clauses increase the pivotal buyer's profits, while their effects on other buyers and sellers are ambiguous.

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While we illustrate our analysis using the cable industry as an example, our model is sufficiently general to apply elsewhere. The cable industry provides a particularly useful framework since the supply-side elements of the industry correspond nicely to the specific characteristics of our model: pivotal buyers, vertical ownership, uncertainty regarding product valuation, uncertainty regarding payments from non-pivotal buyers, MFN clauses, and a zero marginal cost of product provision for an additional buyer.

In what follows, “sellers” refer to upstream program providers, such as Home Box Office, while “buyers” refer to downstream cable operators, such as Comcast, who distribute programming to consumers. Moreover, a “pivotal” buyer in the cable industry is a program buyer without whom a program seller would otherwise produce zero output. In this paper, we restrict our use of the term pivotal to large buyers who alone can fully compensate a seller for their avoidable program production costs. Finally, a “most-favored-nation” clause in the cable industry is a contractual specification such that a program seller commits to giving a large, pivotal program buyer a per-customer price no higher than that of any other program buyer.¹

The central focus of our model relates to the division of the bargaining surplus among large pivotal program buyers, small non-pivotal program buyers, and program sellers, under varying structural and contractual conditions. As we noted briefly above, we find that a large buyer with some positive level of vertical ownership always benefits from an MFN, while the effect of an MFN on small buyers is ambiguous (in part, the outcome depends on the small buyers “type”). Moreover, we find that sellers have strong incentives to undertake risky projects that do not necessarily maximize either the total surplus or the large buyer’s profits, which may help explain the rapidly escalating programming costs in the cable industry. As we show, the MFN clause emerges in response to this product selection bias on the part of the sellers. If, however, the MFN fails to circumscribe the seller’s choice, vertical ownership compensates the large, pivotal buyer. Importantly, these results are derived under the assumption of risk neutrality.

The paper is organized as follows. In Section Two, we introduce a model without vertical ownership and an exogenously selected project. In Section Three, we characterize the optimal choices of the participants. In Section Four we analyze the implications of MFN clauses without vertical ownership. In Section Five, we extend the model to include vertical ownership. In Section Six, we analyze the implications of vertical ownership

¹For simplicity, we assume the large buyer chooses the level of transfer payments embedded in the MFN clause, and that there is a penalty if the seller decides to charge a smaller buyer a price below the transfer price specified by large buyer. This penalty transfer price level is not necessarily equal to the per-customer cost of the large buyer, which is reasonable since a large buyer may find it optimal to choose an MFN trigger level below a buyer’s per-customer cost. However, this assumption is not crucial to our results.

and MFN clauses. In Section Seven, we further extend the model to show how the MFN emerges from the model. In Section Eight, we discuss the main results. Finally, we make some concluding remarks.

II The Model

To begin, we assume there is a single program seller, a large program buyer and a small program buyer. The seller has a programming project that requires an investment equal to I , and the large, pivotal buyer decides whether to undertake (commit to purchasing) the project. The programming project yields the large buyer a revenue stream of v_H if the state (the quality of the project) is high and v_L if the state is low, where $v_H > v_L \geq 0$. Let $\lambda \in (0, 1)$ denote the probability that the state is high.

We assume the large buyer is pivotal and therefore (by our definition of pivotal given above) has to make a payment of I to the seller for the project to be undertaken. If the project is undertaken, the large buyer sets a minimum transfer payment level (hereafter, MTP)², T_{min} , to be paid by the small buyer to the seller. If the seller charges the small buyer a transfer price T below the minimum transfer payment level, the seller must pay a penalty of $p(T_{min} - T)$ to the large buyer, where $p > 0$.

We assume there is a liquidity constraint for the seller such that the sum of the transfer payments charged to the large and small buyers has to be greater than or equal to the investment cost, i.e., $I + T - \text{penalty} \geq I$.

The small buyer can be one of two types: high or low. The probability that a small buyer is a low type is $\phi \in (0, 1)$. The i -type small buyer values the project at $\gamma_i v_H$ if the state is high and $\gamma_i v_L$ if the state is low, $\gamma_H > \gamma_L > 0$. Only the small buyer knows its type.

The seller makes a take-it-or-leave-it offer (β, T) to the small buyer, where $\beta \in [0, 1]$ is the share of the variable revenue $\gamma_i(v_H - v_L)$ kept by the small buyer.³

The timing of events is as follows:

Stage I: Nature chooses $\gamma_i \in \{\gamma_H, \gamma_L\}$, λ , I , $\{v_H, v_L\}$. Note that γ_i is observed only by the small buyer, while λ , I , and $\{v_H, v_L\}$ are observed by all parties.

Stage II: The large buyer decides whether to accept or reject the investment proposal. If the investment proposal is accepted, the large buyer chooses T_{min} .

Stage III: If the project is accepted at Stage II,

²Note that the minimum transfer payment level denotes the MFN clause trigger point endogenously determined by the large buyer.

³In the cable industry, this is advertising revenue.

the seller, after observing T_{min} , makes a take-it-or-leave-it offer (β, T) to the small buyer.

Stage IV: The small buyer accepts or rejects the seller's proposal.

Stage V: v_j is realized and observed by all parties.

Next, we define the Nash Equilibrium.

Definition 1: The subgame perfect Nash Equilibrium consists of (1) a large buyer's $action^* \in \{\text{accept, reject}\}$; (2) a minimum transfer payment level T_{min}^* ; (3) the seller's offer schedule (β^*, T^*) ; and (4) the small buyer's $action^* \in \{\text{accept, reject}\}$ such that:

- a. The small buyer's action maximizes, conditional on its type, its expected profits based on the seller's offer schedule.
- b. The seller's offer schedule maximizes the seller's profits, given the minimum transfer payment level, and taking into account the small buyer's optimal behavior in Stage IV.
- c. The large buyer's action and minimum transfer payment level maximize the large buyer's profits, taking into account the seller's and the small buyer's optimal behaviors.

III Characterization of the Equilibrium

A Stage IV

We solve the problem by backward induction. At Stage IV, the small buyer knows its own type γ_i . Taking the seller offer schedule to be (β, T) , the small buyer accepts the offer if, and only if, its expected future revenue exceeds the transfer payment, i.e., the small buyer accepts the offer iff:⁴

$$\lambda \gamma_i v \beta - T \geq 0 \tag{1}$$

The small buyer rejects the seller's offer if:

$$T > \lambda \gamma_i v \beta$$

⁴For convenience, we will assume that $v_H = v > 0$ and $v_L = 0$. Notice that when $v_L > 0$, $v_H = v_L + m$, where $m > 0$. This assumption does not change our qualitative results.

B Stage III

At Stage III, the minimum transfer payment level T_{min} is known. Note that the transfer payment charged by the seller must satisfy the seller's liquidity constraint:

$$I + T - p(T_{min} - T) \geq I$$

which simplifies to

$$T \geq \frac{p}{1+p} T_{min}.$$

Notice that if the seller wants its offer to be accepted by at least one type of small buyer, (1) must hold with equality for that buyer, since the seller's profits are strictly increasing in T . This suggests that in a separating equilibrium where only high-type small buyers are served:

$$T^* = \lambda \gamma_H v \beta^*$$

and in a pooling equilibrium where both types of small buyers are served:

$$T^* = \lambda \gamma_L v \beta^*.$$

Before proceeding, we make two straightforward technical assumptions that do not affect the results, but greatly simplify the calculations. Thus:

$$\text{Assumption 1: } \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right) > p$$

and

$$\text{Assumption 2: } \gamma_H \frac{p}{1+p} > \gamma_L$$

We now explore four cases relating to the value of T_{min} that exhaust the range of possible transfer prices.

Case 1: $\lambda \gamma_L v \geq T_{min}$.

(i) In the pooling equilibrium, either $T_{min} \geq T$ or $\lambda \gamma_L v \geq T \geq T_{min}$. Let $T_{min} \geq T$; then $\beta = \frac{T}{\lambda \gamma_L v}$. The seller's expected profits are $E\pi_i = \phi \lambda (1 - \frac{T}{\lambda \gamma_L v}) \gamma_H v + (1 - \phi) \lambda (1 - \frac{T}{\lambda \gamma_L v}) \gamma_L v + T - p(T_{min} - T) = \phi \lambda \gamma_H v + (1 - \phi) \lambda \gamma_L v + T(1 + p - \phi \frac{\gamma_H}{\gamma_L} - (1 - \phi)) - p T_{min} = \phi \lambda \gamma_H v + (1 - \phi) \lambda \gamma_L v + T(p - \phi(\frac{\gamma_H}{\gamma_L} - 1)) - p T_{min}$. Since $\phi(\frac{\gamma_H}{\gamma_L} - 1) > p$, the maximum $E\pi_i$ will be achieved at the lowest level of T , $\frac{p}{1+p} T_{min}$. So, in this instance, $T_i^* = \frac{p}{1+p} T_{min}$; $\beta_i^* = \frac{p}{(1+p)\lambda \gamma_L v} T_{min}$; and $E\pi_i^* = \phi \lambda \gamma_H v + (1 - \phi) \lambda \gamma_L v + T_{min}(p - \phi(\frac{\gamma_H}{\gamma_L} - 1)) - p T_{min} = \phi \lambda \gamma_H v + (1 - \phi) \lambda \gamma_L v - T_{min}(1 + \phi(\frac{\gamma_H}{\gamma_L} - 1)) \frac{p}{1+p}$.

(ii) Let $\lambda \gamma_L v \geq T \geq T_{min}$. Then, $\beta = \frac{T}{\lambda \gamma_L v}$, and the MTP constraint does not bind. The seller's expected profits are $E\pi_{ii} = \phi \lambda \gamma_H v + (1 - \phi) \lambda \gamma_L v -$

$T\phi(\frac{\gamma_H}{\gamma_L} - 1)$. Since $\phi(\frac{\gamma_H}{\gamma_L} - 1) > 0$, the seller's profits will be maximized at the lowest level of T . This implies that $T_{ii}^* = T_{min}$; $\beta_{ii}^* = \frac{T_{min}}{\lambda\gamma_{LV}}$; and $E\pi_{ii}^* = \phi\lambda\gamma_{HV} + (1 - \phi)\lambda\gamma_{LV} - T_{min}\phi(\frac{\gamma_H}{\gamma_L} - 1)$.

Remark: Comparing i and ii, the binding pooling equilibrium is preferred to the nonbinding pooling equilibrium if $E\pi_i^* > E\pi_{ii}^*$. This implies that $-T_{min}(1 + \phi(\frac{\gamma_H}{\gamma_L} - 1))\frac{p}{1+p} > -T_{min}\phi(\frac{\gamma_H}{\gamma_L} - 1)$ and $\phi(\frac{\gamma_H}{\gamma_L} - 1) > 0$. Since $E\pi_i^* > E\pi_{ii}^*$ holds, case i is preferred to case ii by the seller.

(iii) In the separating equilibrium only the high-type small buyers are served, and the seller extracts all of the small buyer's surplus. The seller does this by setting: $T_{iii}^* = \lambda\gamma_{LV}$, $\beta_{iii}^* = \frac{\gamma_L}{\gamma_H}$ and $E\pi_{iii}^* = \phi\lambda\gamma_{HV}$.⁵

Remark: The pooling equilibrium dominates the separating equilibrium if $E\pi_i^* \geq E\pi_{iii}^*$ or $(1 - \phi)\lambda\gamma_{LV} \geq T_{min}(1 + \phi(\frac{\gamma_H}{\gamma_L} - 1))\frac{p}{1+p}$. If

$$(1 - \phi)\lambda\gamma_{LV} \geq T_{min}(1 + \phi(\frac{\gamma_H}{\gamma_L} - 1))\frac{p}{1+p} \quad (2)$$

then the pooling equilibrium results, and the MTP is binding. If

$$(1 - \phi)\lambda\gamma_{LV} \leq T_{min}(1 + \phi(\frac{\gamma_H}{\gamma_L} - 1))\frac{p}{1+p} \quad (3)$$

then the separating equilibrium results, and the MTP level is not binding.

Case 2: Let $\lambda\gamma_{HV} \geq T_{min} \geq \lambda\gamma_{LV} \geq \frac{p}{1+p}T_{min}$.

(iv) In the pooling equilibrium, it must be the case that $\lambda\gamma_{LV} \geq T \geq \frac{p}{1+p}T_{min}$ for the low-type small buyer to accept seller's offer. The seller's expected profits are (similar to case i) $E\pi_{iv} = \phi\lambda\gamma_{HV} + (1 - \phi)\lambda\gamma_{LV} + T(p - \phi(\frac{\gamma_H}{\gamma_L} - 1)) - pT_{min}$. This implies that $T_{iv}^* = \frac{p}{1+p}T_{min}$; $\beta_{iv}^* = \frac{p}{(1+p)\lambda\gamma_{LV}}T_{min}$; and $E\pi_{iv}^* = \phi\lambda\gamma_{HV} + (1 - \phi)\lambda\gamma_{LV} - T_{min}(1 + \phi(\frac{\gamma_H}{\gamma_L} - 1))\frac{p}{1+p}$.

(v) In the separating equilibrium, only the high-type small buyer is served, and the seller extracts

⁵There is more than one schedule of transfer payments that gives rise to the same level of profits.

all of the high-type small buyer's surplus by setting $T_v^* = \lambda\gamma_H v$, $\beta_v^* = 1$ and $E\pi_v^* = \phi\lambda\gamma_H v$.

Remark: Since $E\pi_{iv}^* = E\pi_i^*$ and $E\pi_v^* = E\pi_{iii}^*$, the conditions under which the pooling equilibrium dominates the separating equilibrium are the same. If $(1 - \phi)\lambda\gamma_L v \geq T_{min}(1 + \phi(\frac{\gamma_H}{\gamma_L} - 1))\frac{p}{1+p}$, then the pooling equilibrium results and the minimum transfer payment level is binding. If $(1 - \phi)\lambda\gamma_L v \leq T_{min}(1 + \phi(\frac{\gamma_H}{\gamma_L} - 1))\frac{p}{1+p}$, then the separating equilibrium results and the minimum transfer payment level is not binding.

Case 3: Let $\lambda\gamma_H v \geq T_{min} \geq \frac{p}{1+p}T_{min} > \lambda\gamma_L v$

(vi) Since the minimum transfer payment level which satisfies the liquidity constraint is greater than $\lambda\gamma_L v$, only a separating equilibrium can result. Like case v, in the separating equilibrium $T_{vi}^* = \lambda\gamma_H v$, $\beta_{vi}^* = 1$ and $E\pi_{vi}^* = \phi\lambda\gamma_H v$.

Case 4: Let $T_{min} \geq \lambda\gamma_H v$

(vii) Assumption 2 guarantees that $\frac{p}{1+p}T_{min} > \lambda\gamma_L v$. The only possible equilibrium is a separating equilibrium where $T_{vii}^* = \lambda\gamma_H v$, $\beta_{vii}^* = 1$ and $E\pi_{vii}^* = \phi\lambda\gamma_H v - \phi p(T_{min} - \lambda\gamma_H v) = \phi\lambda\gamma_H v(1 + p) - \phi T_{min}$.

C Stage II

Consider the large buyer's choice of T_{min} in Stage II. The large buyer makes additional positive profits only if the minimum transfer payment level is binding. This suggests that in the separating equilibrium, the large buyer chooses the highest T_{min} such that the MTP is binding, and the seller's surplus is zero. This setting corresponds to case vii. Solving for the separating equilibrium MTP, we note that $T_{min}^{S*} = \lambda\gamma_H v(1 + p)$ and the large buyer's expected additional revenue is $E[R_{LS}^*] = \phi\lambda\gamma_H v(1 + p)$.

From Stage III, we know that in the pooling equilibrium a seller charges $\frac{p}{1+p}T_{min}$. This implies that a large buyer should charge the highest possible T_{min} such that the seller still prefers the pooling equilibrium to the separating equilibrium, i.e., condition (2) holds with equality. This implies that

$$T_{min}^{P*} = \frac{(1-\phi)\lambda\gamma_L v}{1+\phi(\frac{\gamma_H}{\gamma_L}-1)} \frac{1+p}{p}$$

and the large buyer's expected additional revenue is

$$E[R_{PS}^*] = p(T_{min}^{P*} - T_{min}^{P*} \frac{1+p}{p}) = \frac{(1-\phi)\lambda\gamma_L v}{1+\phi(\frac{\gamma_H}{\gamma_L}-1)}.$$

To summarize, the pooling equilibrium dominates the separating equilibrium in Stage II if $\frac{(1-\phi)\lambda\gamma_L v}{1+\phi(\frac{\gamma_H}{\gamma_L}-1)} \geq \phi p \lambda \gamma_H v$ or, equivalently, if:

$$\frac{(1-\phi)\gamma_L}{1+\phi(\frac{\gamma_H}{\gamma_L}-1)} \geq \phi p \gamma_H \quad (4)$$

while the separating equilibrium dominates the pooling equilibrium if

$$\frac{(1-\phi)\gamma_L}{1+\phi(\frac{\gamma_H}{\gamma_L}-1)} < \phi p \gamma_H. \quad (5)$$

Note that the large buyer undertakes the project if $\lambda v +$ (additional expected revenue) $\geq I$. Note also that since the solution exists at each stage of the game, the solution to the stage game also exists.

IV Implications of Minimum Transfer Payments in the Absence of Vertical Ownership

In the absence of both vertical ownership and the MTP, a project is undertaken if $\lambda v \geq I$. This condition is less restrictive in the presence of the MTP, which suggests projects that are not undertaken in the absence of an MTP, might be undertaken under an MTP. In the absence of the MTP, both types of small buyers are always served since the seller can extract all the surplus from the small buyers by choosing $(\beta, T) = (0, 0)$. However, under an MTP, the low-type small buyer is excluded in a separating equilibrium. In the pooling equilibrium, the high-type small buyers profits are positive, and the low-type small buyers profits are zero. These findings, together with the conditions from the previous section, are summarized in Claims 1 – 3.

CLAIM 1. If assumptions 1 and 2, condition (4), and $\lambda v \geq I$ hold under no vertical ownership, then both types of small buyers are served under the MTP.

Remark: In the case of Claim 1, the introduction of an MTP (1) increases the large buyer's and high-type small buyer's profits, (2) decreases the seller's profits, and (3) does not change the low-type small buyers profits.

CLAIM 2. If assumptions 1 and 2, condition (4), and $\lambda v + \frac{(1-\phi)\lambda\gamma_H v}{1+\phi(\frac{\gamma_H}{\gamma_L}-1)} \geq I > \lambda v$ hold under no vertical ownership, then a project that is forgone without an MTP is undertaken under an MTP, and both types of small buyers are served.

Remarks: In the case of Claim 2, the introduction of an MTP (1) increases the large buyer's profits, (2) increases the high-type smaller buyer's and seller's profits, and (3) does not change the low-type smaller buyer's profits.

The introduction of an MTP is Pareto improving.

CLAIM 3. If assumptions 1 and 2, condition (5), and $\lambda v \geq I$ hold under no vertical ownership, then both types of small buyers are served without an MTP. Only the high-type small buyers are served under an MTP.

Remarks: In the case of Claim 3, the introduction of an MTP (1) increases the large buyer's profits, (2) decreases the seller's profits, and (3) does not change high-type small buyer's profits.

The introduction of an MTP moves the equilibrium from a pooling to a separating equilibrium where the low-type small buyers are not served under conditions of Claim 3.

Claims 1-3 suggest that the introduction of an MTP always increases the large buyer's profits. Furthermore, the large buyer always sets the MTP at a level such that it is optimal for the seller to charge a small buyer less than the MTP. Finally, a seller's profits may increase or decrease from the introduction of an MTP.

In Section VI, we will modify Claims 1-3, and show that similar results hold under vertical ownership.

V Minimum Transfer Prices under Vertical Ownership

In this section, we solve the model under the assumption that the large buyer has an ownership share in the seller.⁶ Denote by $\alpha \in [0, 1)$ the large buyer's ownership share. Under this extension, only the large buyer's behavior in Stage II changes; the small buyer's and the seller's optimal behavior remains the same.

In the separating equilibrium, regardless of the value of α , the large buyer will extract all of the seller's surplus, just as in the case without vertical ownership. This implies that the MTP constraint is binding. Specif-

⁶For the purposes of this paper, we assume vertical ownership does not give large buyers direct control over sellers. Instead, in our model the large buyer affects seller behavior indirectly through market mechanisms.

ically, $T_{min}^{S*} = \lambda\gamma_H v(1+p)$ and the large buyer's additional revenue is $R_S^* = \phi p \lambda \gamma_H v$.

In the pooling equilibrium, the MTP constraint may or may not bind. If the MTP constraint does not bind, then the only additional source of revenue for the large buyer is through its ownership share. Thus, the seller's profits will be maximized. This implies that $T_{min}^{PN*} = 0$ and the large buyer's additional revenue is $R_{PN}^* = \alpha(\lambda\phi\gamma_H v + \lambda(1-\phi)\gamma_L v)$.

In the pooling equilibrium where the MTP binds, the large buyer increases its revenue both from its ownership share and the MTP penalty. In this case, the large buyer's incremental revenue is given by:

$$R_{PB}^* = \max\left\{p\left(1 - \frac{p}{1+p}\right)T_{min} + \alpha(\phi\lambda\gamma_H v + (1-\phi)\lambda\gamma_L v - (1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right))\frac{p}{1+p}T_{min})\right\} = \max\left\{\frac{p}{1+p}(1 - \alpha(1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right)))T_{min} + \alpha(\phi\lambda\gamma_H v + (1 - \phi)\lambda\gamma_L v)\right\}.$$

If $1 - \alpha(1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right)) \geq 0$, then the optimal MTP (from the buyer's perspective) is the highest possible MTP under which the pooling equilibrium is preferred by the seller, i.e.,

$$T_{min}^{PB*} = \frac{(1-\phi)\lambda\gamma_L v}{1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right)} \frac{1+p}{p}.$$

In this case, the large buyer's additional revenue is:

$$R_{PB}^* = \frac{(1 - \alpha(1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right)))(1 - \phi)\lambda\gamma_L v}{1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right)} + \alpha(\phi\lambda\gamma_H v + (1 - \phi)\lambda\gamma_L v).$$

If $1 - \alpha(1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right)) \leq 0$, then the optimal MTP (for the buyer) is the lowest possible minimum transfer payment level, i.e., $T_{min}^{PB*} = 0$. In this case, the large buyer's only source of additional revenue is through its ownership share, $R_{PB}^* = \alpha(\phi\lambda\gamma_H v + (1 - \phi)\lambda\gamma_L v)$. Thus, the large buyer prefers the separating equilibrium to the pooling equilibrium if and only if $R_S^* \geq \max\{R_{PB}^*, R_{PN}^*\}$.

Summarizing these results, we note that if:

$$1 - \alpha(1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right)) \geq 0 \quad (6)$$

and

$$\phi p \gamma_H \leq \frac{(1 - \alpha(1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right)))(1 - \phi)\gamma_L}{1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right)} + \alpha(\phi\gamma_H + (1 - \phi)\gamma_L) \quad (7)$$

hold, then the pooling equilibrium where the MTP is binding dominates all other equilibria. However, if:

$$1 - \alpha(1 + \phi\left(\frac{\gamma_H}{\gamma_L} - 1\right)) \leq 0 \quad (8)$$

and

$$\phi p \gamma_H \leq \alpha(\phi\gamma_H + (1 - \phi)\gamma_L) \quad (9)$$

hold, then the pooling equilibrium where the MTP does not bind dominates all other equilibria.

Finally, we see that if condition (6) holds but condition (7) fails, or if condition (8) holds but condition (9) fails, then the separating equilibrium with a binding MTP dominates all other equilibria.

VI Implications of Minimum Transfer Payments in Relation to Vertical Ownership

In this section, we discuss how vertical ownership affects the choice of the MTP level and equilibrium selection by the large buyer. First, note that under vertical ownership the MTP constraint does not have to bind, whereas without vertical ownership the MTP constraint always binds. Also, notice that in constraint (7), the right-hand side is increasing with respect to α :

$$\frac{\partial}{\partial \alpha} \left(\frac{(1 - \alpha(1 + \phi(\frac{\gamma_H}{\gamma_L} - 1)))(1 - \phi)\gamma_L}{1 + \phi(\frac{\gamma_H}{\gamma_L} - 1)} + \alpha(\phi\gamma_H + (1 - \phi)\gamma_L) \right) > 0$$

This implies that without vertical ownership the set of parameter values under which the pooling equilibrium dominates the separating equilibrium is a subset of parameter values with vertical ownership under which the binding pooling equilibrium dominates the separating equilibrium. And, since the MTP is higher under the separating equilibrium, we make the following claims:

CLAIM 4. If assumptions 1 and 2 hold, then:

1. The MTP level in the absence of vertical ownership is never larger than the MTP level in the presence of vertical ownership.
2. If conditions (8) and (9) hold, then $T_{min}^{Ver*} = 0$ with vertical ownership and $T_{min}^* > 0$ without vertical ownership.
3. If conditions (5), (6) and (7) hold, then $T_{min}^* > T_{min}^{Ver*} \geq 0$.

Note that vertical ownership reduces the negative effects of an MTP on sellers, since the MTP level is lower under vertical ownership. Thus, we can conclude that all parties, except for high-type small buyers, do at least as well under vertical ownership as without it. In the pooling equilibrium, if the large buyer decides to set the MTP to zero, then the seller extracts all of the high-type small buyer's surplus. In contrast, in the pooling

equilibrium without vertical ownership, the high-type small buyer's profits are positive.

Clearly, vertical ownership can provide additional incentives (via the ownership revenue) for the large buyer to undertake the project. In Claim 5, we state the conditions under which a project that is not undertaken without vertical ownership is undertaken with vertical ownership. This can only happen in a pooling equilibrium. The condition under which the large buyer undertakes the project in the presence of vertical ownership is:

$$\max\{\alpha(\lambda\phi\gamma_H v + \lambda(1 - \phi)\gamma_L v), \frac{(1 - \alpha(1 + \phi(\frac{\gamma_H}{\gamma_L} - 1)))(1 - \phi)\lambda\gamma_L v}{1 + \phi(\frac{\gamma_H}{\gamma_L} - 1)} + \alpha(\lambda\phi\gamma_H v + \lambda(1 - \phi)\gamma_L v)\} + \lambda \geq I > \max\{\phi p \lambda \gamma_H v, \frac{(1 - \phi)\lambda\gamma_L v}{1 + \phi(\frac{\gamma_H}{\gamma_L} - 1)}\} + \lambda v \quad (10)$$

CLAIM 5. Let assumptions 1 and 2 and condition (10) hold in the presence of an MTP. Then, with the introduction of vertical ownership, (1) the project which is not undertaken in the absence of vertical ownership will be undertaken; (2) all types of small buyers will be served; and (3) large buyer's, seller's, and high-type small buyer's profits will increase while the low-type small buyer's profits will not change.

Claim 5 can be modified to compare the effects of vertical ownership when the MTP is absent. Consistent with Claim 5, we note that vertical ownership gives additional incentives to undertake the project. The condition under which the project is undertaken with vertical ownership is given by:

$$\lambda v + \alpha(\lambda\phi\gamma_H v + \lambda(1 - \phi)\gamma_L v) \geq I \quad (11)$$

CLAIM 6. Let assumptions 1, 2, condition (11) and $I > \lambda v$ hold without the MTP. Then, with the introduction of vertical ownership, (1) the project which is not undertaken otherwise will be undertaken; (2) all types of small buyers will be served; (3) large buyer's and seller's profits will increase; and (4) the high-type small buyer's and low-type small buyers profits will not change.

Claims 4-6 consider the effects of vertical ownership with and without the MTP. These claims suggest that vertical ownership is Pareto-improving in the absence of the MTP. The Pareto optimality of vertical ownership is a well-known result in industrial organization: vertical ownership suppresses the negative effects of double marginalization. However, in conjunction with the MTP, vertical ownership may not be Pareto improving because it may decrease the high-type small buyers profits.

Next we consider the implications of the MTP when vertical ownership is present. Claims 7-10 are similar to Claims 1-3 and are directly implied by the model in Section V.

CLAIM 7. If assumptions 1 and 2, conditions (6), (7), and (11) hold under vertical ownership, then both types of small buyers are served regardless of the MTP. The introduction of the MTP (1) increases the large buyer's and high-type small buyer's profits, (2) decreases the seller's profits, and (3) does not change the low-type smaller buyer's profits.

CLAIM 8. If assumptions 1 and 2, conditions (8), (9), and (11) hold under vertical ownership, then both types of small buyers are served regardless of the MTP. The introduction of the MTP (1) increases the large buyer's profits, (2) decreases the seller's profits, and (3) does not change the small buyer's profits.

CLAIM 9. If assumptions 1 and 2, condition (6), and the expression:

$$\frac{(1-\alpha(1+\phi(\frac{\gamma_H}{\gamma_L}-1)))(1-\phi)\lambda\gamma_L v}{1+\phi(\frac{\gamma_H}{\gamma_L}-1)} + \alpha(\lambda\phi\gamma_H v + \lambda(1-\phi)\gamma_L v) + \lambda v \geq I$$

hold, and condition (11) fails under vertical ownership, then the project that forgone without the MTP will be undertaken with an MTP and both types of small buyers will be served. The introduction of the MTP (1) increases the larger buyer's, high-type smaller buyer's, and seller's profits, and (2) does not change the low-type smaller buyer's profits.

CLAIM 10. Let assumptions 1 and 2, conditions (6) and (11) hold but condition (7) fails; or assumptions 1 and 2, conditions (8) and (11) hold but condition (9) fails. Then, the project is undertaken both with and without the MTP. However, the low-type smaller buyer's are not served under the MTP. The introduction of the MTP (1) increases the larger buyer's profits, (2) decreases the seller's profits, and (3) does not change the smaller buyer's profits.

Like the results of Claims 1-3, Claims 7-10 state that the introduction of the MTP benefits the large buyer. The effects of the MTP on the seller are ambiguous. The high-type smaller buyer benefits from the introduction of the MTP, while the low-type smaller buyer may be excluded from the project. Under the conditions of Claim 9, the introduction of the MTP is Pareto improving. These conditions hold if the investment cost of the project is sufficiently high. Under the conditions of Claim 10, low-type small buyers are not served, and the large buyer appropriates all of the seller's and high-type small buyer's surplus.

VII The Emergence of the Minimum Transfer Payment

In this section, we investigate how the MTP might emerge. To do so, we first redefine the game and the equilibrium when the seller has a choice among n mutually exclusive projects. The transition to an n project environment enhances the realism of the model. Then, we consider the implications of our extension. We begin with:

Stage I: Nature chooses $\gamma_i \in \{\gamma_H, \gamma_L\}$, $\{\lambda^j, I^j, \{v_H^j, v_L^j\}\}_{j=1}^n$.

Stage II.a: Seller observes $\gamma_i \in \{\gamma_H, \gamma_L\}$, $\{\lambda^j, I^j, \{v_H^j, v_L^j\}\}_{j=1}^n$ and chooses $k \in \{1, \dots, n\}$, a project among n mutually exclusive projects.

Stage II.b: Large buyer observes $\gamma_i \in \{\gamma_H, \gamma_L\}$, $\lambda^k, I^k, \{v_H^k, v_L^k\}$ and decides whether to accept or reject seller's investment proposal. If the investment proposal is accepted, the large buyer chooses minimum transfer payment level.

The remaining stages are the same as before. Now, the equilibrium can be redefined by noting that the seller's optimal choice of k maximizes the seller's profits taking into account the large buyer's, small buyer's, and seller's own behavior in the following stages.

First, consider the seller's optimal choice of k when the MTP is absent. Regardless of vertical ownership, the seller's profits are given by $(\phi\gamma_H + (1 - \phi)\gamma_L)\lambda^k v^k$. Thus, the seller is indifferent to the investment cost as long as it is accepted by the large buyer.

Notice that the seller's profits are a multiple of $\lambda^k v^k$. This implies that the seller favors projects that have the highest expected revenue, and not necessarily the projects that maximize the large buyer's profits, $\lambda^j v^j + \alpha(\phi\gamma_H + (1 - \phi)\gamma_L)\lambda^j v^j - I^j$, or the projects that maximize total expected surplus, $\lambda^j v^j + (\phi\gamma_H + (1 - \phi)\gamma_L)\lambda^j v^j - I^j$. However, the set of projects that the large buyer plausibly accepts is restricted by a nonnegative profits condition for the large buyer: $\lambda^j v^j + \alpha(\phi\gamma_H + (1 - \phi)\gamma_L)\lambda^j v^j - I^j \geq 0$.

Now, consider the seller's optimal choice of k in the presence of the MTP. First, the seller's profits are strictly positive only in the pooling equilibrium. Thus, the seller prefers the pooling equilibrium to the separating equilibrium. The conditions necessary and sufficient for the pooling equilibrium depend upon whether or not (6)-(9) hold. However, these conditions do not involve λ^j or v^j , which implies that the seller cannot alter the large buyer's equilibrium selection. Nevertheless, if the conditions for the pooling equilibrium hold, the seller might increase its profits by the appro-

ropriate choice of project. The seller's profits in the pooling equilibrium are $(1-\alpha)(\phi\gamma_H+(1-\phi)\gamma_L)\lambda^k v^k$ or $(1-\alpha)((\phi\gamma_H+(1-\phi)\gamma_L)-\frac{(1-\phi)\gamma_L}{1+\phi(\frac{\gamma_H}{\gamma_L}-1)})\lambda^k v^k$.

Noting again that the seller's profits are a multiple of $\lambda^k v^k$, we see that in any pooling equilibrium the seller will choose the project with the highest expected revenue.

When conditions for the separating equilibrium hold, the seller's profits are zero and the seller is indifferent among the projects. We assume that the seller chooses a project that yields the highest profits to the large seller when the seller is indifferent among projects. These results are summarized in Claim 11, noting that large buyer's profits must be nonnegative.

CLAIM 11. If assumptions 1 and 2 hold under vertical ownership with the MTP and $n > 1$, then:

1. The seller cannot alter the equilibrium selected by the large buyer.

If we also assume:

$$\max\{\alpha(\lambda^j\phi\gamma_H v^j + \lambda^j(1-\phi)\gamma_L v^j), \lambda^j\phi\gamma_H v^j, \frac{(1-\alpha(1+\phi(\frac{\gamma_H}{\gamma_L}-1)))(1-\phi)\lambda^j\gamma_L v^j}{1+\phi(\frac{\gamma_H}{\gamma_L}-1)} + \alpha(\lambda^j\phi\gamma_H v^j + \lambda^j(1-\phi)\gamma_L v^j)\} + \lambda^j v^j \geq I^j$$

for some j , then:

2. If conditions (6) and (7) hold, or conditions (8) and (9) hold, then seller chooses the project with the highest $\lambda^j v^j$.
3. If the conditions in part 2 do not apply, then the separating equilibrium will be selected by the large buyer and the seller chooses the project that maximizes the large buyer's profits.

When the conditions in part 2 of Claim 11 hold, the seller chooses the projects with the highest risk.⁷ In this case, the large buyer may be compensated via an ownership share and the MTP penalty. In part 3 of Claim 11, the seller's profits are zero regardless of the choice of project. Thus, vertical ownership and the MTP allow the large buyer to induce the seller to choose the projects that have highest net value to the large buyer. We may conclude that the large buyer might use the MTP to induce the seller to choose the projects that the large buyer prefers, or to compensate itself for the seller's bias toward risky projects. On the other hand, vertical ownership, by itself, simply compensates the large buyer for the seller's bias toward risky projects but does not alter the seller's behavior. Notice that these results hold under risk-neutrality.

⁷In our model highest $\lambda^j v^j$ is equivalent to the highest risk level.

The seller's choice among the n projects does not change the qualitative results of Claims 7-10. This is so because in the pooling equilibrium the seller chooses the project with the highest expected revenue, with or without the MTP. In the separating equilibrium, the buyer extracts all of the seller's and high-type small buyer's surplus regardless of the seller's choice among the n projects.

VIII Discussion

An important question explored in our analysis relates to the division of the surplus among the large buyer, the seller, and the small buyer, under various combinations of the MTP and vertical ownership. We find that the large buyer always benefits from the introduction of an MTP under vertical ownership. In this case, the large buyer profits are increased due to the payments (both penalty and ownership) from the seller. The high-type small buyer might also increase its profits if the MTP level does not allow the seller to appropriate all of the small buyer's advertising revenue. However, when the MTP increases the set of projects that might be undertaken, both the seller and the high-type small buyer might benefit from the introduction of an MTP. These results, among others, are summarized in Table 1.

The introduction of vertical ownership is Pareto improving in the absence of the MTP. However, the high-type small buyer's profits might decrease with the introduction of vertical ownership under the MTP. This happens because vertical ownership induces the large buyer to act less aggressively in setting the MTP level. Thus, the seller can appropriate a greater share of the advertising revenue from the high-type small buyer.

We also found that the seller has the incentive to undertake high risk projects with high expected revenues. These projects do not necessarily maximize either the total surplus or the large buyer's profits. The seller's bias toward projects with high expected revenue might explain the escalating programming costs in the cable industry.⁸ The introduction of the MTP might induce the seller to choose the projects that are preferred by the large buyer, which suggests that the MTP has emerged as a tool to discipline the seller. When the MTP fails to alter the seller's choices, the large buyer is compensated via vertical ownership and payments from the seller. Note that these results hold under the assumption of risk-neutrality.

An important question relating to the cable industry from a regulatory perspective is the effect of vertical ownership on the provision of programming. Claims 5 and 6 imply that vertical ownership expands the set of projects that might be undertaken. Moreover, Claim 4 implies that when MTP clauses are present, vertical ownership reduces MTP levels, and thus

⁸Assuming there is a positive correlation between revenue and investment.

the large buyer has a stronger incentive to have the low-type small buyer served.

We assume that vertical ownership does not give the large buyer direct control over the seller's decisions, although the large buyer can affect the seller's choices indirectly through various market mechanisms. However, if vertical ownership does give the large buyer the power to directly circumscribe the seller's behavior, then the large buyer may use vertical ownership to achieve goals that potentially diverge from profit maximization. These goals might include various anti-competitive outcomes that vary depending on market structure, concentration, and buyer-seller specific characteristics.⁹ Importantly, if vertical ownership by a pivotal buyer is sufficient to directly control the seller's decisions, then the pooling equilibrium will result where the large buyer extracts all of the surplus from the seller and the small buyer. Thus, in this instance, the pivotal buyer does not have an incentive to exclude small buyers from programming.

The effect of the MTP on the provision of programming is ambiguous. As implied by Claim 9, the MTP increases the set of projects that might be undertaken. However, when the separating equilibrium results, the low-type small buyers are not served under the MTP.

IX Conclusion

In this paper, we constructed a model to analyze the implications of pivotal buyers, vertical ownership, and most-favored-nation clauses, using the cable industry to illustrate. Our findings suggest that without MTP clauses, the introduction of vertical ownership is Pareto improving. However, when MTP clauses are present, vertical ownership may disadvantage small buyers that highly value the seller's project. The introduction of the MTP benefits large buyers while their effects on the seller and small buyers are ambiguous.

The MTP clause and vertical ownership compensate the large buyer against the seller's incentive to undertake risky projects. Furthermore, MTP clauses might induce the seller to choose projects that are preferred by the large buyer. This suggests that MTP clauses emerge as a tool to discipline sellers. When MTP clauses fail to alter a seller's choice, the large buyer is compensated via vertical ownership and penalty payments from sellers. These results hold under the assumption of risk-neutrality.

⁹To incorporate the potentially divergent goals of large buyers, our model can be extended to a dynamic framework.

Table 1: Change in Profits

	Claim 6	Claims 1-3	Claims 7-10	Claims 4-5
From:	No MTP, No Vertical Ownership	No MTP, No Vertical Ownership	No MTP, Vertical Ownership	MTP, No Vertical Ownership
To:	No MTP, Vertical Ownership	MTP, No Vertical Ownership	MTP, Vertical Ownership	MTP, Vertical Ownership
Large Buyer	+	+	+	+, =
Seller	+, =	+, =, -	+, =, -	+, =
High-Type Small Buyer	=	+, =	+, =	=, -
Low-Type Small Buyer	=	=	=	=