The Economics of the Network-Affiliate Relationship: Comment

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In a recent issue of this Review, Stanley Besen and Ronald Soligo (hereafter, B-S) presented an ingenious graphical analysis of the economics of network-affiliate relationship in the television broadcasting industry. The purpose of this note is to correct several errors in their analysis, to “adjust” their basic diagram in a way that makes certain results much more transparent, and to demonstrate that the relaxation of one assumption invalidates one of their major conclusions.

I. The Besen-Soligo Model

We begin by describing the analysis of B-S and our extension of it. The focal point is the relationship between a network and a “representative” affiliate for the case in which the number of local stations exceeds the number of networks. In this context B-S assume that the network has monopoly power in the purchase of cleared time from the affiliate. The affiliate is viewed as supplying a service to the network, namely, the broadcasting of network programs, and the total supply of this service is referred to as cleared time. Affiliates are compensated in two ways: 1) by receiving a share of the revenue that the network collects from its sale of advertising time on network programs, and 2) by receiving a share of the total time available for commercials within each network program. (The affiliate retains all revenue from its sale of this commercial “spot time.”)

For the ith hour of programming, the affiliate can calculate that value of \( \hat{p} \) (the fraction of network advertising revenues returned to the affiliate) for which it would be indifferent between clearing the time to the network and using the time for local programming. This break-even value of \( \hat{p} \) is labeled \( \hat{p}_i \) by B-S and is given by the condition:

\[
\hat{p}_i A_i + S_i = V_i
\]

where

\[
A_i = \text{network advertising revenues for the } \text{ith hour}^1 \\
S_i = \text{affiliate advertising revenues from the sale of spot time during the } \text{ith hour} \\
V_i = \text{net revenue that could be earned by the affiliate by broadcasting local programming during the } \text{ith hour}.
\]

The B-S analysis may be clarified somewhat if we assume that the network and affiliate can sell commercial time on a given program for the same price\(^2\) and if we let \( \beta_i \) denote the ratio of spot time to network advertising time during the ith hour. We may then write

\[
A_i = T_i/(1 + \beta_i) \\
S_i = \beta_i T_i/(1 + \beta_i)
\]

where \( T_i = \) the total value of advertising time on the ith hour of network programming. If we further assume, as in fact appears to be the case,\(^3\) that \( \beta_i \) does not vary from hour to hour, then equation (1) may be rewritten as

\[
\hat{p}_i = (1 + \beta) V_i/T_i - \beta
\]

where \( \beta \) denotes the common value of the \( \beta_i \).

The heart of the B-S analysis is the affiliate’s supply curve of cleared time. To construct this curve, array program hours in order of increasing \( \hat{p}_i \) or, equivalently, in order of increasing \( V_i/T_i \). The supply curve

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1 This is not total network advertising receipts but only that portion attributable to the region serviced by the particular affiliate.
2 Notice that both affiliate and network are selling what is inherently the same commodity, e.g., a “New York, Gunsmoke, viewer minute.”
3 See Roger Noll, Merton Peck, and John McGowan, p. 61.
is then obtained as the curve described by the coordinate pairs \( \sum_{j=1}^{n} A_j, \hat{p}_j \). This supply curve relates the quantity of cleared time supplied (measured in terms of the associated value of network advertising) to the revenue-share \( \rho \) set by the network.

Such a supply curve is illustrated by the curve BC in Figure 1. If the network should set \( \rho_0 \), for example, the affiliate would clear all hours to the left of \( A_0 \) since \( \rho_0 \) exceeds the break-even \( \hat{p}_i \) for each of these hours. In such circumstances B-S point out that the network's share of advertising revenues would be area II and the affiliate's share would be the sum of areas \( I_a \) and \( I_b \).

They also point out that the net profit or quasi rent to the station from network affiliation is given by the sum of areas \( I_a \) and III. Although this last observation is correct, it can be made much more transparent by adding a horizontal line to their diagram at a distance \( \beta \) below the horizontal axis. Regarding this line \( \beta W \) as the new horizontal axis, we may interpret the area under the supply curve and to the left of \( A_0 \) as the opportunity cost to the affiliate of supplying \( A_0 \) of cleared time. This can be seen as follows. The \( i \)th hour accounts for network advertising revenues equal to \( A_i \) or, in Figure 1, for that portion of the horizontal axis corresponding to the width of rectangle FR. Since the height of this rectangle from T to R is equal to \( \beta \) or \( S_i/A_i \), and since the width is equal to \( A_i \), the area from T to R must be equal to \( S_i \).

Recalling equation (1), to break even on this hour \( \hat{p}_i, A_i \) (the area of the rectangle from J to T) plus \( S_i \) (the area from T to R) must be equal to \( V_i \). Thus, by construction, the area from J to R must be \( V_i \), the opportunity cost to the affiliate of clearing the \( i \)th hour. Summing over the total amount of cleared time \( A_o \), we obtain the area under BC and above the new axis \( \beta W \) as the total opportunity cost. It should now be clear that the total revenue received by the affiliate from its share of network advertising and from its sale of spot time (the area of rectangle \( \beta \rho_0 M W \)) exceeds the total opportunity cost by the sum of areas \( I_a \) and \( III \) (the affiliate's quasi rent).

The addition of the \( \beta W \) line would have enabled B-S to avoid an error of interpretation. On page 263 they refer to the area under the supply curve and above \( \text{their} \) axis \( OA_0 \) (comparable to area \( I_b \) in Figure 1) as the profits on hours to the right of X that "the station would earn if it were an independent station." This is clearly in error since it understates the true opportunity cost by an amount equal to the value of the spot time for these hours.

II. The Nondiscriminating Monopsonist Solution

The B-S solution to the network profit-maximization problem is reproduced in Figure 2. They assume that the marginal cost of supplying an additional program to the affiliate is zero. Thus profits are maximized when the curve marginal to the supply curve intersects the horizontal line at \( \rho = 1 \). This point is characterized by the fact that the marginal revenue product to the network of the last program hour is equal to the zero marginal cost of programming. The network maximizes profits, therefore, by setting a revenue-share price equal to \( \rho_a \) and by purchasing \( A_e \) of cleared time from the affiliate.

There appear to be two errors in this
analysis. First, B-S argue that the curve "marginal to" $BC$ is given by $XD$:

The curve $XD$ does not extend below the horizontal axis because the network will have programs of value $OX$ cleared even if $p=0$. If the network were permitted to make $p$ negative, i.e., to charge the affiliate for a cleared program, the curve marginal to the supply curve would begin at $B$. [p. 262, fn. 8]

The fact that negative $p$ values are not allowed, however, has nothing to do with where the marginal curve begins. The correct marginal curve is essentially the same as the marginal outlay curve of a monopsonist confronting a factor supply curve subject to a minimum factor price constraint. In Figure 2 the correct curve coincides with the horizontal axis from $O$ to $X$, skips discontinuously from $X$ to $H$, and coincides with the dashed curve $HD'$ thereafter. If negative $p$ were allowed, $HD'$ would extend leftward to point $B$. This, of course, does not alter the fact that the correct marginal curve must "pass through" point $H$ in either circumstance.

The second deficiency in the B-S analysis involves the assumption (pp. 260, 262) that all network programming costs are fixed and that the marginal cost of supplying an additional hour of existing programming is therefore zero. There are at least two problems with the assumption of zero marginal programming costs.

First, according to B-S, Figure 2 depicts a representative affiliate. Presumably, therefore, we can regard all affiliates as reaching an equilibrium relationship with the network characterized by the intersection of the marginal curve and the horizontal line at $p=1$ (where marginal programming costs are zero). But this implies that the network overinvested in programming. That is, if the marginal revenue product to the network of the last hour cleared by a representative affiliate (and thus by all affiliates) is to be zero, then the network would have been better off had it not invested in that last hour of programming.

The second problem with the assumption of zero marginal programming costs is that it is conceptually misleading. Zero marginal programming costs imply fixed programming costs during the period in which the network sets its pricing policy concerning affiliates. However, at repeated intervals the network must enter into agreements to purchase programs. At such times the network must answer questions of the sort, "How much is program __________ worth?" The answers to such questions are, of course, dependent upon the particular pricing policy that the network will be able to employ vis-à-vis its affiliates. The network must, therefore, determine its optimal pricing policy toward affiliates interdependently with the determination of its demand for programs.

We would argue, therefore, that the actual solution of the network pricing problem would be made at the time that programs are purchased and would involve setting a revenue sharing price for affiliates such that the marginal revenue product to the network of the last hour is equal to the nonzero cost of purchasing that hour of programs. Since, as Noll, Peck, and McGowen indicate (p. 66), the cost of programs may amount to 30 percent of total network advertising revenue, the difference between this solution and that of B-S may be substantial.

One further aspect of the nondiscriminating monopsonist solution should be men-
tioned. While B-S admit that the proportion \( \beta \) of commercial time given to an affiliate is an important dimension of the affiliation agreement (p. 259), they assume, presumably for purposes of simplicity, that this proportion is fixed and not subject to change by the network (p. 260). While, as we shall see, this assumption has no appreciable effect upon the nondiscriminating monopsonist solution, it does have a rather significant effect if the network can discriminate. Turning first to the nondiscriminating case, we observe that equation (2) can be rewritten as

\[
\frac{\hat{p}_i + \beta}{1 + \beta} = \frac{V_i}{T_i}
\]

This means that if the network were to set any \( \hat{p}, \beta \) combination satisfying

\[
\frac{\hat{p} + \beta}{1 + \beta} = \frac{V_i'}{T_i'}
\]

a total of \( t' \) hours of cleared time would be supplied by the affiliate. Thus \( \gamma = (\hat{p} + \beta) / (1 + \beta) \) can be regarded as the parameter which determines the supply of cleared time and the supply function can be written

\[
t = f(\gamma)
\]

where \( t \equiv \) supply of cleared time (demand for network programming) by affiliate measured in hours. The network profit maximization problem thus becomes

\[
\max \pi = \sum_{i=1}^{I} [(1 - \hat{p}) A_i - C_i]
\]

where \( C_i \equiv \) the cost to the network of obtaining the \( i \)th hour of programming.\(^4\)

Substituting for \( A_i \) yields

\[
\pi = \sum_{i=1}^{I} [T_i(1 - \hat{p}) / (1 + \beta) - C_i]
\]

\[
= \sum_{i=1}^{I} [T_i(1 - \gamma) - C_i]
\]

The network problem of selecting \( \hat{p} \) and \( \beta \) so as to maximize profit thus reduces to one of selecting \( \gamma \). Denoting this profit maximizing \( \gamma \) by \( \gamma^* \) it follows that the network would be indifferent among all \( \hat{p}, \beta \) combinations which satisfy

\[
\frac{\hat{p} + \beta}{1 + \beta} = \gamma^*
\]

Since all such pricing policies have already been shown to entail the same supply of cleared time, the ability to set \( \beta \) adds nothing of interest to the solution. Given an arbitrary \( \beta \) the network would do just as well by simply solving equation (3) for the associated \( \hat{p} \); the total supply of cleared time, network profit, and affiliate profit would remain invariant under all such solutions.

III. The Discriminating Monopsonist Solution

B-S show that the ability of the network to discriminate, i.e., to extract portions of the quasi rents that accrue to affiliates, hinges upon the use of two devices: 1) uncompensated time, a two-part pricing scheme in which the network sets a zero price for an initial number of hours cleared and a positive price for all subsequent hours; and 2) option time, a scheme in which affiliates are required to clear a certain minimum number of hours in order to maintain their affiliation.

Using graphical analysis they argue that while the use of uncompensated time allows the network to capture a portion of the quasi rent, it is necessary for the network also to use option time if it wishes to extract all rents. Referring to the Federal Communications Commission ban on the use of option time B-S conclude: “The bar against option time, if it is effective, may result in some quasi rents being retained by the affiliate” (p. 265). As support for this conclusion, they go on to cite the empirical finding that network affiliates are more profitable than independents when other determinants of profitability are taken into account.

The B-S argument can be seen by reference to Figure 3. Here point \( \hat{A} \) is chosen so that area \( I \) is equal to area \( II \). Suppose now that the network wants to buy \( \hat{A}^* \) of cleared
time from the affiliate. By setting \( p \) equal to zero for the first \( A \) of cleared time and by setting \( p \) equal to \( p^* \) for all subsequent hours the network would render the affiliate indifferent between clearing \( X \) hours and \( A^* \) hours. Thus the network would capture the quasi rents on all hours to the right of \( X\). As B-S point out, however, quasi rents equal to area \( III \) still accrue to the affiliate. The network, moreover, is apparently unable to capture this remaining rent since increasing the amount of uncompensated time would induce the affiliate to clear only \( X \) hours and since reducing \( p \) below \( p^* \) on subsequent hours would also induce the affiliate to clear less than \( A^* \) hours. These considerations are the basis for the B-S conclusion that the use of option time is necessary to capture the remaining quasi rent.

We find this conclusion to be unwarranted, however, since it depends crucially upon the simplifying assumption that the network cannot control \( \beta \). If the network can in fact determine \( \beta \) then it can extract all the quasi rent with the use of uncompensated time alone. This is done by reducing the value of \( \beta \). Such reductions in \( \beta \) shift the affiliate supply curve in such a way that point \( X \) moves leftward. By continuing until point \( X \) coincides with the origin, the network can eliminate area \( III \) entirely. It can then determine \( A \) so that quasi rents on all hours are captured by the network. More precisely, by setting

\[
\beta^* = \frac{V_1}{T_1 - V_1} > 0
\]

it follows from equation (2) that

\[
\rho_1 = (1 + \beta^*) \frac{V_1}{T_1} - \beta^* = 0
\]

This choice of \( \beta \) thus produces an affiliate supply curve which intersects the horizontal axis at the origin. Now suppose that the network wishes to clear \( t^* \) of programs measured in hours. This requires that the network set

\[
p^* = (1 + \beta^*) \frac{V_{t^*}}{T_{t^*}} - \beta^*
\]

By then selecting that number of uncompensated hours which equates the quasi rent on subsequent hours to the losses on the uncompensated hours, the network can capture all quasi rent without recourse to option time.

REFERENCES
