THE VALUE OF TELEVISION TIME AND
THE PROSPECTS FOR NEW STATIONS

PREPARED FOR THE JOHN AND MARY R. MARKLE FOUNDATION

STANLEY M. BESEN

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PREFACE

This Report is one of a series dealing with television broadcasting as part of Rand's Communications Policy Program. The Federal Communication Commission has allocated large portions of the radio frequency spectrum to television in an effort to provide most viewers with a wide range of programming choices, but many such allocations remain unused. This suggests that new stations operating on these channels would be unprofitable. If the range of viewing choice is to be expanded, therefore, additional policies may be necessary to improve the prospects for new stations.

A number of attempts have been made in the past to analyze the factors that determine station profits. One of these purports to show, contrary to widely held belief, that television stations operating in the Ultra High Frequency band do not face a handicap in attaining profitability. Were this finding sustained, past policies that focused on the elimination of the handicap would have been misdirected. However, the present study demonstrates that the handicap is indeed significant. The study analyzes the determinants of the prices that stations charge for the use of their time and extends our understanding of the determinants of station profits. It thereby contributes to an evaluation of alternative policies aimed at increasing the number of television stations.

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SUMMARY

This study provides evidence about the likely effectiveness of policies aimed at increasing the number of television stations in the United States. Since it has been widely observed that stations operating in the Ultra High Frequency (UHF) band are less profitable than those operating on Very High Frequency (VHF), most policies that have been proposed or pursued to increase the number of stations have concentrated on eliminating or reducing the UHF "handicap," which is alleged to stem primarily from the inferior transmission properties of UHF. However, a recent study of the profits of stations failed to find a significant relationship between whether a station operated on VHF or UHF and its level of profits when other factors believed to affect profits were held constant. Thus, a question arises as to whether it is a statistical artifact that UHF stations are less profitable than VHF stations or whether there really is a UHF handicap that affects station profitability. If, for example, UHF stations are located primarily in markets with small potential audiences or many competing stations, the elimination of the UHF handicap may have a limited effect on the prospects for these stations. However, the present study demonstrates that a substantial UHF handicap does exist. It assesses some of the factors affecting station profits and evaluates a number of policies for improving the prospects for new stations.

The basic service that television stations have to sell is the use of their time. Stations may produce or purchase programs and sell advertising time on them, or they may sell the use of their time to others in return either for a share of advertising revenues or for a fixed price. The price fixed by the station provides a direct measure of the value of time to the station. This study analyzes the value of the time of commercial television stations in the United States by examining the determinants of the prices quoted for the use of station time. These data are obtained from trade sources, and the analysis is carried out for stations in all major markets.

The empirical results indicate that the value of the time of a station is determined by the number of homes with television sets in
its market, by the number of stations with which it competes, and by the characteristics of the station and its competitors. These characteristics include whether a station is operating on VHF or UHF and whether it is affiliated with one of the major networks. The value of station time is greatest for network-affiliated VHF stations, followed by network-affiliated UHF stations, by independent VHF stations, and by independent UHF stations. The value of a station's time is greater when it competes with independent stations or with UHF stations than if it competes with network affiliates or VHF stations. Further, the results suggest that the aggregate value of the time of all stations in a market depends only upon the number of homes in the market and on the number of stations. The loss to one station as a result of the UHF handicap, for example, is completely captured by its competitors.

The results of the analysis of the determinants of the value of time are then used to analyze the effects of policies to improve the prospects for new stations. Since in all major markets a new station would be forced to operate on UHF, and, in the absence of the formation of a fourth television network, without network affiliation a new station would face significant handicaps. For example, in Memphis, Tennessee, a medium size market with three existing network affiliates all operating on VHF, a new independent UHF station would have a value of prime time of about $158 per hour. For each of the network affiliates the value is $1422. Since there are currently several unoccupied UHF channels assigned to Memphis, a new station with a value of an hour of prime time of $158 would not be profitable.

Policies designed to eliminate the UHF handicap would substantially raise the value of time for new stations and improve their prospects. If an additional VHF allocation were created for Memphis, the hourly rate of a new independent station would rise to $503. But even if the UHF handicap were completely eliminated, there may still be a substantial barrier to emergence of new stations, if they do not have a fourth network with which to affiliate. However, the elimination of the UHF handicap, either by creating new VHF assignments or by shifting all stations in a market to UHF operation, may enhance the prospects for the formation of new networks and improve the prospects for new stations as well.
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I. INTRODUCTION

For many years, the Federal Communications Commission has attempted to increase the number of television stations in the United States in order to expand the range of choice available to viewers. Within the constraint imposed by the requirement that television stations serve local communities, the Commission has sought, in various ways, to improve the prospects for new stations. The policies pursued or considered have included limitations on the development of cable television as a potential competitor to local broadcasting, the promotion of legislation to require that all television receivers be capable of receiving UHF television, and various attempts to change the frequency allocation plan to reduce the handicap that new stations would face.¹

All VHF allocations to commercial television in the 100 largest television markets are currently occupied, so new stations must operate in the UHF band. In the absence of the formation of a fourth television network, almost all new stations would be forced to operate without benefit of network affiliation.² But only six of the 48 independent UHF stations, or 12.5 percent, reported profits in 1971; 83.4 percent of network-affiliated VHF stations, 40.6 of network-affiliated UHF stations, and 45.2 percent of independent VHF stations reported profits.³

¹In 1952, the Commission rejected a plan to organize the television broadcasting industry as a system of powerful regional stations and chose instead to rely on a system of local stations. The adoption of the former concept would have resulted in most viewers having access to a larger number of stations than they do currently. But the Commission felt that it was more important that stations be media of local expression. Whatever the merits of the regional station system, the idea that stations be local in nature is embedded in the structure of the television industry, and this report does not consider the effects of adopting the regional station plan.

²See "The Economics of the TV-CATV Interface," Staff Report to the Federal Communications Commission, Washington, D.C., July 15, 1970, pp. 7-9. The data cited there are as of May 1970 but the situation has not changed.

³Federal Communications Commission, 38th Annual Report/Fiscal Year 1972, Number of Television Stations Reporting Profit or Loss by Amount of Profit or Loss, 1971, p. 181.
Unless factors other than the lack of a network affiliation and the inability to obtain a VHF allocation account for the below average profitability of independent UHF stations, their prospects are not bright. Policies designed to eliminate the UHF handicap and to improve the likelihood of the formation of new networks can improve the prospects for new stations.

Data on profitability for broad groupings of stations do not necessarily indicate that the factors used for aggregation, in this case network affiliate vs. independent and VHF vs. UHF, "explain" variations in station profits. When other determinants of station profits are taken into account, the effects of these factors may disappear. Indeed, a recent study of the profitability of individual stations failed to find a significant difference between the profits of UHF and VHF stations.\footnote{E. Greenberg, "Television Station Profitability and FCC Regulatory Policy," *Journal of Industrial Economics*, July 1969, pp. 210-238.} If this finding is sustained, then policies designed to deal with an apparent UHF handicap will not be effective in increasing the number of television stations.

**THE SALE OF TELEVISION TIME**

That television stations are frequently observed as sellers of advertising time and purchasers of programming should not obscure the fact that the basic service a station sells is the use of its time. In commercial broadcasting, station time is combined with creative talent, technical personnel, studio facilities, and management to attract the attention of viewers who are then exposed to advertising messages. The revenue obtained from the sale of these messages compensates stations for the use of their time and covers other costs.

Stations may engage in program production, program acquisition, and the sale of advertising messages or they may leave some or all of these activities to others. At one extreme, a station may engage in both program production and the sale of advertising spots interspersed within and adjacent to the program. The most common instance of this is the production of local news programming. When a station produces its own program its compensation consists of the difference between
advertising revenues and program production costs. Here, television
time and the program are sold jointly.

A second way for a station to sell its time is in conjunction with
a program produced by a specialist in program production. The sale of
programs in this way is referred to as syndication. Syndicated programs
may be newly produced for television, feature films previously distri-
buted in theaters, or programs previously shown on network television.
The sale of a program not previously shown on television is known as
first-run syndication. Where the program has already been aired by a
network the process is called off-network syndication. When syndicated
programming is used, the station’s compensation consists of the dif-
ference between advertising revenues and the price paid for the program.
Again, the sale of station time occurs jointly with the sale of pro-
gramming. ¹

The third and most common way for network affiliates to sell their
time is to accept network programming in return for a share of the ad-
vertising revenues. The typical arrangement is for the station to
retain all of the advertising revenues from the sale of spots adjacent
to the program and to share in revenues from the sale of spots with the
program once some minimum number of hours of network programming has
been accepted. ² The station may prefer to use network programming
rather than to acquire programming in the syndication market or to
engage in program production itself because it avoids the cost of pro-
gram acquisition and because spots are likely to be substantially more
valuable when they are adjacent to a network program. The compensation
to the station for the use of its time consists of its share of advert-
ising revenues.

The acceptance of a network program in return for a share of adver-
tising revenue is a "pure" time sale with the network as buyer. The

¹ Another way of selling station time is through the "barter" method.
Under this arrangement, an advertiser supplies a program in return for
the right to some of the advertising spots within the program. The
station's compensation is derived from the sale of other spots.

² This arrangement is described in detail in S. M. Besen and R.
Soligo, "The Economics of the Network-Affiliate Relationship in the
p. 259-268.
station does nothing other than make its time available and plays no role in the production or acquisition of programming or in the sale of advertising. The payment it receives from the network is for the use of station time and need not be shared with station employees or program suppliers.

When the station produces or acquires a program, advertisers purchase the use of both station time and the program the station has obtained to fill that time. Part of the payment received from advertisers is used to compensate the producers of the program. The payment for time is a residual after the cost of acquiring the program is deducted from advertising revenues.

It is difficult to measure precisely what networks pay their affiliates for an hour of their time because of the relatively complicated way in which stations are compensated. Furthermore, there are no data showing what networks pay independent stations for the relatively infrequent occasions on which independents carry network programs when affiliates decline to do so. There is, however, an alternative source of data to measure the value of station time directly. All stations, whether affiliated with a network or not, quote prices for pure time sales. These sales can be either to advertisers or to program suppliers. In the former case, the advertiser purchases a program within which to advertise his product. In the latter, the supplier arranges for the sale of advertising on his program. When pure time sales are made, the purchaser is billed for any additional costs the station incurs so that the program rates, as the prices charged for these time sales are called, represent the net compensation received by the station.

Presumably, a station will accept no less compensation for a pure time sale than it would if it took a network program, purchased a program in the syndication market, or produced its own program. The program rate is a measure of the value of a station's time in its best alternative use.

POLICIES TO IMPROVE THE PROSPECTS FOR NEW TELEVISION STATIONS

In its Sixth Report and Order, in 1952, the Federal Communications Commission established the structure for the television broadcasting
industry that still prevails. The Report and Order explicitly rejected a proposal by the now defunct Dumont Television Network, which would have established a system of a relatively small number of powerful regional stations to serve wide areas. Although such a system would produce a large number of choices to most viewers, the Commission argued that it was more important that stations serve local communities than that the number of viewing alternatives be maximized. Consequently, the plan that was adopted called for more than 1700 commercial television station assignments. To make such a large number of stations available the Commission was forced to increase the portion of the radio frequency spectrum assigned to television. It did so by creating 70 channels in the Ultra High Frequency (UHF) band; previously all television stations had operated in the Very High Frequency (VHF) portion of the spectrum. Approximately 1200 of the 1700 station assignments were on UHF.

Because two television stations operating on the same or adjacent channels are potential sources of interference to each other, the Commission adopted a set of "separation standards" designed to minimize this problem. In so doing it was forced to decide which cities would obtain which channels and how many stations each city would obtain. An important consideration was that as many cities as possible have at least one television station, but the plan called for large cities to receive more stations than small cities.

A final aspect of the Sixth Report and Order was that the frequency allocation plan called for both VHF and UHF stations to be assigned in the same city. In the jargon of the industry there were to be many such "intermixed" markets.

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2 A channel is a particular portion of the radio frequency spectrum. More than one station can occupy the same channel so long as they are separated in time or space.

3 For example, separations between two stations operating on the same channel were set at approximately 170 miles in the Northeast, 220 miles in the Gulf region, and 190 miles elsewhere.

4 The important features of the Sixth Report and Order are discussed in H. J. Levin, The Invisible Resource, The Johns Hopkins Press, Baltimore,
By 1954, 121 commercial UHF stations were on the air and hopes for UHF television were high. But by the end of the decade, with the number of such stations reduced to 76, the FCC was able to say in its Annual Report that "one of the most perplexing questions still facing the Commission is...how to get at least three or four signals into every home."¹

The source of the Commission's difficulties lay in its own Sixth Report and Order. The Dumont proposal for powerful regional stations would have made it possible for almost all viewers to receive at least four VHF signals. In rejecting the plan in favor of a system based on local stations, the Commission reduced the number of VHF signals many viewers could receive. To increase the number of viewing choices available, therefore, the FCC was forced to open up the UHF band to television. But a relatively small percentage of homes had receivers capable of UHF reception and UHF stations faced a severe handicap as a result. Most viewers could receive some television over VHF and had only a limited incentive to purchase an all-channel (VHF-UHF) receiver or to convert their existing set for UHF reception. Fewer than 10 percent of all television sets at the end of the 1950s were capable of UHF reception.

UHF stations also faced reception problems. In certain geographical areas, the quality of UHF reception was worse than that of VHF. These stations attracted small audiences, which limited their ability to compete for programming, further limiting public incentive to acquire all-channel receivers. Not surprisingly, UHF stations were largely unprofitable and many went out of business.

Confronted with the difficulties that UHF stations faced, but still desiring to expand the range of choice open to viewers, the Commission considered a variety of solutions.² The first proposal was to create

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additional VHF assignments of television by relaxing the channel separation standards. The policy was called "short-spacing," since it would have reduced the permitted distances between stations operating on the same or adjacent channels. It was rejected by the Commission in 1961, largely because other stations claimed that excessive interference would result.  

A second proposal would have reduced the handicaps of new stations by shifting all stations in some markets to UHF. It was believed that if UHF stations faced only other UHF stations in competition they would not face any competitive disadvantage. Viewers in these markets would, of course, be forced to purchase all-channel receivers, and all stations would be placed on an equal footing. This policy, called de-intermixture because it would have eliminated some intermixed (VHF-UHF) markets, was initially proposed as an experiment for a few markets; but the experiment was not ever carried out for all of these. The policy was dropped in 1962 because of opposition from stations that would have lost VHF assignments.

Finally, the Commission supported passage of legislation to require that all television receivers sold in the United States be capable of UHF reception. The passage of such legislation would eventually eliminate an important source of the UHF handicap—that many households did not possess the equipment required to receive UHF signals. The All-Channel Receiver Law, which took effect in 1964, has been largely responsible for an increase in UHF receiver penetration from less than 10 percent in 1962 to over 80 percent today. Over the same period, the number of UHF stations has increased from 76 to more than 180. But UHF stations operating without network affiliation are still almost

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1 There is a request to the FCC now pending by the Washington, D.C. educational station, which operates on UHF, to shift to VHF on an experimental basis. The station would operate on Channel 12, and there have already been complaints from several other stations operating on Channel 12 as well as from stations in Baltimore operating on Channels 11 and 13. They claim that their signals would be interfered with if the "drop-in" were permitted. See Broadcasting, August 14, 1972, pp. 48-49 and November 6, 1972, pp. 41-42.

2 A detailed discussion of this legislation and its effects is found in Webbink, "The Impact of UHF Promotion."
all unprofitable, and more than half of all network-affiliated UHF stations fail to make a profit.\footnote{See Federal Communications Commission, 38th Annual Report/Fiscal Year 1972, p. 181.} One interpretation of the failure of the high penetration of all-channel receivers to place UHF stations on a par with VHF stations is that there are other factors making UHF unprofitable than simply that they operate on UHF.\footnote{Another interpretation is that because of tuning and reception differences, UHF stations will still be handicapped even if all sets can receive UHF. In an attempt to deal with tuning differences the FCC will require in the near future that all receivers have "comparable" tuning capability for VHF and UHF channels. The practical effect of this requirement is that UHF tuners will be of the "click" type rather than continuous as they are at present. See 37th Annual Report/Fiscal Year 1971, Federal Communications Commission, p. 37.}

If the All-Channel Receiver Law cannot increase the number of programming alternatives to viewers, then policies such as de-intermixture and short-spacing may have to be reconsidered. The evidence on the determinants of the value of television time developed in this report will be useful in determining the effectiveness of these policies. The concluding section of this study presents estimates of the effects on program rates of de-intermixture and short-spacing, as well as of the formation of the fourth network, for a typical market.
II. A MODEL OF THE VALUE OF TELEVISION TIME

THEORY

Television station revenues are obtained by combining station time and other inputs to produce programs that attract viewers who are then exposed to advertising messages. These other inputs consist of creative talent—writers, directors, actors, singers, and so on—and technical personnel—cameramen, engineers, and so on. The program is an intermediate good necessary to the production of what the station actually sells, viewer exposures, the showing of, say, one minute of advertising to one viewer. 1

I hypothesize that increasing expenditures on programming inputs will increase the quality of a program and thereby increase the number of viewers watching the station. If the number of minutes of advertising per hour is assumed as given, the number of viewer exposures can be expanded only by increasing audience size. Beyond some point, attracting additional viewers by improving program quality will become increasingly difficult, and the cost of attracting an additional viewer will rise. The station will continue to increase expenditures on programming until the point at which the cost of producing an additional viewer exposure is just equal to the extra revenue it receives for such exposures. For each unit of time a station earns a return equal to the difference between its total revenue (the price per viewer exposure times the number of exposures produced) and the costs incurred during that time. A station's profit is equal to its returns from all units of time minus any costs that are independent of how it fills its time—for example, the cost of its transmitting facility.

If a station produces a program itself, the expenditures it incurs and the number of viewer exposures it produces and sells depend on the price at which exposures can be sold and on the cost of producing exposures. The higher the price at which exposures can be sold and the

1The number of minutes of advertising per hour is within the control of the station and the number is different for different parts of the day. However, to introduce this variable would needlessly complicate the analysis.
lower the cost of producing them, the larger will be the number of exposures produced and the greater will be the return to the station from the use of its time.

If the local advertising market is competitive, in the sense that an individual station has no influence on the price of viewer exposures and can sell all the exposures it produces at the going price, each station will increase programming expenditures until the extra cost of producing an exposure equals the price of such exposures. An increase in the number of stations in a market will, by increasing the number of exposures, reduce the price of an exposure. The cost of producing exposures will rise because a given expenditure on programming will attract a smaller number of viewers. The lower price per exposure and the increased cost of producing them will reduce the number of exposures produced. The increase in the number of competing stations will, therefore, reduce the profit of existing stations.

Even if the local advertising market is not perfectly competitive, increasing the number of stations should still reduce the profit of existing stations. The ability of television stations to charge more than the competitive price for a viewer exposure is likely to depend on the number of stations in the market. The fewer the number of stations the higher the price. If that is the case, the return to existing stations from the use of their time will decline as new stations enter.

At the other extreme, advertisers might be indifferent between viewer exposures produced in different markets. Since about 80 percent of all television advertising is done by national or regional advertisers this is not an altogether unreasonable assumption. Nothing that any individual station does affects the price of a viewer exposure in its market. However, an increase in the number of stations in a market will reduce the return to the use of existing station time since the cost of producing an additional viewer exposure will rise.

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1 Even when network sales are excluded, the figure is about 60 percent. Federal Communications Commission, 38th Annual Report/Fiscal Year 1972, Broadcast Financial Data of Three National Television Networks and 688 Stations, 1971, p. 177.
What each of the above models suggests is that the number of stations in a market is one of the determinants of the value of station time. A second determinant is, of course, the number of viewers in the station's market. The larger the potential audience a station faces, the greater the value of its time should be, since a given expenditure on programming will attract a larger number of viewers in a larger market.

To this point I have proceeded as if all stations have equal access to audiences and identical costs, but that is not likely to be the case. One factor that may limit the ability of a station to reach audiences and therefore raise its cost of producing viewer exposures is the UHF handicap. This handicap may stem from the still incomplete penetration of all-channel receivers, from poor transmission properties of UHF, or from the absence of click tuning. Whatever the source, if there is a UHF handicap, UHF stations would have higher costs and a lower value of station time than otherwise identical VHF stations. By the same token stations that have UHF competitors should have a higher value of time.

The UHF handicap has been called into question by Greenberg, who found that, when other factors affecting station profitability were accounted for, no independent effect could be found for variables that measured whether a station or its competitors operated on UHF. This result is especially surprising since Greenberg's data are for the early 1960s when most homes did not have UHF receivers. There is, however, a plausible explanation for his findings. Greenberg used data on the number of homes with television sets "within a station's broadcast area" as one of his explanatory variables. Two stations located in the same market need not have the same value of this variable since, if a station has a sufficiently small audience in a county, the homes in that county are not included in that station's broadcast area. UHF stations were likely to have quite small audiences in many counties because of the limited number of all-channel receivers, so that their broadcast areas contained fewer homes than VHF stations in the same

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1 Greenberg, "Television Station Profitability."
markets. The variable used by Greenberg to measure a station's market size may entirely capture the effect of the UHF handicap, so no independent effect can be found for a variable that specifies whether the station operates on VHF or UHF.\(^1\) By contrast, in this study the potential audience is assumed to be the same for all stations in a given market and differences in the ability of VHF and UHF stations to capture audiences is measured directly.\(^2\)

A final factor that should affect the value of a station's time is whether it is affiliated with a national network or is an independent station. Stations that are members of networks gain the advantage of having their programming costs spread over a large number of stations. The cost of producing a viewer exposure is likely to be smaller for these stations than for independents. Although the syndication market serves somewhat the same purpose for independent stations, the higher transactions costs of engaging in station-by-station sales make this market an inferior substitute for networking, and the cost of producing viewer exposures should be smaller for network affiliates than for independents. However, since they share in the advertising revenues of their affiliates, it is possible for the networks to capture all of the cost reductions that result from the existence of the network, leaving the value of station time for affiliates no greater than that for independents. Nevertheless, Greenberg found that profits were greater for affiliates than for independents, and I shall also test the hypothesis that the value of station time is greater for affiliates than for independents.

**MODEL SPECIFICATION**

The model used in this study is simple, yet it captures all the principal aspects of the above discussion. First, the model makes a

\(^1\)Paradoxically, as all-channel receivers achieve universal use and the homes in UHF stations' broadcast areas increase, the UHF handicap, as measured by Greenberg, can also increase.

\(^2\)Another way to put the difference is that Greenberg's measure of audience size is not an exogenous variable but rather a variable that is jointly dependent with station profits. Both are determined by the potential audience a station can reach and by the characteristics of the station and its competitors.
station's program rate depend on the number of potential viewers in its market and on the number of competing stations it faces. Second, the model allows for differences in the factors that affect a station's costs, whether it has a network affiliation and whether it operates on VHF or UHF. Finally, the model allows for differences in the nature as well as the number of competitors a station faces.

The larger the potential audience a station can reach the greater is the value of its time, since it will attract a larger audience for any quantity of programming inputs. If all stations in a market have access to the same programming sources and have the same transmission and reception characteristics, the value of time should be the same on all of them. If RATE is the asking price for an hour of a station's time, N the number of stations in a market, and TVH the number of homes with television sets in the market,

\[ \text{RATE} = a_0 + a_1(\text{TVH}/N). \tag{1} \]

If \( a_0 = 0 \) and \( a_1 = 0.75 \), in a three-station market with 1000 homes the rate of each station would be $250.

Suppose now that one of the stations broadcasts over UHF. If the reduction in RATE a television station experiences as a result of being forced to operate on UHF does not affect the RATE of its competitors,

\[ \text{RATE} = a_0 + a_1(\text{TVH}/N) + a_2(\text{TVH}/N)(\text{UHF}), \tag{2} \]

where UHF is a variable taking the value 1 if a station is UHF and zero otherwise. According to this equation, the effect of broadcasting on UHF varies according to the RATE a station would have received had it had no handicap. The RATE for a UHF station is smaller than that of a VHF station in the same market by the amount \( a_2(\text{TVH}/N) \) since \( a_2 \) is expected to be negative. If \( a_2 = -0.15 \), the rate of $250 would decline to $200, for a UHF station in the example above.

Suppose instead that other stations benefit from the UHF handicap of their competitors. I hypothesize that a portion of the loss caused
by the handicap of the UHF station is "captured" by its competitors and is divided equally among them. For example if there are three stations in a market, one of them broadcasts on UHF, and \( c_1 \) is the proportion of the UHF station's loss that is captured by others, then each of the two VHF stations experiences an increase in rate equal to \((1/2)a_2 c_1(TVH/N)\). If, in another case, there are two UHF stations in the market, the lone VHF station receives one-half of the amount captured, or \( a_2 c_1(TVH/N) \), and each of the UHF stations receives one-fourth, \( 1/2 a_2 c_1(TVH/N) \), since it obtains half of the proportion of the other UHF station's loss that is captured. This leads to the following general estimating equation:

\[
\text{RATE} = a_0 + a_1(TVH/N) + a_2(TVH/N)(UHF) + a_3 \left[ (TVH/N) \left( \frac{NUHF-UHF}{N-1} \right) \right]
\]

(3)

where \( NUHF \) is the number of UHF stations in the market and \( a_3 = -a_2 c_1 > 0 \). The gain to a station from having one of its competitors a UHF station is its share of the captured loss. Since the loss is shared equally, a station gains \((1/(N-1))\) times the amount captured if it has a UHF competitor. Each VHF station competes with \( NUHF \) Ultra High Frequency stations while each UHF station competes with \( NUHF-1 \) such stations. If \( a_3 = 0.12 \) in a market with one UHF station, two VHF stations, and 1000 homes, the rate for each of the VHF stations is $270 and that of the UHF station is $200. In the previous example, the VHF rate was $250.

A particularly important hypothesis to test is that \( a_2 = -a_3 \); for if they are equal the reduction in return a station experiences as a result of broadcasting over UHF is matched by an equal gain to its competitors. If so, and a policy of de-intermixture were pursued with VHF stations being shifted to UHF, the effect would be to redistribute returns among stations but not to change the total of station returns in a market. If \( a_2 = -0.15 \) and \( a_3 = 0.15 \), the rates for the two VHF stations are $275 and the sum of the returns for all stations in the market is $750, the same as when all stations operate on VHF.

In addition to the handicap that stations face as a result of broadcasting over UHF, stations that have network affiliations have one use
of their time that is unavailable to independents—the acceptance of network programs. If this is the best use of a station's time, the availability of an affiliation may increase the value of time.

I treat the handicap of "non-affiliation" in the same way I deal with the UHF handicap. Now, however, there are three kinds of handicapped stations relative to network-affiliated VHF stations: network-affiliated UHF stations, independent UHF stations, and independent VHF stations. For each of these types of stations I include a variable that represents the handicap the station faces and an additional variable that represents the amount of this loss captured by its competitors. The estimating equation now becomes:

\[
\text{RATE} = b_0 + b_1 \left( \frac{\text{TVH}/\text{N}}{\text{NU}} \right) - \frac{\text{NU}}{\text{N - 1}} + b_2 \left( \frac{\text{TVH}/\text{N}}{\text{NIU}} \right) - \frac{\text{NIU}}{\text{N - 1}} + b_3 \left( \frac{\text{TVH}/\text{N}}{\text{NIV}} \right) - \frac{\text{NIV}}{\text{N - 1}} + b_4 \left( \frac{\text{TVH}/\text{N}}{\text{IU}} \right) + b_5 \left( \frac{\text{TVH}/\text{N}}{\text{NIU}} \right) + b_6 \left( \frac{\text{TVH}/\text{N}}{\text{NIV}} \right) + b_7 \left( \frac{\text{TVH}/\text{N}}{\text{NIV}} \right)
\]

(4)

where NU, IU, and IV are variables that take on the value 1 if a station is a network-affiliated UHF station, an independent UHF station, or an independent VHF station, and zero otherwise; and NNU, NIU, and NIV are the number of network UHF stations, independent UHF stations, and independent VHF stations. I test the hypothesis that the lost returns to a handicapped station are totally captured by its competitors for these three sets of stations.

One additional source of competition, educational stations, can also be taken into account. The hypothesis tested is that the loss from facing competition from an educational station is divided equally among all commercial stations in a market. This implies the addition of the variable \( \text{TVH}/\text{N} \cdot \text{NE} \) to Eq. (4), where NE is the number of educational stations in the market.
THE DATA

The data in this study were obtained from Standard Rate and Data Service, *Spot Television Rates and Data*,¹ a monthly trade publication prepared for the use of advertisers. It contains data on station facilities, contract terms, and advertising rates, which include the prices of program spots as well as the program rates analyzed in this study. The published program rates are those at which an hour of the station's most expensive time can be purchased. The purchaser of the time supplies programming and sells his own advertising. Prime time varies slightly among stations, but it is typically the four evening hours between 7 and 11 p.m.

The use of quoted prices has the disadvantage that one cannot be sure of the extent to which sales are, or would be, consummated at these prices. Since the actual time price is negotiated between the station and the time buyer, there may be deviations between quoted and actual prices. The quoted price represents a point of departure for such negotiations. It is assumed in this study that deviations between actual and quoted prices for a given station are small relative to price variations among stations and that the deviations are uncorrelated with any of the explanatory variables.

Standard Rate and Data Service organizes the station data on a market basis, grouping together all stations it regards as directly competing. Their market definition has been used in this study for classifying stations and competitors. Only markets in which there are three or more stations are included in the sample.² All Spanish language stations are excluded from both the sample and the measures of a station's competitors. Several nonprofit and religious independent stations are also omitted. Finally, only markets in the contiguous United States are considered.

¹Data are from the September 15, 1972 edition. In a few cases data from *Television Factbook, Stations Volume*, 1972/1973 Edition were used to fill in missing information. A few stations were excluded from the sample because neither source provided their program rates.

²A few Standard Rate and Data Service markets were excluded because a network had more than one affiliate in the market.
The size of the market in which a station operates has been defined above as the number of homes with television sets. A number of such measures are available, and I have used the American Research Bureau's Area of Dominant Influence measure in this study.\(^1\) The data are for hundreds of television homes. Table 1 describes some of the characteristics of the sample.

<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHARACTERISTICS OF STATION SAMPLE</td>
</tr>
<tr>
<td>Number of stations</td>
</tr>
<tr>
<td>Network affiliates</td>
</tr>
<tr>
<td>Independents</td>
</tr>
<tr>
<td>VHF</td>
</tr>
<tr>
<td>UHF</td>
</tr>
<tr>
<td>In a three-station market</td>
</tr>
<tr>
<td>In a four-station market</td>
</tr>
<tr>
<td>In a five or more station market</td>
</tr>
<tr>
<td>Number of markets</td>
</tr>
<tr>
<td>Three-station markets</td>
</tr>
<tr>
<td>Four-station markets</td>
</tr>
<tr>
<td>Five or more station markets</td>
</tr>
<tr>
<td>VHF markets</td>
</tr>
<tr>
<td>UHF markets</td>
</tr>
<tr>
<td>Intermixed markets</td>
</tr>
</tbody>
</table>

**EMPIRICAL EVIDENCE**

Equation (4) with the addition of the variable \((TVH/N)(NE)\) was initially estimated and the results are presented in Eq. (5). All of the coefficients were significant at the 5 percent confidence level.

\(^1\) The Area of Dominant Influence consists of all counties in which the home-market stations receive a preponderance of viewing. Each county is allocated exclusively to one Area of Dominant Influence. The data are reported in *Spot Television Rates and Data*. 
and had the expected signs. Moreover, as expected, the largest handicap was observed for independent UHF stations.

\[
\text{RATES} + 252.4 + 0.724 \ (TVH/N) \\
(5.44) \ (13.94)
\]

\[
-0.760 \ (TVH/N) (IU) + 0.971 \ \left( \frac{(TVH/N)}{N - 1} \right) \\
(24.89) \ (12.19)
\]

\[
-0.446 \ (TVH/N) (NU) + 0.329 \ \left( \frac{(TVH/N)}{N - 1} \right) \\
(5.12) \ (3.00)
\]

\[
-0.486 \ (TVH/N) (IV) + 0.705 \ \left( \frac{(TVH/N)}{N - 1} \right) \\
(18.74) \ (9.66)
\]

\[
-0.035 \ (TVH/N) (NE) \\
(2.25)
\]

\( R^2 = 0.9186 \). Figures in parentheses are t values.

To test the hypothesis that a station's competitors totally capture the losses its handicap produces, I compare the coefficients of the "handicap" and "capture" variables. In the one case in which the capture was smaller than the handicap, that of network-affiliated UHF stations, I could not reject the hypothesis that the coefficients were equal in absolute value. In the comparisons of the two remaining pairs of handicap and capture variables I found the capture significantly exceeded the handicap. Since on a priori grounds such a result is highly implausible, I estimated a version of Eq. (5) in which all the capture variables were constrained to be equal and opposite in sign to their handicap variables.

In Eq. (6), all of the coefficients have the expected sign and all except that of the educational station variable are significant, with the educational station variable falling just short of being so. Once again, the relative magnitudes of the coefficients of the handicap variables conform to expectations.
\[ \text{RATE} = 163.2 + 0.826 (\text{TVH/N}) \]
\[ (4.78) \quad (23.70) \]

\[-0.798 \left[ (\text{TVH/N}) \left\{ \frac{\text{IU}}{N-1} + \frac{\text{IU}}{N-1} \right\} \right] \]
\[ (32.69) \]

\[-0.408 \left[ (\text{TVH/N}) \left\{ \frac{\text{NU}}{N-1} + \frac{\text{NU}}{N-1} \right\} \right] \]
\[ (5.06) \]

\[-0.520 \left[ (\text{TVH/N}) \left\{ \frac{\text{IV}}{N-1} + \frac{\text{IV}}{N-1} \right\} \right] \]
\[ (22.48) \]

\[-0.025 (\text{TVH/N}) \quad \overline{R^2} = 0.9173 \]
\[ (1.89) \]

A final specification of the basic equation, presented as Eq. (7), constrains markets that are identical except for operation on all VHF or all UHF to have the same rate structure. This implies that the coefficient of the independent VHF handicap should be equal to the difference between the coefficients of the network UHF handicap and that of the independent UHF handicap.\(^1\) In Eq. (7), where these are constrained to be equal, once again all of the coefficients are significant at well beyond the 5 percent confidence level with the exception of the coefficient of the educational station variable, which continues to fall just short of significance.\(^2\)

\[ \text{RATE} = 163.7 + 0.826 (\text{TVH/N}) \]
\[ (4.78) \quad (22.64) \]

\[-0.806 \left[ (\text{TVH/N}) \left\{ \frac{\text{IU} + \text{IV}}{N-1} - \frac{\text{NIU}}{N-1} - \frac{\text{NIIV}}{N-1} + \frac{\text{IU}}{N-1} + \frac{\text{IV}}{N-1} \right\} \right] \]
\[ (33.55) \]

\(^1\)In Eq. (6) they were not significantly different.

\(^2\)The coefficient of the independent VHF station handicap is the difference between -.806 and -.293 or -.513. In Eq. (6) this coefficient is -.520. Only the coefficient of the network-affiliated UHF station handicap changes markedly between Eq. (6) and Eq. (7).
\[-0.293 \left(\frac{TVH/N}{N} \right) \left\{ NU - IV - \frac{NNU}{(N-1)} + \frac{NIV}{(N-1)} + \frac{NU}{(N-1)} - \frac{IV}{(N-1)} \right\} \]

\[-0.025 \left(\frac{TVH/N}{N} \right) \quad (1.88) \]

\[R^2 = 0.9170 \]

The results reported above support the hypothesis that the number of television homes in a station's market, the number of stations in the market, and the characteristics of a station and its competitors affect a station's rates. The larger the potential audience a station can reach and the smaller the number of stations with which it must divide the market, the greater will be its rate. The rate will be larger if a station operates on VHF or has a network affiliation. It will also be larger if its competitors operate on UHF or are independent stations. A more tenuous conclusion is that the loss to any one station stemming from its being an independent station or its operating on UHF is completely captured by its competitors.

There are two tests of the proposition that networks are able to capture all of the cost savings from networking leaving their affiliates no better off than independent stations in the same market. These involve comparisons of the rates of independent VHF and network-affiliated VHF stations and of the rates of independent UHF and network-affiliated UHF stations. One of the tests is of the significance of the coefficient of \((IV)(TVH/N)\). If this coefficient is significantly less than zero the opportunity cost of the time of a network affiliate is greater than that of an independent station when both are operating on VHF in the same market. The second test is of the significance of the difference between the coefficients of \((NU)(TVH/N)\) and \((IU)(TVH/N)\). Since these coefficients measure the handicaps faced by network-affiliated UHF stations and independent UHF stations, if the latter is larger in absolute value, network affiliates have higher rates than do independents when both operate on UHF in the same market. In all of the specifications we can reject the hypothesis that network-affiliated
stations have the same rates as do independent stations when both operate in the same portion of the frequency spectrum.\textsuperscript{1} These results indicate that networks do not obtain all of the extra revenue that their existence makes possible.\textsuperscript{2}

The results of this study conform closely to those obtained by Greenberg in his study of station profits. Greenberg found that market size, number of stations in a market, and whether a station is a network affiliate are significant in determining a station's profits. The only major points of disagreement are in Greenberg's failure to find significant effects for whether a station operates on UHF and whether a station is in an intermixed market. However, the results of this study indicate that these variables are highly significant.

\textsuperscript{1}In Eq. (7) the two tests amount to the same thing.

\textsuperscript{2}Despite these results, in some markets network affiliates fare little better than do independent stations operating in the same portion of the frequency spectrum. In both Denver and Minneapolis, for example, the independent VHF station has the same rate as the weakest affiliate; similar situations obtain in Washington, D.C., Portland, Oregon, and San Francisco.
III. APPLICATIONS OF THE EMPIRICAL RESULTS

THE STRUCTURE OF PROGRAM RATES

One use to which the equations of Section II can be put is in the analysis of the structure of time rates among stations within a market. For a hypothetical market with 6000 television homes, three commercial stations, and no educational stations, Table 2 illustrates how rates vary among stations depending upon how many of the stations operate on UHF. The estimates are made using Eq. (7).

Each of the stations would have a rate of $1816 if all stations operated on either VHF or UHF. However, if there are two VHF stations and only one UHF station, the rates of the VHF stations rise to $2109, and the rate of the UHF station is only $1230. A VHF station is in the most advantageous position when it is the only VHF station in the market. Its rate is $2402, and that of each of two UHF stations is $1523, greater than the rate of a single UHF station since each UHF station faces a UHF and VHF station in competition rather than two VHF stations.

The results are borne out by an examination of the rate structures in a number of markets. Rates tend to be much more similar when all stations operate in the same portion of the frequency spectrum than when a market is intermixed. The three VHF stations in Beaumont, Texas have rates of $525, $600, and $550. In South Bend, Indiana, where all stations operate on UHF, the figures are $630, $625, and $500. By contrast, in Flint, Michigan the rates for the two VHF stations are $1250 and $1100, and that for the lone UHF station is $375. In Columbia, South Carolina the one VHF station has a rate of $900, and the rates for the two UHF stations are $250 and $240.¹

¹Using Eq. (7) the predicted rates for these stations are: $517 for each of the Beaumont stations; $649 for each of the South Bend stations; $1247 and $744 for the VHF and UHF stations in Flint; and $714 and $493 for the VHF and UHF stations in Columbia.
Table 2
STRUCTURE OF PROGRAM RATES FOR A HYPOTHETICAL THREE-STATION MARKET

<table>
<thead>
<tr>
<th></th>
<th>RATE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3 VHF Stations</td>
<td>$164 + (0.826) (6000/3) = $1816$</td>
<td></td>
</tr>
<tr>
<td>2 VHF Stations</td>
<td>$164 + (0.826) (6000/3) - 0.293 [(6000/3) {-1/2}] = $2109$</td>
<td></td>
</tr>
<tr>
<td>1 UHF Station</td>
<td>$164 + (0.826) (6000/3) - 0.293 [(6000/3) {1}] = $1230$</td>
<td></td>
</tr>
<tr>
<td>1 VHF Station</td>
<td>$164 + (0.826) (6000/3) - 0.293 [(6000/3) {-1}] = $2402$</td>
<td></td>
</tr>
<tr>
<td>2 UHF Stations</td>
<td>$164 + (0.826) (6000/3) - 0.293 [(6000/3) {1-1/2}] = $1523$</td>
<td></td>
</tr>
<tr>
<td>3 UHF Stations</td>
<td>$164 + (0.826) (6000/3) - 0.293 [(6000/3) {1-1}] = $1816$</td>
<td></td>
</tr>
</tbody>
</table>
SHORT-SPACING, DE-INTERMIXTURE, NEW NETWORKS, AND THE PROSPECTS
FOR NEW STATIONS: AN EXAMPLE

The equations developed in this report to analyze the determinants of the value of station time can also be used to assess the effects of policies designed to enhance the prospects for new stations. These policies include de-intermixture (the shifting of markets to all UHF operation to reduce the handicap UHF stations face), short-spacing (the creation of new VHF assignments by loosening channel separation standards), and the formation of a fourth network.

Memphis, Tennessee is a medium size market (32nd largest in 1970) with three commercial television stations, each of which operates on VHF and is affiliated with one of the national networks, and one educational station. Barring any action on the part of the FCC, a new station in Memphis would operate under the dual handicap of UHF operation and the absence of network affiliation. Memphis is therefore typical of most of the top 100 television markets where a fourth station would face the same handicaps. Equation (7) predicts the rates for each of the three stations as $1421. The actual rates are $1200, $1300, and $1400.

Table 3 shows the predicted rates for four television stations in Memphis in a variety of situations. These predictions are also made using Eq. (7). If all stations were identical, each would have a rate of $1107 or [164 + $0.826(4709/4)]. But the handicap of being an independent UHF station is $0.806(4709/4) or $949, which is divided equally among the three network-affiliated VHF stations. This leaves the independent station with a rate of $158 and each of the network affiliates with a rate of $1423.

If the market is de-intermixed by shifting all of the stations to UHF operation or if a new VHF allocation is created for Memphis by means of short-spacing, the entrant's rate rises to $503 since the handicap of being an independent station when network affiliates operate in the same portion of the frequency spectrum is only $0.513(4709/4) or $604. This rate is still quite small when compared with that of the network-affiliated VHF stations.
Table 3
PREDICTED RATES FOR TELEVISION STATIONS IN MEMPHIS, TENNESSEE

<table>
<thead>
<tr>
<th>Market Structure</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three network-affiliated VHF stations</td>
<td>$1423</td>
</tr>
<tr>
<td>One independent UHF station</td>
<td>158</td>
</tr>
<tr>
<td>Three network-affiliated UHF stations</td>
<td>1308</td>
</tr>
<tr>
<td>One independent UHF station</td>
<td>503</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Three network-affiliated VHF stations</td>
<td>1308</td>
</tr>
<tr>
<td>One independent VHF station</td>
<td>503</td>
</tr>
<tr>
<td>Three network-affiliated VHF stations</td>
<td>1222</td>
</tr>
<tr>
<td>One network-affiliated UHF station</td>
<td>762</td>
</tr>
<tr>
<td>Four network-affiliated VHF stations</td>
<td>1107</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Four network-affiliated UHF stations</td>
<td>1107</td>
</tr>
</tbody>
</table>

Still another interesting case is one in which no shifting of frequency assignments occurs but where a new network is created. As Table 3 shows, the potential entrant's rate is raised to $762 since the handicap of being a network-affiliated UHF station is $.293(4709/4). Again, although this rate is substantially above that of an independent UHF station, the UHF handicap still leaves a significant gap between the rates of existing stations and the entrant. Further, the creation of the new network may not be feasible if it must affiliate with UHF stations.
Clearly, a policy that caused a new network to be formed and that eliminated the UHF handicap through either de-intermixture or short-spacing is the only one that would place the potential entrant on a par with the existing stations. The effect would be for all stations in the market to have rates of $1107. The difference between $1107 and $158, the new station's rate in the absence of the change, is $949, obtained from the reduction in the rates of the other three stations from $1423 to $1107.\footnote{The prospects for the formation of a fourth network may be enhanced by policies that place new stations on a par with existing ones. The relationship between new network formation and the handicaps stations face is being explored in R. E. Park, \textit{New Television Networks}, R-1408-MF (forthcoming).}

Whether the increase in the rate of the entrant from $158 to $1107 and the reduction in the rates of existing stations from $1422 to $1107 will increase the number of stations in the market depends on the costs of station operation. If the total returns of a station with a prime time rate of $1107 are sufficient to produce a positive profit, the change will lead to four stations in Memphis rather than three. However, even the increase to $1107 may not be sufficient.

A full assessment of the effect of policies to improve the prospects for new stations clearly requires an analysis of station costs, which is beyond the scope of this study. The results presented here do permit an important qualitative conclusion, however. Policies to eliminate the UHF handicap and to promote the formation of a new television network will raise the returns to new stations. And, in some markets, this may be sufficient to make new stations profitable where they would not otherwise have been so.\footnote{It is even possible, of course, that eliminating only one of the handicaps produces an increase in the rate sufficient to make the new station profitable.}
IV. CONCLUSIONS

The empirical results presented in this report demonstrate the importance of market size, number of competing stations, network affiliation, and place in the frequency spectrum as determinants of a station's program rate. A station in a large market with few competitors will have a higher rate than a station in a small market with many competitors. Similarly, a network-affiliated VHF station will have a higher rate than an independent UHF station. A station that faces UHF stations in competition will have a higher rate than one whose competitors operate on VHF.

The theoretical analysis developed here suggests that station profitability is closely linked to the level of station rates. A station's profits should be equal to the value it places on each unit of time less any costs that are independent of how time is used, even if stations use their time themselves rather than lease it for use by others since the asking price for use of time should reflect its opportunity costs.

Finally, the results suggest that the prospects for entry of new television stations can be enhanced either by de-intermixture or short-spacing to place all stations in the same portion of the frequency spectrum. Apparently, the substantial penetration of all-channel receivers has not succeeded in completely eliminating the UHF handicap. Even if the UHF handicap is completely eliminated, however, new stations will still be at a disadvantage unless a fourth network is formed.