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A public and private-choice model of broadcasting

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INTRODUCTION

A television set is enshrined in almost every home, and households allocate extraordinary portions of their disposable time to its viewing. Few disagree that television is a major factor in modern society, with a pervasive influence on politics, culture, economics, and social affairs. It is therefore somewhat surprising to note how little interest academic economists have taken in the study of the medium, and particularly in the more theoretical aspects of program diversity.

In a sparse literature, one can discern two approaches. The first, by Steiner (1952), dates back to an analysis of radio programming; it was carried on by Rothenberg (1962), Wiles (1963), and Beebe (1977). The basic concept is the assignment of viewer preferences to fixed program categories which are exogenous and discrete. The model does not analyze different control arrangements, except for the difference between a competitive and monopolistic structure, and the political environment does not enter the model. The second approach, taken by Spence and Owen (1977) and expanded by Wildman and Owen (1985), provides a comparative welfare analysis and incorporates viewer-demand functions. That model, too, does not deal with the political dimension of broadcasting control and its impact on program diversity.

This paper attempts to carry on this analysis, and to link it with

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public-choice theory, in a third type of model. Public-choice theorists have analyzed the optimal political platforms which parties would adopt to maximize their political support, following a Hotelling (1929) approach which was used by Downs (1966) for the electoral process. A similar analysis can be applied to television. The aim of this paper is not to investigate a specific hypothesis, but rather to create a methodological instrument for analyzing television programming and, in particular, the interrelation of program diversity, channel capacity, and institutional structure. The existence of such an analytical model of program distribution is particularly important, given the increased complexity of media, and the discussions that surround its structure around the world. The model's simplicity provides a tool useful in applications outside of economics, too. For that reason, a geometric presentation is used.

One must recognize that broadcast policy is distributive policy. Setting up a system which satisfies the taste patterns of one group is like giving that group free movie passes and producing those films which it favors. Different types of governmental or market regimes affect the distributive outcome, and the paper traces the program allocations which result. The allocations of an advertiser-supported market system are not different from the political outcomes of a direct democracy and are squarely at the center of the taste distribution. In order to provide higher-quality programs -- which are favored by elite subgroups of the viewing population -- structural or behavioral policies have been instituted, such as independent public-broadcast authorities, program regulation, and protectionist entry restrictions. The necessity for these policies in order to assure quality programs declines as television program distribution -- due to technological and entrepreneurial changes -- enters the realm of regular economic-exchange transactions and leaves that of political allocation. The constituencies that are supportive of quality programs can be served by the market, where their economic strength generates consumption options which previously needed to be provided through the political system. Hence, the importance of politics in broadcast issues declines, because the redistributive role of the medium is less important than before. This helps to explain the growing acceptability of liberalization and commercialization of television that can be observed in many developed countries. It also helps to explain the decline of the role of public broadcasting.

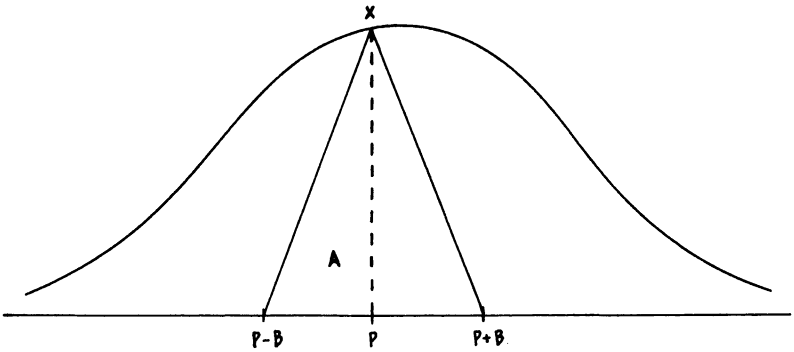
THE MODEL

Television programs come in a great variety. Let us assume that they can be ordered along an axis ranging from "low culture" to "high culture," using the terminology of the sociologist Herbert Gans (1974). An ordinal rather than cardinal ranking is sufficient. For most programs, such classification is possible; in some instances, a program speaks on several levels, and an ordinal assignment is more difficult, but it is in the nature of modeling to simplify.

Any given level of programming, which is termed here the programming "pitch," appeals to a segment of the television viewing audience in a way that it would designate that particular "pitch" as its first viewing preference. Thus, viewers can be ranked by pitch preferences in an ordinal fashion. These preferences are distributed unevenly across the population. Few households prefer a program of modern poetry over all other alternatives. At the other extreme -- despite the dictum that nobody ever went broke underestimating the taste of the American public -- one arrives at a level of program simple-mindedness which is the first preference of only a few. The majority of first preferences are somewhere in between. We now assume that preferences are distributed normally across the spectrum of program pitches, as depicted in Graph 1, with the dimensions defined for a standardized normal distribution. There are, of course, other dimensions to a program that affect preferences, such as technical sophistication, "name" actors, etc. These elements could be modeled into a multidimensional distribution but that would complicate the model without adding much to the theoretical analysis. Similarly, the use of a distribution other than the normal would alter not so much the basic analysis as the computations.

While viewers prefer a particular program pitch, they are willing to watch programs in a general range around their first preference, though at a declining rate. This probabilistic assumption permits a relaxation of the unrealistic binary yes-no decision rules of the

Graph 1



previous models. We assume that a program of pitch P will be watched within a band of B around P; the audience is represented, on Graph 1, by the triangle bounded by (P-B), and X. B is not infinite; programs too distant from individuals' preferred pitch will not be viewed by them. There are, of course, anecdotes about people who will watch anything, including the test pattern, but these stories -- exceptions aside -- go back to the days when television was a novelty (Barnouw, 1982). We make no assumptions on the width of B, only that it is constant.

Programs are delivered to households by broadcasting organizations, operating under a variety of institutional and regulatory settings. Their main programming policy decision is to select the pitch of the programming which they supply. While the selection of programs spans a range of pitches, there is an average pitch for a broadcaster as illustrated by the differing pitches of an American public-broadcasting station and those of a commercial station. In radio broadcasting, these pitches are referred to as "formats" such as all-news, classical music, "easy listening," etc. (Howard and Kievman, 1983). Broadcasters may very their program pitch over the hours of the day, in response to a changing, underlying distribution of program preferences (Levin, 1980). For example, the pool for daytime audiences has a different composition than the pool for evening audiences. This leads to different pitches but does not alter the analysis for each time period. Within a given distribution of program preference, a broadcaster could scatter the pitch of its programs in order to reach, at least sometimes, outlying program preferences. This would entail, in each case, a loss of part of the primary audience in favor of marginal audiences and would make economic sense if an audience, once tuned in, would remain with the broadcaster even after the pitch was changed. This assumes that audiences exhibit a delay in moving back to their program preference, an assumption which the model does not make, though it is possible to incorporate lag-factors. We assume, furthermore, that the cost of acquiring programs for broadcasting is independent of the program's pitch. This assumption will later be relaxed. Also, we assume that once the station's power is set, the marginal cost of broadcasting to an additional household is zero within the station's reach. The impact of additional power on the reception range drops quickly for VHF and UHF transmissions, which do not follow the curvature of the earth. Adding antenna height helps but reaches the structural limits of practicable height quickly, too.

SINGLE-CHANNEL BROADCASTING

Commercial broadcasting

The first case discussed is an unconstrained, commercial, advertiser-supported broadcaster X, operating on the only television channel available. Program choice is based on a maximization of advertiser revenue, which in turn means -- to simplify for the moment -- a maximization of audiences.

X must thus find the pitch P_1 that maximizes triangle A in Graph 1. Its height at P_1 is given by the normal distribution:

$$H_{P_1} = (2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P_1^2} \tag{1}$$

With audiences ranging between ±B, total audience is

$$A = \tfrac{1}{2}(2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P_1^2} \cdot 2B = (2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P_1^2} \cdot B \tag{2}$$

It is obvious that the maximum A is reached when $P_1 = 0$. Strictly speaking, advertising revenues will not be simply related to the size of the audience but will weigh the audience by its "consumption power," since this is what advertisers seek (Poltrack, 1983). We assume that income equals consumption power and that income and preference for upper culture are, on average, positively and linearly correlated due to the higher educational levels associated with higher incomes. The pitch P_2 that maximizes C is then determined by maximizing the audience triangle weighted by its median consumption power c. We choose a linear weight

$$c = \frac{1}{Z}(Z + P) \tag{3}$$

Z is a constant, defined so that c = 1 when P = 0, i.e., a neutral weight at the peak of the distribution. The smaller Z is, the greater is the weight given to income. Audience consumption power is

$$C = \tfrac{1}{2}H_{P_2} \cdot 2B \cdot \frac{1}{Z}(Z + P_2) \tag{4}$$

$$= B(2\pi)^{-\frac{1}{2}}\, e^{-\frac{1}{2}P_2^2}\, \frac{1}{Z}(Z + P_2) \tag{5}$$

To maximize, we set

$$\frac{dC}{dP_2} = B(2\pi)^{-\frac{1}{2}}\, \frac{1}{Z}\, [Ze^{-\frac{1}{2}P_2^2}(-P_2) + e^{-\frac{1}{2}P_2^2} + P_2 e^{-\frac{1}{2}P_2^2}(-P_2)] = 0. \tag{6}$$

We have

$$e^{-\frac{1}{2}P_2^2}(-ZP_2 + 1 - P_2^2) = 0 \tag{7}$$

Since the left-most part of this expression is always positive, we can solve for a maximum at

$$P_2 = -\frac{Z}{2} + \sqrt{\frac{Z^2}{4} + 1} \tag{8}$$

The greater the income weight (the smaller Z), the more will the maximizing pitch be shifted from 0 towards 1.

Governmental control

Suppose, alternatively, that the single channel is operated by a governmentally-controlled broadcasting organization. Depending on the policy goals of the government, different programming choices will occur.

A first strategy is a policy in which the government, in a selfless pursuit to make as many citizens as possible happy, aims to provide a maximum audience with programs they like: this will be at $P_3 = 0$, identical to the unweighted commercial solution P_1, and in fact at a lower-quality pitch than the income-weighted commercial P_2.

A second alternative is that governmental television-program policy is not selfless but designed to serve the government's interest. Let us, for simplicity, make the assumption that the electoral contests are carried on by political parties contesting for supporters who have various degrees of program quality preferences. Voters with elitist tastes vote for elitist parties, and voters with popular tastes vote for populist parties. If television-programming policy is the only electoral issue differentiating the parties, they will promise policies designed to maximize voters, i.e., viewers. In a two-party system, this will result in both parties promising a centrist pitch, aiming for the peak of the distribution, $P_4 = 0$. (Children would be served only to the extent that enough adults value television programs for their or their neighbors' offspring.) With multiple parties, different platforms would emerge; coalitions would tend to push the equilibrium towards the center, although unstable solutions are also possible. This is the usual public-choice voting analysis (Mueller, 1979).

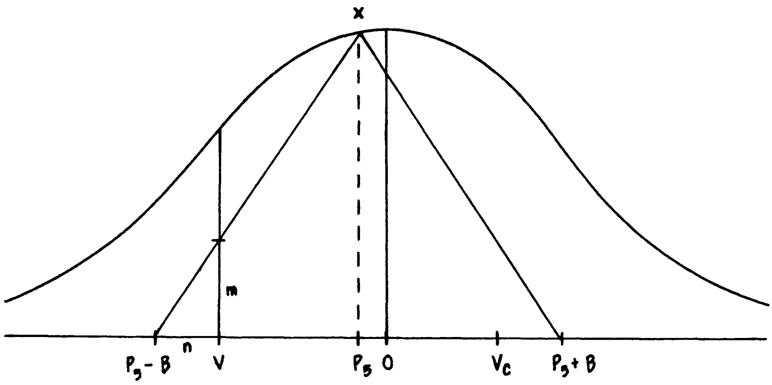
A third variant is a governmental program policy, in which the government rewards its supporters by providing programs of their preference. This "spoils" system assumes that an election has been conducted on a variety of issues. A winning party controls government and broadcasting and sets the programming policy to please its followers. Let us assume that the victorious grouping comprises voters with taste preferences to the right of V. (See Graph 2.)

If the government has a spoils-policy, it will set P_5 to satisfy the maximum number of its supporters. It will set programming pitch at

(a) $P_5 = 0, \text{ if } |V| \geq \frac{1}{2}B$ (9)

(b) Where the majority is slimmer $(|V|) < B)$, the general solution is to maximize the triangle defined by P_5 minus the smaller triangle on the

Graph 2



left of V, i.e.,

$$S = B(2\pi)^{-\frac{1}{2}}\, e^{-\frac{1}{2}P_5^2} - \frac{m\cdot n}{2} \tag{10}$$

with

$$n = \frac{B}{2} + \frac{P}{5} - V. \tag{11}$$

By similar triangles, m is

$$m = \frac{B}{2}(2\pi)^{-\frac{1}{2}}\, e^{-\frac{1}{2}P_5^2}\ \left(\frac{B}{2} + P_5 - V_0\right) \tag{12}$$

so that

$$S = B(2\pi)^{-\frac{1}{2}}\, e^{-\frac{1}{2}P_5^2} - \left(\frac{B}{2} - P_5 - V\right)^2 \frac{B}{2}(2\pi)^{-\frac{1}{2}}\, e^{-P_5^2} \tag{13}$$

$$S = B(2\pi)^{-\frac{1}{2}}\, e^{-\frac{1}{2}P_5^2}\ \left(1 - \frac{B}{4} - \frac{P_5}{2} + \frac{V_0}{2} \right) \tag{14}$$

This simplifies to the solution

$$P_5 = -\left(1 - \frac{B}{2} + \frac{V_0}{2}\right) \pm \sqrt{\left(1 - \frac{B}{2} + \frac{V_0}{2}\right)^2 - 1} \qquad (15)$$

A variant exists if a coalition government needs to satisfy its several constituencies. For example, if the winning coalition comprises two parties -- one to the left and one the right of V_C in Graph 2 -- the program pitch may be set at V_C, or in its neighborhood, to serve both coalition parties. This could carry the programming pitch considerably off center. The analysis for this case is analogous to the one discussed below when the opposition is included in program provision.

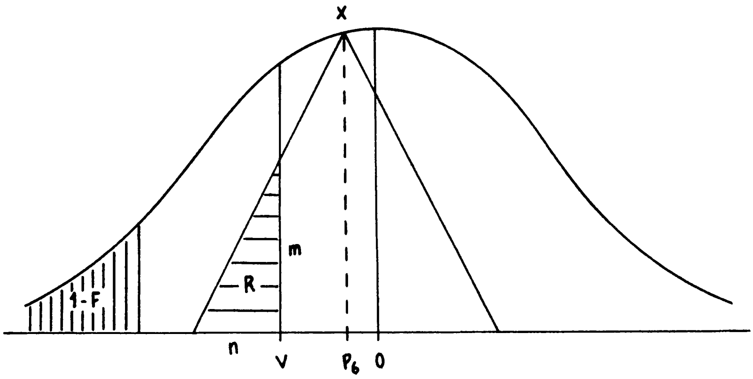
So far, governmental programming has been analyzed as either (a) pursuing a public benefit policy; (b) part of an electoral party strategy; (c) or an allocative policy benefiting the government's supporters. A fourth policy would be to take into account that programming is also a propaganda tool that can be consciously wielded in order to influence the hearts, minds, and votes of viewers. It is largely for that potential that control of television has been so fiercely fought over in many countries. Television is thus not merely a governmental public service but also a means of widening and securing its voter base. By choosing a certain program pitch, it can influence viewers' values and eventually their voting preferences. In pursuit of an optimal propaganda strategy, a trade-off must be made between the "purity" of the pitch (i.e., its being squarely within majority preferences) and its reach of opposition viewers. The more "pure" and distant a pitch is from the opposition voters' preferences, the less likely they are to watch the programs. On the other hand, the closer the pitch is to these voters, the less propaganda impact will be made on the actual audience. The optimization problem of propaganda can be stated as selecting a pitch P_6 that maximizes the product of opposition viewers reached, weighted by the distance of P_6 to them. (See Graph 3.)

The selected propaganda pitch P_6 must be to the right of V -- the boundary between government and opposition -- since otherwise it would draw viewers towards the government. Opposition viewers that are reached are $R = mn/2$, with

$$n = P_6 + B - V \qquad (16)$$

m can be found by reference to similar triangles so that

Graph 3



$$m = (2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P_6^2}(P_6 + B - V)/B \tag{17}$$

Distance of pitch to opposition is $V = P_6$. Total propaganda G is thus

$$G = (2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P_6^2}(g)(P_6 + B - V_0)^3/2B \tag{18}$$

P_6 is found by solving for the maxima of this equation. Moderate pitch (small D) is an optimal broadcast propaganda policy, because of its high reach of opposition audience. Analogies can be found in the international broadcasts of various countries that are aimed at influencing public opinion abroad. For example, the BBC's approach, in its international news, has been to be close to the equivalent of V, projecting a position that is relatively moderate in relation to that prevalent in other countries (Briggs, 1979). In contrast, the Voice of America, for a variety of constraints, aims its programs more at audiences already on its own side of V and thus is reputed to be less effective (Browne, 1982).

The analysis has shown that a two-party electoral system results in a centrist program pitch identical to the commercial solution. Hence, for viewers with preference for high-quality programs, in a single-channel broadcast system neither the market nor the democratic process leads to satisfactory supply. For them, there exists both a market failure and political failure. This is one of the peculiarities of quasi-public good broadcasting. To assure the supply of high-quality programs takes a different institutional set-up, in which neither the market nor the democratic process is dominant. Most typically, this involves a semi-independent governing authority which sets program policy. Such bodies provide some insulation and can pursue other optimization goals (Turnstall, 1983). To political parties, such arrangement will also often be preferable to outright governmental control -- which they may lose from time to time -- unless they are risk-preferers or hope to have control over the government for an extended period.

The program preferences of an independent broadcast authority will correspond to those of its board, management, and staff, most of whom tend to have above-average program preferences. The first governing board of the BBC included one Earl, two Lords, the Headmaster of the Winchester School, and the wife of the Chancellor of the Exchequer. Of the first 80 governors serving during the BBC's first half-century, 40 were Oxford or Cambridge graduates, and 20 were graduates of Eton, Harrod, and Winchester (Briggs, 1979). What program pitch would such groups select? There are limits to elite tastes on a mass medium. Viewers cannot be forced to watch, and heightened program quality is accompanied by declining audiences. Beyond a certain point, further cultural refinement will lose the intended viewers. Thus, we assume that the goal of an independent broadcast authority is to maximize a "quality-weighted" program viewing. A weight, W, is assumed to be linearly proportional to the program quality pitch, W = 1/M (M+P), so that the weight is neutral for the centrist pitch, P = 0.

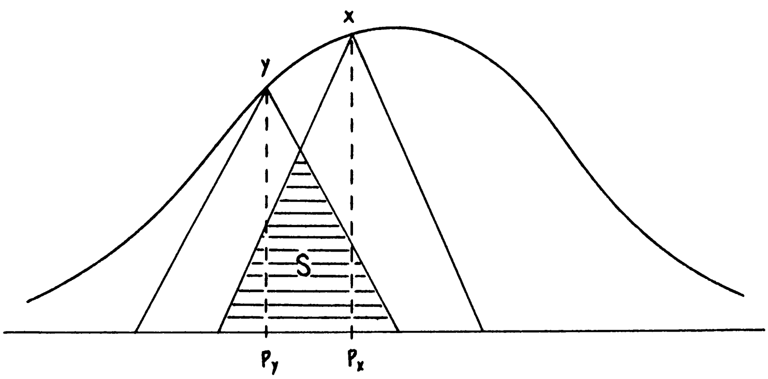
$$K = B(2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P_7^2} \frac{1}{M}(M + P) \tag{19}$$

Similar to the case of income-weighting, differentiation yields a maximizing P_7 to the right of center, at $P_7 = -\frac{M}{2} + \sqrt{\frac{M^2}{4} + 1}$. This optimal pitch is not the extreme of program quality. Even high weights for culture (low M) shift it up to only one standard deviation rightward.

Multi-channel television

The model is now extended into systems that provide more than one channel, in an analysis of comparative statics. Let us again begin with a commercial system with multiple stations. A new broadcaster Y will position itself in such a way, relative to an incumbent broadcaster X, to maximize audiences. (We ignore the weighting by consumption capacity in the following.) For a given program pitch, P_y, audience range is again 2B. Depending on the choice of P_y, there could be an overlap with X's audience. (See Graph 4.) We assume that for the area of overlap, audiences are split between X and Y. This does not mean that they are equally shared at a given pitch of overlap, since, depending on audience location, there are unshared audiences above triangle S at any point except for the point of intersection.

Graph 4



The decision rule for a choice of P_y, given P_x, is then to maximize the triangle defined by P_y, minus half of the triangle of overlap S. That smaller triangle is given by mn/2, where n is the distance between P_x + B and P_y - B

$$n = P_x - P_y + 2B \tag{20}$$

Height m is given by the relation

$$m = (2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P_x^2}(P_x - P_y + 2B)\frac{1}{2B} \tag{21}$$

and the triangle is

$$T = n \cdot m/2 = \frac{1}{4B}(P_x - P_y + 2B)^2(2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P_x^2} \tag{22}$$

The optimization problem for y is then to find P_y that maximizes area A_y

$$A_y = (2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P_y^2} B - T/2 \tag{23}$$

This relation is a reaction function $P_y = f(\hat{P}_x)$, since P_x has been assumed as given. But once chosen, the previous P_x would be modified, since y cuts into its audience. Thus, there is also $P_x = g(\hat{P}_y)$, creating a simultaneous relation. X and Y settle in an equilibrium at opposite sides of the peak of the distribution. In other words, they do not have the same pitch. Much of the conventional interpretation of television sees commercial broadcasting as inherently striving for identical "lowest common denominator" (Mander, 1978); however, one can see from the model that differentiation is the rational policy.

The addition of further broadcast stations repeats the process, placing stations $x, y, z_1, \ldots z_n$ across the audience-preference distribution. As the number of stations increases, their spread across the distribution widens, i.e., more "outlying" program tastes are reached. At the same time, the spacing between the chosen program pitches decreases, and viewers find closer substitutes for their favored program pitches. In the process, the "band" of primary audience tuned to a station is narrowed without a shift in preferences. The implication is that program channels become relatively more specialized and more "narrowcasting" in terms of their actual audience. This can be observed in cable television where increasingly specialized program channels have been emerging. Furthermore, the proximity of spacing is closest near the peak of the distribution; these audiences will have the greatest choice of programs appealing to their tastes.

Two important measures for programming diversity can be defined. The first is the "spread" of programs from the right-most to the left-most pitch:

$$S = P_R - P_L \tag{24}$$

"Spread" as a measure of program diversity concentrates on the reach to outlying preferences and does not measure the extent of satisfying more centrist ones. In Graph 5, the areas T_1 and T_2 are regions of substantial nonviewing in a hypothetical 3-channel spread-maximizing system, i.e., various segments of the audience are not especially satisfied with the programs delivered. T_1 and T_2 are reduced as more intermediate channels emerge. Therefore, a second useful measure is that of viewer "preference satisfaction," measured by the extent of viewing participation within the entire population. The measure for viewer preference satisfaction is to find the total area under the program triangles as a share of total population.

It is possible to calculate several relations, such as the change in spread S and the number of channels n and the number of stations that would be required in order to reach a desired pitch P_E. One question is at what point certain programs that are deemed socially meritorious in terms of quality would be provided by a market mechanism. The model permits a calculation of when such an outlying point would be reached.

Table 1 provides the results for total audience coverage (preference satisfaction), audience shares per channel, and their changes with the number of channels. The results were generated by a computer simulation of the model, using equation (23) over n-channels. An intermediate B = 1.5 was chosen for illustrative purposes. As can be seen, the marginal contribution of channels to total audience satisfaction drops rapidly to close to zero, and the audience share of each station declines. Hence, a mere addition of channels will, beyond a point, increase program diversity only slightly while challenging the economic foundation of the channels.

A symmetry exists in a market provision of program pitches. As the spread moves rightward towards higher quality with larger channel capacity, it also moves leftward on the graph towards the lower-pitch offerings, and adds centrist offerings. Low- and intermediate-quality

Table 1

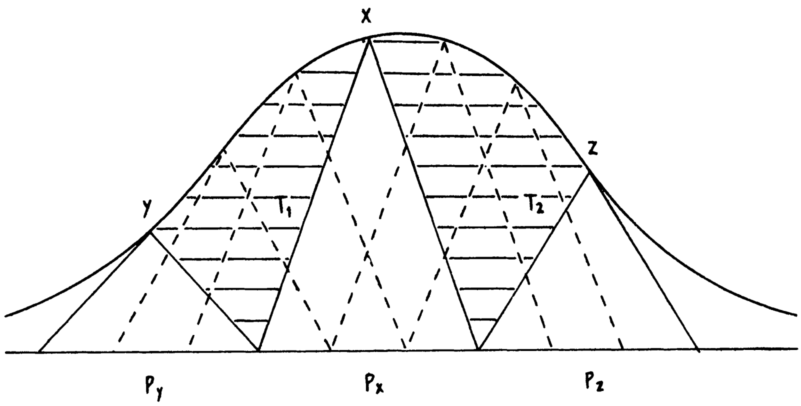
Audiences and Number of Channels

Number of Channels	Total audience (in % of Total population	Average audience per channel	Incremental Total audience (in % of total population)	Incremental audience per channel (in % of total population)
1	30	30	-	-
2	56	28	26	-2
3	64	21.3	8	-6.7
5	77	15.4	6	-6.0
10	82	8.2	1	-7.2
15	90.04	6	~ 0	-2.2
20	90.12	4.5	~ 0	-1.5
30	90.22	3	~ 0	-1.5

programs thus expand together with higher and intermediate quality. Therefore, it may take a good number of additional channels in a market system to reach an outlying point. This then has created an impetus for regulatory or public-ownership solutions. For example, a government may set up a channel with the requirement to have an outlying pitch P_Z (Graph 5). A good example is the American PBS (Frank and Greenberg, 1982). Similarly, it may, by regulation, require each commercial station to devote part of its broadcast time to programs of pitch P_Z, thus in effect creating the equivalent of a channel of type P_Z. The latter policy is behind the licensing requirement, in the United States, to provide some programs that deal with issues of concern to the community (Noll et al., 1983).

It should be noted that one side-effect of a PBS-type channel is to push the commercial stations towards lower-pitch programs. Commercial television would be somewhat higher in program pitch if the high-quality

Graph 5



segment were not occupied by a PBS station. Hence, a casual comparison between commercial and public stations can overstate the "inherent" difference in their program pitches. Similarly, an increase in commercial stations reduces, after a point, a PBS-type station's audience by providing programs that are near-substitutes. If that PBS station has flexibility in selecting its program pitch, and if it cared either about increasing its audience or about reaching hitherto unserved audiences, it would move to a higher P. Hence, increased commercial offerings raise the program quality of a PBS-type station, too.

This illustrates that the introduction of a commercial television channel that competes with a previously monopolistic public channel does not inherently push the public monopolist towards lower program quality. If earlier the public station had been close to the center of the distribution, a commercial station near it would push it outward towards higher-quality programs. If the public station were already fairly far outward in pursuit of a quality goal other than audience maximization, the second channel need not take much of its audience -- only the pride (and power) of being number one.

The marginal effect of channel additions on the audiences of existing channels can also be calculated. If the audience band is narrow (small B), a second channel need not reduce the first channel's audiences by very much, since the two can be sufficiently apart so as not to draw too many viewers from each other. As further channels are added, however, the overlap becomes more pronounced and results in relatively large marginal losses for each incumbent channel. Further on, however, as channels are crowded close to each other, the effect of yet another channel on all incumbent channels is small again, as can be seen in Table 1, i.e., it is absorbed over the large number of existing channels, all of which readjust to form a new equilibrium. Hence, one would expect that opposition to an expansion of channels by the incumbent broadcasters would be fiercest in the intermediate range. This helps to explain the resistance to multichannel television distribution, for example, cable television (MacAvoy, 1977). Once a multichannel system is established, the opposition to its expansion is diluted, because the cost of organizing a coalition of resistance increases with channel size (Olson, 1965), while benefits of containment are shared and decrease with a number of other channels. More effective than a coalition of broadcasters in containing channel expansion would be a monopoly (including a cable operator with control over all channels), because it could limit channel supply beyond the point of net overall marginal audiences, in contrast to the continued carving up of the same audience into ever-finer slices in a free-entry system (Steiner, 1952).

A monopoly system can also cover a broader variety of program pitches with a lower number of stations, because it can avoid duplication if it wishes to. For example, graph 5 shows schematically that it takes three monopoly channels to reach a program diversity which would require more channels in a competitive commercial system. This would seem to make a monopoly system more efficient in terms of diversity in that diverse viewer preferences can be served with less resources and less duplication. (We assume for simplicity that the cost of operating n independent channels is the same as that of an n-channel monopoly system). This is a major justification for a governmental system if a maximization of program spread is sought. But the argument is problematic in several respects. First, as discussed above, a simple maximization of spread makes no sense for a government. It would be conceivable primarily if it corresponded to the spoils-systems of several parties in a government coalition. For example, in Italy the public channel RAI-1 is controlled in an almost official fashion by the conservative Christian Democratic party, whole RAI-2 is similarly openly allocated to the appointees of the Socialist party. But the Italian system did not prove stable, because the incentives to serve the centrist audience niches by private providers could not be contained (Sasson, 1985).

Second, a total governmental monopoly is not necessary to achieve program diversity. Thus, the channel X in Graph 5 could be commercial, with governmental channels Y and Z serving the outlying areas.

New media

The so-called "new media" of cable television, direct satellite broadcasting (DBS), multipoint distribution systems (MDS), and video cassette recordings (VCR) add to the change of environment (Noam, 1985). The VCR, in particular, permits outlying tastes to be satisfied, given a willingness to pay.

To say that more channels of program provision than previously provided are technically possible does not mean that they are economically feasible. To analyze this it is necessary to introduce a measure of cost into the model and to relate it to audience size. We assume initially, as before, that the programming cost for each program channel is the same, regardless of pitch. In Graph 6, this is represented by the horizontal line C. The bell-shapped curve is that of revenues. It should be recalled from equation (2) that total audiences are distributed normally with program pitch, assuming constant width of audience band B.

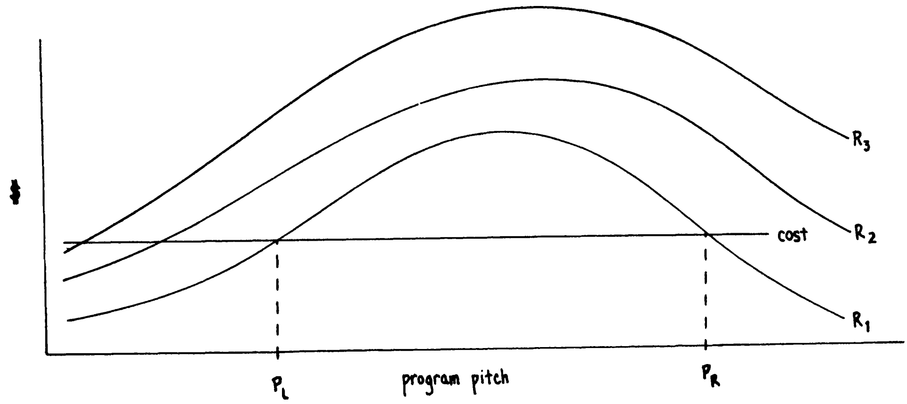
If each audience is equal in terms of advertising revenues, with a constant "per thousand" advertising charge of t, revenues are also normally distributed

$$R_1 = t \cdot B(2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P^2} \qquad (25)$$

This defines the range of economically feasible pitches for a one-channel system between the intersection points P_L and P_R of cost and revenue curves.

If the upper-pitch audiences are more valued than the lower ones, the curve would be tilted upwards around its peak, resulting in the

Graph 6



feasibility range shifting to the right. Conversely, if high-quality programs are more expensive to produce than low-quality ones, the cost line will tilt upwards and shift the feasibility range towards lower quality.

The emergence of new distribution technologies has several effects. First, it shifts the cost curve downwards by reducing distribution costs. For example, with a satellite transponder that can be rented for a few million dollars (Henry, 1985), all of North America or Europe can be covered for reception by cable TV systems, master antennas, or back-yard direct reception. Secondly, the new technologies unfreeze the number of channels available, which have been severely restricted by international frequency agreements and allocation to governmental purposes that do not take into account the economic value of the scarce resource "electro-magnetic spectrum." These administrative steps have thus created an artificial scarcity for civilian uses (Levin, 1971). The new media skirt that bottleneck, either by using nonbroadcast forms of transmission (cable, fiber-optic distribution, cassettes), or by using other parts of the frequency spectrum (MDS, DBS).

By providing added channels, total audiences increase up to a point, because the unserved audiences are being reached. In Graph 6, this is shown by R_2, the revenue curve for 2 channels and varying average pitch. On the other hand, this increased total revenue has to be split by more channels. Because average audiences are decreasing with number of channels, revenues are declining (see Table 1). Hence, the economically feasible range of program pitches may actually shrink in a multichannel environment, if the channels' source of revenues is conventional. It is therefore necessary for a multichannel system to crate new sources of revenue in order to "stretch" the smaller audiences. Media liberalization in terms of greater program options is therefore tied to a liberalization of financing options. In particular, the new media technologies permit audiences to acquire television programs in a regular market setting, through cable subscriptions, pay-cable, subscription-TV, satellite signal unscrambling charges, and cassette rentals and sales (Owen, 1975). As a consequence, it is possible for program providers to take into account viewer-demand elasticities for different program pitches. For example, outlying program preferences held by only small audiences (outside the feasible set of Graph 6) can be satisfied if the demand is sufficiently price inelastic. This also reduces the need for broadcasting to serve the outlying taste areas, and transforms the question of adequate supply to these taste minorities to one largely resembling that of books.

The existence of various distribution modes that can be segmented from each other makes it possible to engage in mixed distribution strategies, i.e., in price discrimination by a controlled release sequence (e.g., movie theaters → cassettes → pay-cable → regular cable → TV network → syndication) which reduces consumer surplus (Waterman, 1985). For each program pitch a higher revenue can be extracted by a controlled release sequence. This is denoted in Graph 6 as R^3. Hence, a wider program range is feasible than under advertiser-based television, assuming that cost is not affected.

Because of the introduction of a market mechanism, income differentials make themselves felt. If income determines willingness to pay, and if quality preferences rise with income, the revenues for the right segment of R_3 rise higher above R_1 than those on the left. Thus, while the economically feasible set of program options increases in both directions, it does so most pronouncedly on the higher-quality part of the program distribution.

$$R_N = B(2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P^2} N(m + P) \qquad \infty > N, M > 0 \qquad (26)$$

In this media environment, the higher-taste preferences are better served than before, by permitting the superior economic position of their holders to make itself felt (Mosco, 1979).

CONCLUSION

This paper has established a framework for the analysis of program diversity and audience shares under different regimes of ownership, regulation, and channel quality. The model is one of comparative statics, and lends itself to analytical solutions. It can serve as a tool to clarify programming decision-making and the impact of various institutional arrangements. The audience maximization of commercial broadcasting leads to program quality similar to that of a direct democratic process. To create a bias towards quality, alternative mechanisms had to be introduced. That, together with the potential for the propaganda use of broadcasting and the potentially large rents of controlling a scarce channel, made questions of broadcast policy extraordinarily hard-fought, especially in European countries. However, the emergence of alternative distribution channels and payment mechanisms has moved television programs much more into the mainstream of economic transactions. In consequence, the need to use the political arena to assure the supply of certain programs has declined, the marginal losses to incumbent channels has successively decreased, and the propaganda reach has been reduced by the spread of programs over the distribution. Therefore, liberalization is less resisted because the stakes have become lower.

There are, however, some losers, in relative or absolute terms, of a multichannel media landscape, in particular the traditional public-broadcast institutions. Not only does their audience share decline, but, most fundamentally, an important part of their programming function, together with the influential constituencies that go with it, is taken away by regular market participants. Thus, while the analysis predicts a decline in the importance and intensity of media policy discussion, the major exception will be the friction accompanying the decline in the scope of public broadcasting.

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