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THE IMPACT OF CABLE TELEVISION ON VIEWING TIME OF CANADIAN TELEVISION STATIONS

ECONOMIC POLICY AND STATISTICS BRANCH

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I. Introduction

> The aims (in establishing a national broadcasting system) have been national survival, whether in English or French Canada or in Canada as a whole; a Canadian sense of identity; national unity; increased understanding between regions and language groups; cultural development; and serving the Canadian economic interests....[1]

> In 1935 Graham Spry explained that there were two motives that led to the broadcasting legislation of 1932. "The first of these driving motives was the national motive, and it was predominant. The second motive was the free use of broadcasting by all sections of opinion. The positive aspect of the national motive was the use of broadcasting for the development of Canadian national unity, and the negative aspect was the apprehension of American influences upon Canadian nationality, particularly as it concerned public opinion."[2]

Like Quebec and economic nationalism, communications policy is one of the most widely discussed domestic issues in Canada today. All three issues have vital importance for the survival of the nation.

In fact, it has been said that Canada is a country that "exists by reason of communication."[3] But communications in Canada, and in particular broadcast communications, are very difficult and costly. There are several reasons for

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[1] Frank Peers. The Politics of Canadian Broadcasting 1920-1951. (Toronto: University of Toronto Press), 1969, p. 440.

[2] Ibid., p. 441.

[3] Harry J. Boyle. "The Canadian Broadcasting System." A speech at the Canadian Section of the Association for Professional Broadcasting Education Seminar, Washington, D.C., November 6, 1970. (Mimeo.) P. 8.

this. In the first place, the country occupies a land space of some 3.8 million square miles but has a population of just over 20 million.[4] This makes all forms of communications highly expensive when costs are placed on a per capita basis.

In the second place, Canada's bilingual nature means that the country must support two separate broadcasting systems, which increases costs well beyond the cost of either the French or English service alone.

In the third place, Canada's proximity to the United States and the fact that most of her population lives within one hundred miles of the border and can receive signals from the much wealthier American broadcasting system, means that the small Canadian audience is partly drawn away from the native system.[5]

Canadian public policy in connection with broadcasting, then, has reflected a belief that broadcasting has a special significance to the survival of the nation, that broadcasting is not "just another industry" to be governed wholly by the impersonal forces of the market place. It has been seen by government as an instrument for implementing the national policy. As The White Paper on Broadcasting stated

> Any statement of policy related to broadcasting in Canada therefore starkly poses this question. How can the people of Canada retain a degree of collective control over the new techniques of electronic communication that will be sufficient to preserve and strengthen the political, social, and economic fabric of Canada, which remains the most important objective of public policy?... Broadcasting may well be regarded as the central nervous system of Canadian nationhood.[6]

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[4]Dominion Bureau of Statistics. Canada Year Book, 1969. (Ottawa: Queen's Printer), pp. 2 and 157.

[5]Royal Commission on Broadcasting. Report, 1957. (Ottawa: Queen's Printer, 1957), pp. 7, 8.

[6]Judy Lamarsh. White Paper on Broadcasting, 1966. P. 4.

In a similar vein, the Special Senate Committee on Mass Media reported

> "...what is at stake then is not only the vigor of our democracy. It also involves the survival of our nationhood. A nation is a collection of people who share common images of themselves. Our love of the land, and our instinctive yearnings for community implant that image in the first place. But it is the media--together with education and the arts--that can make it grow.... What we are suggesting is that the Canadian media--especially broadcasting--have an interest in and an obligation to promote our apartness from the American reality....[7]

The fact that Canadian nationalism is inseparable from public policy in broadcasting greatly complicates a study of the broadcasting industry. Whereas the usual prescription given in economic studies of most industries is that public policy should be directed toward the implementation of the maximum degree of competition possible in order that the consumer may be protected, in the broadcasting industry it will be found that uncontrolled competition directs broadcasters' behaviour in a direction diametrically opposed to the national policy. If this national policy is to be implemented partially through private broadcasting the question then becomes: How can government, after partially removing the control factor of competition, direct broadcasters' behaviour in such a way as to implement its national goals while at the same time preserving some vestige of private broadcasting? The answers to this question are not at all clear.

The Canadian Radio-Television Commission, the federal regulatory board with the responsibility of implementing the national goals with respect to broadcasting, has since its inception viewed cable television as an added constraint upon the system. In the view of the CRTC, cable television poses a triple threat to private broadcasting in Canada:

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[7]Special Senate Committee on Mass Media, Mass Media, Vol. I. (Ottawa: Information Canada), p. 11. (Italics in original.)

(1) By delivering many more television signals into an area than are normally available, cable television fragments the audiences of the local broadcasting stations. By reducing the total audience size, the television station becomes a less attractive advertising vehicle and its revenues may be expected to suffer. The fact that distant cable systems may carry the station beyond its normal coverage area, thus increasing its potential audience size, does not totally alleviate the difficulty. One broadcaster estimated in an interview that there were only two Canadian television stations that were able to sell this distant audience--CFTO, Toronto and CFCF, Montreal, and even for these stations the distant audience was only worth about 1/8 the local audience. The relative unattractiveness of the distant audience is attributed to the fact that advertisers are less able to pin-point their desired targets when television signals are carried over larger and larger geographic areas. For example, a local car dealer might consider the audience watching his advertisement via cable in a centre a hundred miles or more from his business to be next to worthless.

Therefore, even if one assumes that cable only results in a redistribution of audience composition, so that it does not affect each station's total audience size, it will still reduce each station's advertising revenues.

Rolla Park has shown that in the United States the shifting of audience shares among stations because of cable causes a related difficulty.[8] Cable has a different impact on stations of different sizes. This is because each additional viewer is worth successively less to a station (i.e., the marginal value of viewers declines). Therefore, stations in large urban centres, which may be expected to gain net audience, will not gain as much in advertising

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[8]Rolla Park. Potential Impact of Cable Growth on Television Broadcasting. (Santa Monica: RAND), R-587-FF. October, 1970.

revenues as stations in small centres will lose due to the decline in their net audience. Thus cable television may be expected to cause an over-all decline in television advertising expenditures.

(2) The second concern about the effects of cable television upon traditional broadcasters involves the openness of the economy. In a closed system, as one may assume the United States to be for these purposes, cable television will have either a zero impact on total viewer-hours devoted to the broadcasting system or increase this time somewhat (because of greater channel clarity and diversity). In a closed system, viewer-time lost by one station will be made up by gains to one or more stations whose reception is attributable to cable.

Canada, however, does not have a closed system. In fact, the raison d etre of cable in Canada has been thought to be its ability to bring signals of American stations into areas beyond their normal coverage.[9] The results of cable's ability to lessen total viewership of Canadian television are twofold. First, Canadian television becomes a less attractive advertising medium because of its decreased audience. Stations will be forced to reduce their rate cards in order to maintain a competitive cost-per-thousand viewers for advertisers using television as opposed to other media. Total revenue declines. Second, some advertisers, especially firms with branch plants in Canada, may find it economical to abandon the Canadian broadcasting system altogether and attempt to reach the Canadian markets through advertisements placed on American television stations. In this way, funds available for all Canadian advertising vehicles decline by being syphoned across the border.

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[9]Canadian Cable Television Association. "Submission to the Special Senate Committee on Mass Media," March, 1970. (Mimeo.) P. 41.

(3) By facing increased competition from American stations, private broadcasters may be even further induced to compete for audiences by using mass appeal, light entertainment programmes similar to the American genre. At present the schedules of private stations include material originating in the United States for about 50% of the broadcast day. Increased competition from American sources may force private broadcasters to further lower standards on the 50% produced in Canada in an effort to compete for the mass audience. This effect has been reflected in two recent trends in Canadian broadcasting: (i) co-production with American producers of high cost, light entertainment shows such as Rollin' on the River in an effort to meet the Canadian content requirements and with a view toward export into the lucrative American market, and (ii) production of low cost "Canadian" shows that formerly appeared on American television such as Beat the Clock or low cost mass entertainment shows such as The Amazing Kreskin that are profitable in the Canadian market alone but can pick up some additional revenues from export to the United States. In any case, the resultant continentalization of broadcasting does little in the way of implementing the national policy for broadcasting as set out in the Broadcasting Act viz "to safeguard, enrich and strengthen the cultural, political, social and economic fabric of Canada."[10]

Such, then, are the concerns expressed by the CRTC with regard to cable television in Canada. This paper attempts to set out the impact cable television has had and can be expected to have upon broadcasting. Unfortunately, in order to offer concrete policy suggestions, the scope of this article would have to be expanded substantially due to the complexity of broadcast advertising in Canada. The major thrust of this paper is simply to measure the impact of

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[10] Broadcasting Act, 1968. Section 2.

cable television on the viewing time to Canadian stations. The economics of broadcast advertising is treated only superficially at the close of this paper.

II. Data Source

The data used in the econometric model below were supplied by the CRTC.[11] The viewing statistics originated from a Bureau of Broadcast Measurement survey conducted for the period of October 27 to November 9, 1969. The survey estimated the average weekly viewing hours for all television stations receivable in Canada for both off-air and cable viewers. These data were available for all Canadian counties and metropolitan areas in which television was viewed.

The television revenue data originated from the financial returns that television stations are required to send annually to the CRTC. Data for 54 privately-owned television stations in Canada in the year 1970 were used in the regressions.

III. Methodology

The model specifies that the audience share captured by any given television station will depend upon:

(i) the station's network affiliation

(ii) the number and types of television stations available off-the-air within the station's coverage area

(iii) the number and types of channels that are available via cable

(iv) the percentage saturation of the cable system(s) in the station's coverage area

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[11] I wish to thank the Canadian Radio-Television Commission and especially John Hagborg of the Commission for giving me access to the data and granting me valuable computer time, and also Dennis U. Fisher for help in formulating the model.

The model distinguishes among four types of stations:

(i) alternative (or unduplicated) Canadian channels. Stations affiliated with the same network are considered to be duplicate channels.

(ii) duplicate Canadian channels. These are equal in number to the total number of Canadian channels available less the number of Canadian alternative channels.

(iii) American alternative (or unduplicated) channels. Stations with different network affiliations and independent stations are considered to be alternative stations.

(iv) American duplicate channels. These are equal in number to the total number of United States stations available less the number of United States alternative stations available.

The model accepts the proposition that cable viewers, given channel choice equal to the options of off-air viewers, may exhibit substantially different viewing habits from off-air viewers.

Specifically, the model specifies that

$$(1)\quad V_1/V_3 = f\,(X_1, X_2, X_3, X_4)$$

where

V_1 is total viewing hours per week for the test station, off-air.

V_3 is total viewing hours per week for all television, off-air, in the station's coverage area.

X_1 = number of Canadian alternate channels available off-air in the station's coverage area.

X_2 = number of Canadian duplicate channels available off-air in the station's coverage area.

X_3 = number of American alternate channels available off-air in the station's coverage area.

X_4 = number of American duplicate channels available off-air in the station's coverage area.

In other words, equation (1) specifies that a station's off-air viewing share depends upon the number and type of stations available off-air (X_1---X_4).

(2) $V_2/V_4 = f\ (X_5, X_6, X_7, X_8)$

where

V_2 is total viewing hours per week for the test station, cable audience

V_4 = total cable television viewing hours for all television in the station's coverage area.

X_5 = number of Canadian alternate channels available on the cable

X_6 = number of Canadian duplicate channels available on the cable

X_7 = number of American alternate channels available on the cable

X_8 = number of American duplicate channels available on the cable

In other words, equation (2) specifies that a station's cable television share of audience depends upon the number and type of stations available on the cable (X_5---X_8).

Separate estimates are developed for CBC and CTV affiliates for both equations (1) and (2).

(3) $\Delta\hat{V} = \left[V_1/V_3 - V_2/V_4\right] \cdot (W_1 \cdot \bar{a} \cdot H_2)$.

where

$\Delta\hat{V}$ = change in station's total weekly viewing audience in hours due to cable

$\bar{a}$ = average number of people per household

H_2 = number of cable households within the station's coverage area

W_1 = average weekly viewing hours of television by off-air viewers

In other words, equation (3) gives the predicted impact cable television will have on a station's viewing audience.[12]

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[12]Equation (3) is derived as follows:
Let V represent the total number of weekly viewing hours attained by a given television station. V is composed of both off-air and cable viewing hours so that:

$V = V_1 + V_2$ where V_1 and V_2 are as defined above.

Let H. represent the number of households within the station's grade-B contour, H_1 the number of households within this contour without cable and H_2 the number of cable households.

$H = H_1 + H_2$

If v_1 represents the average number of hours per week spent watching the local station by each off-air viewer within the grade-B contour of the station, and v_2 represents the same for cable viewers within the grade-B, and if $\bar{a}$ represents the average number of people per household, then

$V_1 = v_1 \cdot H_1 \cdot \bar{a}$

$V_2 = v_2 \cdot H_2 \cdot \bar{a}$

Represent a hypothetical variable, which is total weekly viewing-hours of the local station if cable were taken away, by $\hat{V}$.

Generally, $\hat{V} > V = V_1 + V_2$. This is due to the fact that H_2 households have now lost cable television, and one would expect them to view the local station more than V_2. H_1 will not change viewing habits.

Now make two diametrically opposed assumptions. Assume first that the removal of cable causes H_2 to adopt H_1 viewing habits. In this case, the extra television viewing time of the cable subscribers, over that of off-air viewers, is attributable entirely to the increased choice and clarity of television signals brought to the viewers by CATV. These former cable viewers in total now will watch the local station $v_1 \cdot H_2 \cdot \bar{a}$ hours/week.

We now have

(a) $\hat{V} - V = \Delta\hat{V} = v_1 \cdot H_2 \cdot \bar{a} - v_2 \cdot H_2 \cdot \bar{a}$

However, if cable households simply watch more t.v. in any case, i.e., cable

$$(4)\ R = f(V)$$

$$(4a)\ \Delta R = f(\hat{\Delta V}).$$

where

R = a television station's total yearly advertising revenues

V = station's average viewing audience in hours (per week)

ΔR = change in station's advertising revenues

$\hat{\Delta V}$ = change in station's average viewing audience (hours per week)

In other words, equation (4), in conjunction with the preceding three equations, estimates the impact cable television will have on a broadcast station's revenues for any combination of signals off-the-air and on cable and for any cable saturation.

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t.v. is a selector of people who choose to watch television more than other viewers independent or CATV, then v_1 gives too small a correction and the new $\hat{\Delta V}$ is:

$$(b)\ \hat{\Delta V} = v_1 \cdot H_2 \cdot \bar{a} \cdot \frac{w_1}{w_2} - v_2 \cdot H_2 \cdot \bar{a}$$

where

w_2 = total weekly television hours per viewer by cable subscribers

w_1 = total weekly television hours per viewer by off-air viewers

Substituting $v_1 = \frac{V_1}{H_1 \cdot \bar{a}}$ and $v_2 = \frac{V_2}{H_2 \cdot \bar{a}}$ into equation (a) above we get:

$$\hat{\Delta V} = V_1 \cdot \frac{H_2}{H_1} - V_2$$

$$\text{or } \hat{\Delta V} = \frac{V_1}{V_3} \cdot V_3 \cdot \frac{H_2}{H_1} - \frac{V_2}{V_4} \cdot V_4$$

Now, $V_3 = w_1 \cdot H_1 \cdot \bar{a}$ and since by assumption $w_1 = w_2$, $V_4 = w_1 \cdot H_2 \cdot \bar{a}$.

Therefore, $(3)\ \hat{\Delta V} = \left[\frac{V_1}{V_3} - \frac{V_2}{V_4}\right] \cdot (w_1 \cdot \bar{a} \cdot H_2)$

In order to run such equations as described above, it is first necessary to develop a standard by which one may declare whether or not a given channel is available in an area. This is a difficult problem owing to the wide geographical extent of some of the sample populations. A given station may attract a sizeable audience in one part of a county, while being unavailable in other areas of the county. This problem becomes less serious, of course, as the area included in the sample decreases, and for this reason metropolitan areas and small counties were used as much as possible in the sample.

The standard adopted consisted of two rules. First, any station which obtained 0.5% or less of total viewing time in the sample area was assumed to be unavailable. Such a standard is clearly acceptable for off-air viewing, but when applied to cable viewing may bias the results somewhat. Such a low percentage viewing time when applied to CATV viewers may indicate the station is simply not very popular, in which case it should be included in the data. It may also indicate, however, that not all cable systems in the sample area (county or metropolitan area) are carrying the station, or that this station is not being carried for the full broadcast day, in which case the station should not be included in the data. In cases in which several stations showed individual viewing times of less than 0.5% of total viewing time, but cumulatively accounted for over 1% of total viewing time, the number of stations said to be available was adjusted upward. For example, if 5 stations each accounted for 0.4% of total viewing time, and cumulatively 2.0% of total time, 2 such stations were declared to be available.

A second, interacting standard, or guideline, was also used. In cases where the off-air viewing share of a station was less than 10% but its share

of the cable viewing time more than twice its off-air share, the station was assumed to be unavailable off-air. Obviously, when speaking of off-the-air availability of stations, it is necessary to keep in mind a continuum of receptions from excellent pictures to very weak pictures, and when one tries to fit a whole continuum into only two groups (available and not available) difficulties arise. However, it seems reasonable to assume that a station with a small but significant off-air viewing share, and which more than doubles its viewing share when placed on an equal footing with other, less distant, stations via cable, is perceived as a highly desirable station. Such a station will carry programmes for which many viewers are willing to put up with an inferior picture, but generally will carry programmes that many viewers would like to watch but for which they are not willing to sacrifice a good technical picture. Such a large increase in these stations' relative viewing shares when placed on cable is indicative of a general unavailability off-air, even though some off-air viewers, whether through superior location, or expensive aerials, or sacrifice in picture quality, may spend considerable time watching the station.

This second standard combines with the first standard for those cases mentioned earlier, when several stations, each with less than 0.5% of the total off-air viewing time but cumulatively more than 1%, are investigated. If some of these stations obtain more than twice the off-air viewing share on cable, they are declared to be unavailable off-air, and when cumulating the percentage shares of such marginal stations they are removed from the total.

These standards may more accurately be termed guidelines. In recognition of the arbitrariness of such rules, a case by case approach was taken and

other factors were brought in, where appropriate, to determine whether a station was or was not available. For example, if the county being studied was small in geographic extent, it was felt the error caused by omitting a station with a viewing share of close to 0.5% might be greater than that caused by including it; the opposite held true for counties covering a large geographic area. The sample of counties and metropolitan areas was chosen to minimize the number of such decisions, however; this in turn served to limit the sample population.

Another factor limiting the sample size was a desire to prevent biases in the sample. Populations were chosen only in cases in which there was a significant cable presence, in order that both sets of equations (off-air and cable viewing patterns) would reflect the same populations, differing only in factors related to the acts of subscribing and not subscribing to cable television. In this way, whatever biases that may have been left in the sample through the selection process should apply equally to both the off-air and cable t.v. equations and as a result it is to be hoped that more confidence may be placed in any differences in viewing patterns that show up in the equations estimated for these two groups.

IV. The Econometric Model

The exposition of the econometric model is given under the following headings:

(a) the effects of CATV on viewing time to the Canadian broadcasting system as a whole

(b) the effects of CATV on CBC affiliated stations' viewing time, and

(c) the effects of CATV on CTV affiliates' audiences

(d) CATV's impact on revenues

(a) Effects of CATV on viewing time to the Canadian broadcasting system as a whole

Three functional forms were used--a simple linear regression of the number of United States and Canadian channels available on percentage viewing time of all Canadian channels available, a Cobb-Douglas or double log function, and the simple regression of the number of Canadian and American signals described above which includes this time the square of the number of United States signals. In each case the Xi represent the number of Canadian signals or American signals available plus one.

A priori one might feel the Cobb-Douglas function would give the best fit since it allows both for the interaction of the number of Canadian and American channels on percentage viewing time and for a decreasing effect on viewing time as the number of American channels is increased. The simple regression has neither of these merits, while the simple regression with the number of United States channels squared allows for only the latter.

Equations A1, A2 and A3 below present the results obtained by fitting data for off-air viewing to the three functional forms; the equations B1, B2 and B3 show parallel results for cable viewing.

A1 Simple regression, off-air.

$$\frac{Vc}{Vt} = 0.936 + \underset{(1.772)}{0.033X_1} - \underset{(-9.976)}{0.116X_2} \qquad r^2 = .62$$

where Vc = total Canadian viewing hours, off-air

Vt = total television viewing hours, off-air

X_1 = number of Canadian channels, off-air, plus 1

X_2 = number of United States channels, off-air plus 1

The coefficients of X_1 and X_2 have the expected signs and are significant at the 95% level. The numbers in parentheses are t-values.

A2 Cobb-Douglas, off-air.

$$n \log\left(\frac{Vc}{Vt}\right) = -0.325 \underset{(2.609)}{0.273}\, n \log X_1 \underset{(-10.483)}{-\ 0.489}\, n \log X_2$$

$$r^2 = .65$$

This equation may be rewritten in the following form:

$$\frac{Vc}{Vt} = 0.325\, X_1^{\,0.273}\, X_2^{\,(-0.489)}$$

A3 Simple regression with X_2^2 included, off-air.

$$\frac{Vc}{Vt} = \underset{(2.739)}{1.111} + \underset{(-7.679)}{0.044X_1} - \underset{(4.898)}{0.305X_2} + 0.029X_2^2 \qquad r^2 = .73$$

It may be well to pause momentarily and compare the results of the above three functional forms. One may reach the following conclusions:

1) In all cases, the coefficients of the X_1, X_2, X_2^2 variables are significant at the 95% level.

2) Both the coefficients of the X_2 and X_2^2 terms and their t-values are greater than the coefficients and t-values of the X_1 variable. This indicates that generally it may be predicted that successive additions of United States channels will have a greater negative impact on Canadian television viewing time than the positive influence of successive additions of Canadian channels, and one may place greater reliance upon the negative impact of United States channels than on the positive influence of Canadian channels.

3) Equations A2 and A3 show higher r^2's than equation A1, and the X_2^2 coefficient of A3 is significant at greater than the 99.75% level of confidence, indicating a declining influence of the number of United States channels on Canadian television viewing time as the number of United States channels increases.

4) Equation A3 gives the highest r^2 indicating that perhaps the interaction of the number of Canadian channels and United States channels is not significant.

The cable television equations, B1, B2, B3 are given below.

B1 $$\frac{Vcc}{Vtc} = 0.756 + 0.022X_3 - 0.069X_4$$
$$(1.748) \quad (-6.518) \qquad r^2 = .42$$

where

Vcc = total Canadian viewing hours on cable

Vtc = total television viewing hours on cable

X_3 = number of Canadian channels plus one on the cable

X_4 = number of American channels plus one on the cable

The coefficients of X_3 and X_4 have the expected signs and are significant at the 95% level.

B2 $$n \log \left(\frac{Vcc}{Vtc}\right) = -0.475 + 0.308\ n \log X_3 - 0.473\ n \log X_4$$
$$(2.916) \qquad (-6.771) \qquad r^2 = .45$$

Equation B2 may also be written as:

$$\frac{Vcc}{Vtc} = 0.475X_3^{(.308)}\ X_4^{(-0.473)}$$

B3 $$\frac{Vcc}{Vtc} = 1.037 + 0.034X_3 - 0.245X_4 + 0.019X_4^2$$
$$(3.254) \quad (-7.295) \quad (5.427) \qquad r^2 = .62$$

As before, one may make the following conclusions:

(1) The coefficients of X_3, X_4, X_4^2 are all significant at the 95% level of confidence.

(2) The fact that the r^2's of equations B2 and B3 are higher than that of B1, and that the t-value of X_4^2 is so significant indicates a declining marginal influence of American channels on Canadian viewing time.

(3) The coefficients of the X_4 terms are greater in all cases than the coefficients of the X_3 terms, indicating that generally the negative impact of successive American channels is greater than the positive impact of successive Canadian channels.

(4) Equation B3 gives much the highest r^2 indicating that the interaction effect of the number of Canadian and American channels may not be as great as previously supposed.

Tables I and II show the estimated percentage viewing times for the Canadian television system under varying Canadian and American channel availabilities. Table I is derived from equation A3 and is in reference to off-air viewers, while Table II is derived from equation B3 and is in reference to cable viewers. For example, Table I estimates that in an area where 3 Canadian and 2 American channels are available off-the-air, the Canadian channels together will attract 63% of the total viewing time, while in an area where 3 Canadian and 3 American channels are available, the Canadian channels together will attract only 53% of total viewing time.

By studying Table I it will be noted that, generally, the negative impact of successive additions of U.S. channels upon Canadian television viewing time will be greater than the positive impact of successive additions of Canadian channels; however, each addition of a U.S. channel will have a successively smaller negative impact.

Table I.--Estimated Percentage Viewing Time of Canadian Television Channels by Off-Air Viewers for Various Combinations of Canadian and United States Channel Availability

Number of Canadian Channels	NUmber of American Channels				
	1	2	3	4	5
1	71	55	44	40	41
2	75	59	49	44	46
3	79	63	53	49	50
4	84	68	58	53	55
5	88	72	62	58	59
6	93	77	66	62	63

Source: Equation A3

$$(Vc/Vt = 1.111 + 0.044X_1 - 0.305X_2 + 0.029X_2^2)$$
$$(2.739) \quad (-7.679) \quad (4.898)$$
$$r^2 = .73$$

Table II.--Estimated Percentage Viewing Time of Canadian Television Channels by Cable Subscribers for Various Combinations of Canadian and American Channels on Cable

Number of Canadian Channels	Number of American Channels					
	1	2	3	4	5	6
1	69	54	43	36	32	32
2	73	58	46	39	35	36
3	76	61	50	42	39	39
4	79	64	53	46	42	42
5	83	68	57	49	46	46
6	86	71	60	53	49	49
7	90	75	63	56	52	53
8	93	78	67	59	56	56
9	96	81	70	63	59	59

Source: Equation B3

$$(Vcc/Vtc = 1.037 + 0.034X_3 - 0.245X_4 + 0.019X_4)$$
$$(3.254) \quad (-7.295) \quad (5.427)$$
$$r^2 = .62$$

A closer study of Table I reveals the following:

1) The addition of a Canadian channel may be expected to increase Canadian viewing time by about 4%. The marginal effect of a Canadian channel, then, is quite constant, regardless of the number of American and Canadian channels available, and the marginal effect is also quite small. This leads to the conclusion that most of the audience for additional Canadian channels will come at the expense of other Canadian channels rather than U.S. channels.

2) The impact of additional American channels declines quite rapidly, but their negative impact tends to be much greater than the positive impact of Canadian channels for the relevant range of station line-ups. For example, the first American channel may be expected to cause a drop in Canadian viewing time of 20-25%, the second of 12-15%, the third 9-11%, the fourth of 4-5%. The fifth U.S. channel will probably have an impact of 0 to 2%.

3) If the number of available Canadian and American channels is equal, the Canadian channels may expect to obtain 50-60% of total viewing time, but their share will decline slowly as this number rises.

By closely studying Table II one may make the following conclusions with regard to cable television viewing patterns:

1) The marginal impact of Canadian channels is quite constant and low (3-4%).

2) The impact of additional American channels again is greater than the impact of additional Canadian channels, but their negative impact upon the audience share of Canadian television tends to decline as successive American channels are added. The second American channel placed on the cable will generally cause a decline of 11-15% in the Canadian audience share, the third will cause a decline of 8-12%, the fourth 4-7%, the fifth 3-5%, and

the sixth 0-3%. Additional U.S. channels will probably not cause any significant change in the percentage share of audience of Canadian television. The higher the Canadian audience share before the addition of the marginal American channel (i.e., the greater the number of Canadian channels) the greater will be the reduction in the Canadian audience share, and this reduction will approach the upper limits set out above.

3) All other things equal, cable viewers watch Canadian television slightly less than off-air viewers, the general range being 3-6% less. This small difference in the viewing habits of the two groups is surprising for two reasons. In the first place, cable viewers have expressed a desire for additional television signals by the very act of subscribing to CATV. This could be interpreted as an expression of stronger preference for American signals than would normally be attributed to those who had not made this decision. In the second place, cable equalizes the picture quality of all channels and one would expect this to have a greater effect on viewing patterns than is apparent from the regressions; it must be pointed out, however, that this effect has been neutralized to some degree by the guidelines used in deciding whether or not a given television station was available off-the-air.[13]

It appears, then, that CATV subscribers prefer Canadian television only slightly less than off-the-air viewers.

4) There are no significant differences for cable and non-cable viewers in the marginal effects of additional Canadian and American channels upon the percentage share of viewing times of Canadian stations.

5) In cases where equal numbers of Canadian and American channels are

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[13]Since stations with up to 10% off-air share of audience were declared to be unavailable if their cable share more than doubled.

carried on the cable, Canadian television's share of total viewing time may be expected to range from about 58%-45%, the lower figure applying when the number of channels is large. This, again, is somewhat lower than for off-the-air viewers.

6) For each functional form, the r^2's for the CATV equations are significantly lower than the corresponding r^2's for the off-the-air equations. The r^2, for example, of equation B3 is .62 while that for equation A3 is .73. The higher unexplained variation in the viewing patterns of cable subscribers is significant when one recalls that the two sample populations were chosen from identical counties and metropolitan areas. One should recall also that the best estimates of viewing patterns of cable and non-cable viewers were identical, except that the former tended to watch Canadian television 3-6% less than the latter. While one may predict identical viewing patterns between these two groups (after allowing for the 3-6% divergence), the cable predictions should be treated with less confidence when being applied to particular populations.

The most likely explanation for the phenomena described above is that while cable subscribers do not show a significantly greater preference for United States television as such (only 3 to 6% more), they do show greater discrimination in the programmes they watch. The relative time they watch Canadian television will depend not only on the number of Canadian and American channels available, but also their "qualities" to a much greater degree than for off-air viewers.

The fact that the regressions for cable and non-cable populations were so similar indicates that by and large the "quality" differences were neutralized over the whole sample (i.e., "good" and "bad" Canadian channels neutralized one another, as did "good and bad" United States channels). The phenomenon showed

upon the r^2, but no attempt was made to take account of differing qualities of stations.

The study turns now from an analysis of viewing patterns for the Canadian broadcasting system as a whole to a study of viewing patterns for individual stations. From this it will be possible to assess CATV's financial impact on broadcasting.

(b) Effects of CATV on CBC stations' audience size

Separate regressions were run for CBC network stations and CTV stations. The remarks that follow regarding the selection of the sample apply to both the CBC regressions to be discussed presently and the CTV regressions to be discussed in section (c).

Regressions were run for cable and non-cable viewers selected from the same geographical entity. In order to ensure that the test station in each case was a local station, the county or municipality in which the station is located was often used. When other counties or municipalities were used, by checking maps and the ratings of the station among off-the-air viewers, the excellence of the television signal in the area was confirmed.

Since the primary purpose of the exercise was to see how CATV's importation of American channels affects local television stations, predominantly French speaking population areas and French television stations were not included in the sample. For the remaining television stations, generally two sample populations were used. The final sample size for CTV stations was 22 population areas and for the CBC 38 such areas.

Determining the expected viewing loss a CBC affiliate will suffer due to the presence of cable involves three steps:

1. A determination of the expected share of the off-the-air audience the station will attain for various combinations of channels available off-the-air.

2. A determination of the expected share of the cable audience the station will retain for various combinations of channels available on the cable.

3. An application of the results of steps 1 and 2 to the formula developed earlier (equation (3)).

These three steps have been carried out in Table III. The supporting equations for Table III follow immediately.

The data were applied to three functional forms--a simple linear regression, a Cobb-Douglas or double log function, and a linear regression including squared terms. In order to avoid clutter, however, only the functional form giving the highest r^2 appears in the text; the other functions are given in footnotes.

Equation A-CBC1 shows the estimated impact various combinations of Canadian and American alternate and duplicate channels off-air will have on a CBC station's off-air viewing share.

$$\text{A-CBC 1.}\quad \text{nlog}\left(\frac{V_1}{V_3}\right) = \underset{}{0.084} - \underset{(-4.654)}{0.564}\text{nlog } X_1 - \underset{(-3.004)}{0.351}\text{nlog} X_2 - 0.623\text{nlog } X_3 - \underset{(-0.881)}{0.132}\text{nlog } X_4 \qquad r^2 = .75$$

Alternate functional forms for these variables are given below.[14]

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[14]The simple linear regression of CBC off-air viewing shares on X_1 is:

A-CBC2 $\frac{V_1}{V_3} = 1.250 - 0.1697X_1 - 0.0679X_2 - 0.1368X_3 + 0.006X_4$

$(-4.657)\quad (-2.259)\quad (-5.821)\quad (0.151)$

$r^2 = .71$

While the simple regression including the squared terms is:

A-CBC3 $\frac{V_1}{V_3} = 1.674 - 0.471X_1 - 0.212X_2 - 0.1198X_3 - 0.066X_4 +$

$(-2.010)\quad (-2.024)\quad (-1.126)\quad (-0.776)$

$0.084X_1^2 + 0.028X_2^2 - 0.004X_3^3 + 0.015X_4^2$

$(1.326)\quad (1.365)\quad (-0.203)\quad (0.299)$

$r^2 = .75$

In equation A-CBC2 the coefficient of X_4 has the wrong sign, but is not significant at the 95% level. The other variables have the expected sign and are significant at the 95% level. In equation A-CBC3, only the coefficients of X_1 and X_2 are significant at the 95% level, while those of X_1^2 and X_2^2 are significant at the 87.5% level. None of the other variables are significant at the 87.5 level. However, only the coefficient of X_3^2 has the unexpected sign. A positive sign for the squared variables (which *a priori* reasoning would lead one to expect) would indicate a declining marginal impact of adding channels.

When equation A-CBC3 was rerun, dropping the X_3^2 term, the following results were obtained:

A-CBC4 $\frac{V_1}{V_3} = 1.675 - 0.462X1 - 0.211X_2 - 0.141X_3 - 0.052X_4 +$

$(-2.039)\quad (-2.053)\quad (-5.622)\quad (-0.023)$

$0.082X_1^2 + 0.028X_2^2 + 0.013X_4^2$

$(1.333)\quad (1.382)\quad (0.252)$

$r^2 = .75$

It is immediately apparent that the dropping of the X_3^2 term causes the coefficient of X_3 to become highly significant ($t = -5.622$) without appreciably changing the coefficient or disturbing the r^2.

X_1 = the number of Canadian alternate channels available off-air in addition to the test station

X_2 = number of Canadian duplicates available off-air plus one

X_3 = number of United States alternate channels available off-air plus one

X_4 = number of United States duplicates available off-air plus one

In equation A-CBC 1 all the coefficients have the expected negative sign (i.e., each additional channel of any category will cause a decline in the viewer share of the local station). The only coefficient that is not significant at the 95% level is that of the $n\log X_4$ term.

The number of American alternates has the highest t-value and the largest coefficient, followed closely by the number of Canadian alternates and then the number of Canadian duplicates. These observations do not hold entirely for the equations in footnote 14, however.

Equation B-CBC 1 shows the estimates impact differing combinations of channels carried on cable will have on a local CBC station's share of the cable television audience.

$$\text{B-CBC 1}\quad \frac{V_2}{V_4} = 0.783 + \underset{(0.381)}{0.0697X_5} - \underset{(-2.299)}{0.214X_6} - \underset{(-.935)}{0.076X_7} + \underset{(0.333)}{0.032X_8} -$$

$$\underset{(-0.459)}{0.0209X_5^2} + \underset{(1.669)}{0.028X_6^2} - \underset{(-0.071)}{0.001X_7^2} - \underset{(-0.296)}{0.004X_8^2} \qquad r^2 = .51.$$

where V_2 = local station's total viewing hours on cable in the population area for the survey week

V_4 = total television viewing time by cable subscribers in the area of the survey week

X_5 = number of Canadian alternates carried on the cable plus one

X_6 = number of Canadian duplicates carried on the cable plus one

X_7 = number of United States alternates carried on the cable plus one

X_8 = number of United States duplicates carried on the cable plus one

Other functional relationships among these variables are given in the footnotes.[15]

In equation B-CBC 1, only coefficients of X_6 and X_6^2 are significant (that of X_6^2 being right at the border of significance) at the 95% level. Both have the expected sign, indicating that duplicate channels have a large impact on the audience of a local station but the marginal influence declines rapidly as successive duplicate channels are added to the cable.

As in equation A-CBC 3 of footnote 14, the coefficient of the square of the number of American alternates (here, X_7^2; in footnote 14, X_3^2) has the unexpected negative sign, although again it is not significant at the 95%

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[15] The simple regression of CBC cable viewing shares on X_i is:

$$\text{B-CBC 2} \quad \frac{V_2}{V_4} = 0.698 + 0.0002X_5 - 0.059X_6 - 0.076X_7 - 0.0049X_8$$
$$(0.005) \quad (-2.947) \quad (-3.452) \quad (-0.224) \qquad r^2 = .45$$

Only the coefficients of X_6 and X_7 (the number of Canadian duplicates and United States alternates) are significant at the 95% level. The coefficient of X_5, the number of Canadian alternates is for all intents and purposes zero, indicating that CTV network stations do not detract from the viewing of CBC stations. The coefficient of X_8 has the expected sign, although it is not significant.

The Cobb-Douglas function is:

$$\text{B-CBC 3} \quad \text{nlog}\left(\frac{V_2}{V_4}\right) = -0.249 - 0.011\text{nlog}X_5 - 0.636\text{nlog}X_6 - 0.668\text{nlog}X_7$$
$$(-0.042) \qquad (-3.089) \qquad (-2.713)$$
$$+ 0.043\text{nlog}X_8$$
$$(0.191) \qquad r^2 = .37.$$

Here, again, only the coefficients of X_6 and X_7 are significant, while that of X_8 now has the wrong sign. Once more, the coefficient of X_5 approaches zero.

level of confidence. Once again, however, it has reduced the t-value of the coefficient of the variable X_7 (in equation A-CBC 3 of footnote 14, X_3) to such a degree that the coefficient becomes not significant--compare t value of -0.935 in equation B-CBC 1 to -3.452 in equation A-CBC 2 of footnote 14. One might conclude, then, that the number of United States alternates (networks plus independent stations) does not seem to have a decreasing impact on the audience of a local station as the number of these alternates increases, at least up to 4 or 5 such American alternates. Canadian broadcasting may be very fortunate that there are only three United States networks.

The coefficient of X_5, the number of Canadian alternates, has the wrong sign, as does X_5^2, but neither are significant. When X_5^2 is dropped, as in equation A-CBC 2 of footnote 14, the coefficient of X_5 approaches zero. This is strong evidence that CTV stations generally have little or no effect on the viewing share of local CBC stations. It appears that viewers do not consider CTV a substitute for the CBC and CTV's audience is derived almost in whole from what could otherwise have gone to the Americans. This is intuitively not as disturbing a finding as one would at first glance believe. CTV has long concentrated on importation of United States programmes, and in 1970 had a schedule of Canadian programmes of only 2-1/2 hours per week.[16] A good proportion of

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[16]CTV's winter prime-time (7-11 p.m.) schedule for 1969-70 gave the following number of hours/week of programming by country of origin:

United States	20-1/2 hrs.
United Kingdom	3 hrs.
Canada	2-1/2 hrs.
hockey	2 hrs.
	28 hrs.

Source: Woods Gordon and Company. CTV Television Network Ltd. Financial Outlook for the Network (Toronto, March, 1971), p. 40.

its Canadian content is designed for foreign (United States) sales and is, therefore, not concerned with Canadian matters.

Once again, the r^2's for the cable equations are well below those for the off-air population.

Next, equations A-CBC 1 and B-CBC 1 are integrated into a single equation C-CBC which predicts the impact CATV has on the total audience of a CBC television station.

$$\text{C-CBC}\quad \hat{\Delta V} = [0.084X_1^{-0.56}X_2^{-0.35}X_3^{-0.62}X_4^{-0.13} - (0.78 + 0.07X_5 - 0.21X_6 - 0.08X_7 + 0.03X_8 - 0.02X_5^2 + 0.03X_6^2)] \cdot w_1 \cdot \bar{a} \cdot H_2.$$

Equation C-CBC gives the best estimate of the increase in viewing hours a typical CBC station may be expected to obtain were CATV banished from its grade-B contour--and by implication, the decline in viewing hours attributable to the presence of CATV--for any combination of channels receivable off-air and on cable.

Table III gives the estimated audience shares a CBC station may be expected to attract under some typical channel availabilities and the impact cable television is expected to have on the viewing time to a CBC affiliate. This table is based on equations A-CBC 1, B-CBC 1 and C-CBC.

Column (5) gives the results of applying the formula $\hat{\Delta V} = [V_1/V_3 - V_2/V_4] \cdot (w_1 \cdot \bar{a} \cdot H_2)$ to CBC audience share data where $\hat{\Delta V}$ is the estimated loss of total audience due to the presence of cable television.

The parameter $\bar{a}$ was calculated to be 2.7, reflecting the national average in 1966 of persons over 14 years of age per household.[17] The parameter w_1 was

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[17]Dominion Bureau of Statistics. Canada Yearbook 1969 (Ottawa: Queen's Printer), 1970, pp. 183-4.

Table III. Change in Audience of Typical CBC Station with Introduction of CATV, together with Station's Estimated Cable and Non-Cable Audience Shares.

	(1) Channels Off-Air X_1 X_2 X_3 X_4	(2) Channels On Cable X_5 X_6 X_7 X_8	(3) Off-Air Viewing Share (%)	(4) CATV Viewing Share (%)	(5) $\Delta\hat{V}$, Audience Loss (Gain) Due to CATV	(6) $\Delta\hat{V}$, Prime-Time Audience Loss (Gain) Due to CATV
(1)	2 1 1 1	2 1 1 1	73.5	60.4	$8.32H_2$ hrs/wk	$6.91H_2$ hrs/wk
(2)	2 1 2 1	2 1 2 1	47.8	52.5	$(2.98H_2$ hrs/wk)	$(2.67H_2$ hrs/wk)
(3)	3 2 2 1	3 2 2 1	29.8	36.0	$(3.94H_2$ hrs/wk)	$(3.27H_2$ hrs/wk)
(4)	2. 2 1 1	2 2 1 1	57.7	45.4	$7.81H_2$ hrs/wk	$6.48H_2$ hrs/wk)
(5)	2 2 4 2	2 2 4 2	22.2	25.1	$(1.84H_2$ hrs/wk)	$(1.53H_2$ hrs/wk)
(6)	3 3 4 3	3 3 4 3	14.9	15.4	$(0.32H_2$ hrs/wk)	$(0.27H_2$ hrs/wk)
(7)	3 4 4 4	3 4 4 4	17.6	14.0	$2.29H_2$ hrs/wk	$1.90H_2$ hrs/wk
(8)	2 2 1 1	3 2 2 1	57.7	36.0	$13.78H_2$ hrs/wk	$11.44H_2$ hrs/wk
(9)	2 1 2 1	3 3 4 3	47.8	15.4	$20.57H_2$ hrs/wk	$17.07H_2$ hrs/wk
(10)	3 2 2 1	3 4 4 4	29.8	14.0	$10.03H_2$ hrs/wk	$8.32H_2$ hrs/wk
(11)	2 2 1 1	3 4 4 4	57.7	14.0	$27.75H_2$ hrs/wk	$23.03H_2$ hrs/wk
(12)	2 1 1 1	3 4 4 4	73.5	14.0	$37.78H_2$ hrs/wk	$31.36H_2$ hrs/wk

Source: Equation C-CBC.

taken to be 23.5 hours/week.[18] A third parameter, w_3 = 19.5 hours/week, was used to estimate average weekly prime-time viewing hours (prime-time is 7-11 p.m.) and calculations in column (6) show the estimated change in prime-time audience due to cable.

The X_1 in Table III represent one more than the number of channels of various types that are available. The first seven rows of Table III give identical numbers of available channels for off-the-air and cable viewers, while rows (8) to (12) show the effect of increasing numbers of channels available on cable over the number available off-the-air upon a CBC station's audience.

Row (1), which estimates the audience for a local station when only one Canadian alternative (a CTV station) is available, may over-estimate the audience loss due to cable. No cable system carrying only two Canadian channels was included in the sample and so this sort of extrapolation may be unreliable.

Similarly, row (4), which estimates viewing shares when one Canadian alternative and one Canadian duplicate channel are available, is atypical, and the drop of some 12% in cable viewing time may be too large.

Apart from rows (1) and (4), Table III shows that in cases in which CATV only serves to strengthen signals that are already available off-the-air, without adding more distant signals, the audience share of a local CBC station should not be expected to drop off significantly for CATV subscribers as compared to off-the-air viewers. In general, the audience share of cable subscribers will differ by only 4 to 5% from the off-the-air audience.

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[18]Canadian Broadcasting Corporation. "The Impact of Cable Television on the Audiences to Canadian TV Stations," TV/69/74, December, 1969. (Mimeo.)

This finding is highly significant. It reinforces the previous conclusion that cable television subscribers do not have greatly different viewing habits than conventional viewers, and that they apparently do not exhibit, through the act of subscribing to CATV, any greater dissatisfaction with their local television stations. These results indicate also that the only danger inherent in CATV vis à vis the Canadian broadcasting system is through the ability of cable t.v. to increase channel availability. This is not meant to minimize this danger, of course, but it bears emphasizing that CATV by itself does not appear to change viewing habits.

These similarities in viewing habits of the two groups is very important for the longer range ability of Canadian broadcasting to survive. Fear has been expressed that Canadians would become more and more addicted to United States television because of its expensive mass-appeal type programming. It had been forecast that by placing such foreign channels on cable, thereby equalizing the technical qualities of the American and Canadian signals, Canadians would begin to shift their preferences toward these more expensive, lighter, television programmes. Table III suggests no such trend.

The concern expressed by the CRTC, broadcasters and observers of Canadian broadcasting over the deleterious effects of CATV on audiences for local stations is shown to be well-founded by rows (8) to (12) of Table III. This part of the table gives the estimated loss in viewer hours for stations when CATV is allowed to bring in distant signals that are unattainable off-the-air.

For example, row (8) shows that when 1 Canadian alternate and 1 Canadian duplicate channel are available off-the-air and CATV imports an additional Canadian alternate and one American signal, the percentage of viewing time attained by the local station on cable may be expected to be some 20% less than

off-the-air (36.0% compared to 57.7%). This represents a total loss in viewing hours per cable household per week of 13.8 hours, or in total 13.8 H_2 hours, and 11.4 H_2 prime-time hours.

If, as in row (12), one Canadian alternate is available off-the-air, while CATV carries two Canadian alternates, three Canadian duplicates, three American alternates and three American duplicates, the local station's shares of viewing time are 73.5% off-the-air and 14.0% on cable, representing a total loss in viewer-hours of 37.8 H_2 hours per week.

The magnitude of these declines in viewer-hours is very large. The public policy implications of these results will be studied after the effects of CATV on CTV affiliates' audience shares have been discussed.

(c) Effects of CATV on CTV affiliates' audience shares

Equation A-CTV 1 below explains the variation in a local CTV station's audience share by the availability of off-air signals.

$$\text{A-CTV 1.}\quad \frac{V_1}{V_3} + 0.321 + \underset{(0.861)}{0.115X_1} + \underset{(0.246)}{0.061X_2} - \underset{(-2.434)}{0.127X_3} - \underset{(-0.087)}{0.012X_4} \qquad r^2 = .39.$$

An alternate functional form is given below.[19]

In equation A-CTV 1 the coefficient of the X_3 term is significant at the

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[19] A-CTV 2 $\quad \text{nlog}\frac{V_1}{V_3} = -1.391 + \underset{(0.913)}{0.733\ \text{nlog}X_1} + \underset{(1.560)}{0.395\text{nlog}X_2} - \underset{(-2.403)}{0.662\ \text{nlog}X_3} - \underset{(-0.371)}{0.209\text{nlog}X_4} \qquad r^2 = .34$

In equation A-CTV 2 the coefficient of $\text{nlog}X_3$ is significant at the 95% level; the other coefficients are not. The coefficients of $\text{nlog}X_1$ and $\text{nlog}X_2$ have an unexpected positive sign.

95% level of confidence. The coefficients of the X_1 and X_2 terms have the unexpected positive sign; the remaining coefficients have the expected signs.

Equation B-CTV 1 shows the variation in the viewing shares of local CTV stations explained by CATV channel availabilities.

$$\text{B-CTV 1.}\quad \frac{V_2}{V_4} = 2.871 - \underset{(-2.665)}{1.715X_5} + \underset{(3.823)}{0.421X_6} - \underset{(-4.400)}{0.317X_7} - \underset{(-0.858)}{0.153X_8} + \underset{(2.508)}{0.323X_5^2} - \underset{(-3.258)}{0.070X_6^2} + \underset{(1.809)}{0.023X_7^2} + \underset{(0.572)}{0.029X_8^2} \qquad r^2 = .91.$$

Again, alternate functional forms for the cable viewing regressions are given below.[20]

In equation B-CTV 1 all but the coefficients of X_8 and X_8^2 are significant at the 95% level of confidence. The coefficient of X_6 (the variable representing the number of Canadian duplicate channels) is positive, which is contrary to

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[20] B-CTV 2 $\frac{V_2}{V_4} = 0.889 - \underset{(0.887)}{0.074X_5} + \underset{(1.072)}{0.042X_6} - \underset{(-6.462)}{0.145X_7} - \underset{(-0.485)}{0.020X_8}$ $\qquad r^2 = .79$

B-CTV 3 $\text{nlog}\frac{V_2}{V_4} = 0.703 - \underset{(-2.237)}{1.458\text{nlog}X_5} + \underset{(2.918)}{0.892\text{nlog}X_6} - \underset{(-6.356)}{1.285\text{nlog}X_7} - \underset{(-0.899)}{0.216\text{nlog}X_8}$ $\qquad r^2 = .75$

Of the variables in equation B-CTV 2, only the coefficient of the X_7 term is significant at the 95% level. Again, the coefficient of the X_6 term has the opposite sign to that which would be expected a priori.

In equation B-CTV 3, only the coefficient of the X_8 terms is not significant at the 95% level; once more, the coefficient of X_6 has the unexpected positive sign and is this time significant at the 95% level of confidence.

a priori reasoning and is highly significant, although this positive influence on local CTV viewing time is counteracted somewhat by the negative coefficient of X_6^2, which is, incidentally, also highly significant.

Why do the number of Canadian duplicate channels apparently raise the relative viewing time of a CTV station? At the time of the audience survey from which these equations were run (late 1969) there were but eleven CTV network stations in Canada.[21] Such stations are then regional in character. In only two areas are two CTV affiliates in such geographic proximity that a cable system is able to duplicate the local CTV station (CKCO in Kitchener, CFTO in Toronto, CJOH in Ottawa, and CFCF in Montreal).[22] For all intents and purposes, then, the variable X_6 in equation B-CTV 1 represents the number of CBC affiliated stations that may be received. CBC affiliates are much more local in character than CTV affiliates and often face extensive duplication on cable.

The number of duplicate CBC stations that a CATV system can import (without the aid of microwave) probably correlates well with both the regional population density of the CTV station's locale and with that region's economic well-being. In lesser populated areas, and in poorer areas, one would expect to find

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[21] Canadian Radio-Television Commission. CRTC Annual Report 1968-69 (Ottawa), 1969, p. 5. This is subject to change in the near future. The CRTC is requiring CTV to extend its coverage area in Canada by means of re-broadcasting stations; this may have the effect of increasing the amount of duplication of CTV stations' service, in which case the number of Canadian duplicates will probably correlate positively with a decreasing expected audience share for a local CTV station. See CRTC Public Announcement, March 10, 1972. As of March, 1972, there were 14 CTV affiliates.

[22] The only English language independent station in Canada, at this time, CHCH in Hamilton, was treated as an alternative to CTV in the regressions, but its own audience/number-of-channels data was included in the CTV sample. Its coverage area also overlaps those of CFTO and CKCO.

fewer television stations (and more rebroadcasting stations) than in closely populated, richer areas. This means that the largest and wealthiest of the CTV affiliates are to be found in areas in which the number of duplicate Canadian channels (i.e., CBC affiliates) is relatively high, whereas the smaller CTV stations are located in areas served by fewer CBC affiliates. If larger, wealthier CTV affiliates are able to retain their audiences better than the smaller one, then the apparent anomaly in connection with the positive coefficient of the X_6 term is explained. There is, of course, no causal relationship between the number of CBC affiliates available and the increase in the CTV stations' audience, but this relationship remains useful for prediction purposes.

There is a second facet to the CTV equations that deserves explanation. The regressions of CTV viewing time on channel availabilities for CATV audiences give much higher r2's than do the regressions for off-air viewing (r^2 = .91 for cable audiences; r^2 = .39 for off-air audiences). This contradicts the pattern developed earlier.

Once again, the explanation of this phenomenon probably lies in the regional nature of CTV stations. Whereas top quality pictures are available for CBC stations from a local television outlet for every major population centre in the country, the same is not true for CTV outlets, and other audiences without cable will have to make do with a poorer picture in order to watch CTV. Such variations in picture quality are not accounted for satisfactorily in equation A-CTV 1 and may show up in the lower r^2; such variations are automatically removed for cable equation B-CTV 1 and thereby result in a higher r^2.

One may only guess, however, why the r^2 of .91 for CTV's cable share is so much higher than the r^2 both for CBC's off-air and cable audience (which are .75 and .51 respectively). One possible explanation is that CBC stations show

a much larger range in performance than CTV stations. This is intuitively appealing since CBC stations are composed of both the publicly owned stations, whose performance tends to be much higher,[23] and privately owned affiliates, whereas CTV affiliates are all privately owned and operated. However, even within the CTV group, one must expect a range of performances as one moves from large to smaller stations.

Next, equations A-CTV 1 and B-CTV 1 are integrated into a single equation C-CTV which predicts the impact of CATV on the total audience of a CTV television station.

$$\text{C-CTV} = \Delta\hat{V} = [0.321 + 0.115X_1 + 0.061X_2 - 0.127X_3 - 0.012X_4 - (2.8171 - 1.715X_5 + 0.421X_6 - 0.317X_7 - 0.153X_8 + 0.323X_5^2 - 0.070X_6^2 + 0.023X_7^2 + 0.029X_8^2)] \cdot w_1 \cdot \bar{a} \cdot H_2.$$

Equation C-CTV gives the best estimate of the increase in viewing hours a typical CTV station may be expected to obtain were CATV banished from its grade-B contour--and by implication, the decline in viewing hours attributable to the presence of CATV--for any combination of channels receivable off-air and on cable. Table IV was derived from equation C-CTV.

In column four of Table IV, which shows the expected audience shares among CATV subscribers, there is one estimate which seems unreasonable, and this occurs in row four. It is improbable that a CTV affiliate would obtain 87.7%

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[23]The CBC reports that CTV stations generally lose more of their audience as a result of cable penetration than CBC-owned and operated stations (but relatively less than CBC private affiliates). And the greater audience loss by CTV than the CBC-owned stations is most pronounced in those major population centres in which both CBC and CTV stations are located. See CBC Research Report TV/69/74, op. cit., p. 5.

Table IV. Change in Audience of a Typical CTV Station with Introduction of CATV, together with Station's Estimated Cable and Non-Cable Audience Shares

	(1) Channels Off-Air X_1 X_2 X_3 X_4	(2) Channels On Cable X_5 X_6 X_7 X_8	(3) Off-Air Viewing Share (%)	(4) CATV Viewing Share (%)	(5) V; Audience Loss (Gain) Due to Cable	(6) V; Prime-Time Audience Loss (Gain) Due to CATV
(1)	2 1 1 1	2 1 1 1	47.3	66.6	(12.26H_2 hrs/wk)	(10.18H_2hrs/wk)
(2)	2 1 2 1	2 1 2 1	34.6	35.5	(0.57H_2 hrs/wk)	(0.47H_2hrs/wk)
(3)	3 2 2 1	3 2 2 1	52.2	48.3	2.48H_2 hrs/wk	2.06H_2hrs/wk
(4)	2 2 1 1	2 2 1 1	53.4	87.7	(21.78H_2 hrs/wk)	(18.08H_2hrs/wk)
(5)	2 2 4 2	2 2 4 2	14.1	20.5	(10.41H_2 hrs/wk)	(8.64H_2hrs/wk)
(6)	3 3 4 3	3 3 4 3	30.5	26.8	2.35H_2 hrs/wk	1.95H_2hrs/wk
(7)	3 4 4 4	3 4 4 4	35.4	24.9	6.67H_2 hrs/wk	5.73H_2hrs/wk
(8)	2 2 1 1	3 2 2 1	53.4	48.3	3.24H_2 hrs/wk	2.69H_2hrs/wk
(9)	2 1 2 1	3 3 4 3	34.6	26.8	4.95H_2 hrs/wk	4.11H_2hrs/wk
(10)	3 2 2 1	3 4 4 4	52.1	24.9	17.27H2 hrs/wk	14.33H_2hrs/wk
(11)	2 2 1 1	3 4 4 4	53.4	24.9	18.10H_2 hrs/wk	15.02H_2hrs/wk
(12)	2 1 1 1	3 4 4 4	47.3	24.9	14.22H_2 hrs/wk	11.80H_2hrs/wk

Source: Equation C-CTV.

of total viewing time when competing with two CBC channels on cable. The reason that the underlying equation (B-CTV 1) failed to perform well in this instance is due to the fact that cable systems seldom, if ever, carry only three Canadian channels and no American channels, and such backward extrapolation has led to a large error. The remainder of column four appears quite reasonable and the high r^2 of .91 for the supporting equation means it should be quite reliable.

Table IV shows that when at least one U.S. signal is available off-the-air, and when the CATV system carries the same number and types of channels as are available off-the-air (Rows (2), (3), (5), (6), (7)), the CTV station may experience a slight decline in its viewing share, due to the increased clarity of the American signals. Rows (1) and (4) indicate, however, that when no United States signal is available off-the-air or on the cable, the CTV share may rise due to CATV. The reservations mentioned above for the element in column (4) row (4) also hold for column (4) row (1), so that the increases in the cable viewing shares of CTV stations as shown may be inflated but they do reflect a tendency. This would be due, probably, to the regional character of the CTV stations so that cable often improves their picture quality.

As would be expected, when CATV imports distant American signals that are otherwise not available, the CTV station suffers significantly.

When Tables III and IV are studied together, some interesting conclusions may be reached.

(1) A local CBC television station is able to retain its off-the-air audience better than a CTV station when the number of off-air channels is few (compare rows (1), (2), (4)). This is the case in which neither the CBC nor the CTV station faces substantial duplication.

(2) When the number of channels available off-the-air is large, the CTV station is better able to retain its audience share. This is due in part to the fact that the CBC channel now faces direct competition from other CBC channels, whereas the CTV affiliate generally faces no such duplication. (See rows (5) and (6)).

(3) An additional American off-the-air alternate will affect both types of Canadian stations about equally.[24]

(4) Duplicate United States channels may prove to be relatively more harmful to CTV than CBC stations.[25]

(5) A CTV outlet appears to fare somewhat better on cable than a CBC outlet when facing only limited competition (rows (1), (2), (4)) due perhaps to the improvement in the former's signal.

(6) When the number of channels on cable is large, the CTV station will generally gain a large audience share than the CBC station, in part because of the frequent distribution of CBC channels on cable in contrast to the infrequent duplication of CTV channels. Thus, in row (5), with one duplicate Canadian channel, the CBC station's share of audience is 25.1% while the CTV station's share is only 20.5%, but in rows (6) and (7), as the number of duplicate channels rises to two and three respectively, the CBC station's share falls well below that of the CTV station's share.

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[24]Compare the coefficient of -0.623 for CBC to -0.622 for CTV for the $n\log X_3$ terms in equations A-CBC 1 and A-CTV 2; and their respective coefficients of -0.138 and -0.127 in equations A-CBC 2 and A-CTV 1.

[25]The coefficient of the $n\log X_4$ term and X_4 term for CBC stations in equations A-CBC 1 and A-CBC 2 are respectively -0.132 and +0.006 whereas the corresponding coefficients in the CTV equations A-CTV 2 and A-CTV 1 are -0.209 and -0.012. None of these coefficients are significant at the 95% level, however, All references in this footnote are to Appendix B.

(7) When the number of channels that may be received both off-the-air and on cable is large, the CBC affiliate appears to be less harmed by cable than the CTV station (row (6) and (7)). The former is able to retain quite well its off-the-air share of audience on the cable, while the latter shows a substantial decline in the CATV share of audience. When the signal qualities of American and Canadian stations are equalized through cable, CTV shows itself to be a good substitute for American stations, while the CBC seems to be sufficiently differentiated to withstand this pressure.

(8) CTV stations have an insignificant effect on CBC stations on cable. Apparently the CTV audience does not come from the CBC but from what would otherwise have gone to the American networks.[26]

(9) Duplicate Canadian channels hurt the cable viewing share of a CBC station, but are associated with increased cable audience for CTV stations.[27] This apparent anomaly is probably due to the fact that the presence of duplicate Canadian channels on the cable will almost always indicate duplication of CBC stations and almost never duplication of CTV stations. Therefore, it is obvious why duplicate channels will be associated with a decline in a CBC affiliate's audience share and not be associated with a decline in the CTV affiliate's audience share.

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[26]This conclusion is not directly apparent from Tables III and IV but is apparent from studying the underlying equations. The coefficients of the X_5 term in equations B-CBC 1 and B-CTV 1 are respectively +0.0697 (t value = 0.381) and -1.715 (t value = -2.715). The fact that the coefficient for X_5 in the CBC equation is not significant and is almost zero indicates the lack of importance on the CBC of CTV's presence. The fact that the coefficient of X_5 in the CTV equation is both significant and large reflects the fact that other Canadian alternate channels in addition to the English CBC (such as the French CBC, independent French station CFTM, independent English station CHCH) will cause a decline in the CTV's viewing share. Remember that the English CBC is always present when the CTV is available.

[27]The coefficients of X_6 are -0.214 in equation B-CBC 1 and +0.421 in B-CTV 1, both being significant.

(10) American alternate channels harm CTV to a much greater extent than they harm CBC affiliates, again indicating the closer substitutability between CTV and American stations than between CBC and American stations.[28] This would indicate that the CBC is doing a much better job of implementing the mandate set for broadcasting in the Broadcasting Act than are CTV affiliates.

(11) Duplicate American channels also hurt the CTV stations more than CBC stations on cable.

(d) CATV's impact on revenues

Next, regressions are displayed which show the audience-revenue relationship for Canadian television stations. Fifty-four privately owned television stations in Canada were put into the regression, and equation D shows the results based on data for 1970.

D. $R = -3082.1 + 38.763A - 0.0458A^2 + 21.532Q$
$\qquad\qquad\quad (9.939) \quad (-6.525) \quad\quad (3.043)$

$r^2 = .79$

R = television station's total yearly advertising revenue in thousands of dollars

A = average prime-time audience in thousands (7-11 p.m.)

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[28]The coefficients of the X_7 term and the nlog X_7 term are much higher for CTV stations than CBC stations. Compare the CBC coefficients of -0.076, -0.76, and -0.668 (in equations B-CBC 1, B-CBC 2, B-CBC 3) with CTV coefficients of -0.317, -0.145, and -1.285 (in equations B-CTV 1, B-CTV 2 and B-CTV 3 respectively).

Q = a market quality variable,[29] the mean value of which is 100

The three coefficients are significant at the 95% level of confidence and have the expected signs.

Unfortunately, the high t-values and high r^2 of equation D are deceiving and it will be necessary to treat the hidden implications and underlying causes of equation D below. For now, however, it is convenient to use equation D to complete the model of the financial impact of CATV on broadcasters.

By taking the partial derivative of equation D with respect to A, whereby $\frac{\partial R}{\partial A} = 38.753 - 0.0916A$, it becomes obvious that the impact of a change in audience size upon station revenues declines as the audience grows. For instance, if a station's average prime-time audience declines from 71,000 viewers to 70,000

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[29] A market's quality index is described by its creators thusly:

> A market's percent of the national population can be taken to represent par. Divided into the Buying Power Index, it yields the Quality Index, which shows the extent to which the market's "quality" is above or below par (represented by 100). Since the quality index compares the per capita income and per capita sales to the corresponding figures for the U.S. a high index could reflect either high buying power or a high influx of shoppers....
>
> [The Buying Power Index is] a weighted index that converts three basic elements--population, Effective Buying Income and retail sales--into a measurement of a market's ability to buy, and expresses it as a percent of the U.S. potential. It is calculated by giving a weight of 5 to the market's percent of the U.S. Effective Buying Income, 3 to its percent of U.S. retail sales, and 2 to its percent of U.S. population. The total of these weighted percents is then divided by 10 to arrive at the BPT....
>
> [Effective Buying Income is] personal income-wages, salaries, interest, dividends, profits, and property income minus federal, state, and local taxes.... Effective Buying Income is generally equivalent to the Government's "disposeable personal income."

Sales Management Magazine, June 10, 1970.
For Canadian markets, of course, the bases used are Canadian rather than American.

there will be a resulting decline of $32,260 in total advertising revenues, while for a decline in viewers from 170,000 to 169,000, the decline in advertising revenues will only be $23,191 for the year.

By multiplying A, the average number of prime-time viewers, in thousands, in equation D by 19.5, the rough estimate used previously of the average number of prime-time viewing hours per viewer per week, equation E will express station revenues as a function of total prime-time viewing hours in thousands.

E. $R = -3082.1 + 755.879V - 17.415V^2 + 21.532Q$

where V = weekly prime-time viewing hours

The change in revenues, due to a change in total weekly prime-time viewing hours, is:

F. $\Delta R = 755.879\hat{\Delta V} - 17.415V.\hat{\Delta V}.$

By combining equations F and C-CBC, the estimated financial impact on a typical CBC privately-owned affiliate is finally derived:

G. $\Delta R = [755.879 - 17.415V] \cdot [(.084X_1^{-.56} X_2^{-.35} . X_3^{-.62} . X_4^{-.13}) - (.78 + .07X_5 - .21X_6 - .08X_7 + .03X_8 - .02X_5^2 + .03X_6^2) \cdot (19.5)(2.7) \cdot H_2)]$

where ΔR = change in revenues attributable to the presence of CATV

V = total prime-time viewing hours of station per week

X_i = various channel availabilities as defined previously

H_2 = number of CATV households within the station's grade-B contour

19.5 and 2.7 represent respectively the average number of prime-time weekly viewing hours (per viewer) and the average population over 14 years of age per household

Equation H gives the estimated financial impact of CATV upon a CTV affiliate:

H. $\Delta R = [755.879 - 17.415V] \cdot [(.321 + .115X_1 + .061X_2 - .127X_3 - .012X_4) - (2.871 - 1.715X_5 + .421X_6 - .317X_7 - .153X_8 + .323X_5^2 - .070X_6^2 + .023X_7^2 + .029X_8^2) \cdot (19.5)(2.7) \cdot H_2]$

Equations G and H estimate the financial impact of an existing CATV system on the local broadcaster. They may also be used to predict the financial impact of any projected change. For instance, H_2 may be adjusted upward to reflect the projected ultimate number of cable subscribers. Similarly, any of the X_5 --- X_8 may be changed to reflect a desire by the cable operator to change his alignment of channels, and the differential effect of the change on the broadcaster may be estimated.

A short summary of the major findings to this point is next given.

(1) With regard to viewing time of the Canadian broadcasting system, it was found that successive additions of American signals (both off-the-air and on cable) have a greater negative impact than the successive addition of Canadian channels, but there exists a significant declining marginal impact on viewing time for successive American channels. Whereas the positive marginal influence of additions of Canadian channel availabilities tends to be quite constant at 3 to 4%, the declining negative impact of American channels is reflected by the predictions that the first American channel will cause a decline of 20-25% in total Canadian television viewing time while the fourth United States channel will cause a decline of only 4-5%.

(2) With regard to viewing time of the Canadian broadcasting system, it was found that cable viewers tend to watch Canadian television only slightly less (3-6%) than off-the-air viewers when confronted with similar channel availabilities. There was no significant difference found in the effects of adding successive United States and Canadian channels upon viewing patterns of cable vs. off-air viewers. These similarities in viewing patterns between cable and off-air viewers are supported by CBC findings that cable and off-air viewers watch approximately the same amount of television per week.

(3) For any given line-up of channel availabilities, the expected viewing shares of the Canadian broadcasting system on cable and off-the-air are approximately the same, but the variations around the mean (predicted) shares are greater for the cable viewers than the off-air viewers, as reflected in the lower r^2's for the cable regressions. This finding may be interpreted as meaning that CATV subscribers show a greater discrimination in their viewing habits.

(4) With regard to the viewing time of a typical CBC affiliate it was found that cable will not significantly disturb the station's off-air viewing share if CATV does not import distant stations that would otherwise be unavailable. When CATV imports such stations, however, it can have a significant deleterious impact on the CBC affiliate's viewing share.

(5) Where the number of United States signals available off-the-air and on cable are few, CATV may help a CTV affiliate's audience by strengthening its signal. However, CTV suffers significantly with the importation via cable of otherwise unavailable American signals.

(6) CBC affiliates tend to be better able to maintain their audience shares in face of increased United States competition than do CTV affiliates, but they suffer from duplication of CBC network programming on cable. The addition of a CTV network affiliate's signal to a CBC affiliate's coverage area does not significantly disturb the latter's viewing share, indicating that the CTV station's audience comes in most part from that which would otherwise be captured by the United States stations. CTV and American stations appear to be relatively good substitutes and both appear to be relatively poor substitutes for CBC stations.

(7) While a strong statistical audience-revenue relationship exists, its actual significance is clouded due to factors not explicitly taken into account

in the regression.

Unfortunately, in terms of model building, but fortunately in terms of the long-range ability of the Canadian broadcasting system to survive, the financial impact of cable television is a good deal more complicated than has yet been admitted. The scope of this article does not permit a full discussion of the economics of broadcast advertising and without such discussion it is impossible to profitably offer public policy proposals. Suffice it to say that equation D presented earlier, $R = 3082.1 + 38.763A - 0.0458A^2 + 21.532Q \qquad r^2 = .79$ which posits a direct relationship between audience size and broadcast revenues, is an over-simplification of a complex area of study. Another regression was run which more accurately reflects the economics of broadcast advertising, viz:

I. $R = 20.358 + 0.245\ Re \qquad r^2 = .93$
$\qquad\qquad\qquad\quad (26.78)$

where R = station's revenues in thousands of dollars

Re = reach.[30]

Since most television stations are assured that a very high proportion of the viewers within their reception areas will tune in the station sometime during the week, reach is in fact a very good proxy for population within the areas. But it is a poor proxy for what the stations actually sell the advertiser--actual viewers. To this point in time, however, advertisers have been most concerned with the cost per thousand when viewers are defined as the station's weekly reach.

Without going into greater detail at this time it can be shown that in order

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[30]A station's reach, or net weekly circulation, refers to the number of unduplicated homes that turned on the station sometime during the week.

to protect the revenues of Canadian broadcasters, CRTC policy should be directed toward ensuring that each television station in Canada maintains its position of dominant reach in its coverage area. Should an American station overtake the local station in terms of reach, there will result a sharp decline in the station's revenues. Such a policy can be pursued in several ways, the most promising of which include regulations requiring cable companies to carry duplicate American channels (in order to fractionalize the audiences for individual U.S. stations) while at the same time prohibiting the duplication of Canadian stations of the same network affiliation (in order to avoid the fractionalization of the audience to the local station). Further discussion on these points must await a future article.[31]

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[31] See, however, Robert Babe, The Economics of the Canadian Cable Television Industry, 1972. A Ph.D. dissertation available from the Michigan State University library.