THE PROFITABILITY AND VALUE OF LICENSES IN RADIO, TELEVISION, AND CABLE TV

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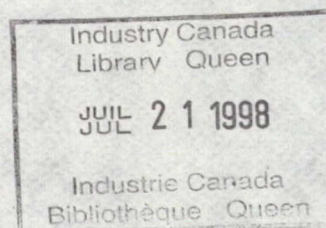
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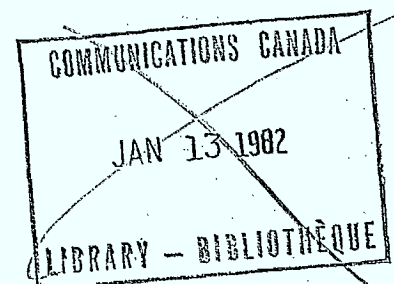
FOREWORD

This report was written as part of a research project for the Department of Communications. The original purpose of this research was the development of a methodology for the valuation of the electromagnetic spectrum. Given the administrative allocation of the spectrum into various totally different uses, it became obvious that the value of the spectrum in any one use was closely related to the value of the spectrum in the competing uses. Hence, the value of the landmobile spectrum, for instance, depends on the value of the broadcasting spectrum, with which it shares the VHF and UHF zones of the spectrum. The valuation of the spectrum in broadcasting led naturally to the valuation of the broadcasting licenses; the methodology was then easily extended into the valuation of CATV licenses.

Throughout this research we have benefited with discussions with several people, whom we would like to thank for their help and advice in producing this report. In particular, we would like to thank Dr. George Warskett of Carleton University (formerly of DOC), Dr. Michel Andrieu, and Mrs. Shirley Serafini of DOC who supervised the research. Mr. Harry Halliwell of the CRTC, Miss Beverly Hillman of DOC (formerly of the CRTC) and Mr. Jan Vanderveen of DOC also lent their assistance in specific parts of the project. The econometric work benefited from the advice of Dr. Thomas Birnberg of the Department of Economics, and Dr. Richard Zind of the Faculty of Administration, both at Ottawa University. Needless to say, we retain sole responsibility for all errors.

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Executive Summary

The profitability and value of Licenses in Radio, Television,

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This study is an econometric investigation of the determinants of profitabi-
lity and the resulting market value of a radio or TV broadcasting station, or of
a CATV system. This market value could be observed in the cases of sales of assets
and license. The prices paid in these sales, and profitability and cost data
from DOC files provided the basic information for our research.
research.

The output of this study has direct relevance to regulatory policy. A number
of characteristics of the license that are uniquely determined by the regulator
such as the allowed power of a television station, and the size of the franchise
for a CATV system are expected to influence profitability, and our results will
allow the regulator to determine the size of the economic benefits that he bestow
upon the licensee. This, in turn, will enable the regulator to assess the extent
of "unprofitable" requirements (such as local programming in CATV and Canadian-
produced programs in TV) that he may impose upon the licensee. Further, were the re-
gulator to decide to auction the licenses, the results of this study would allow
him to determine a reservation price or an estimate of the proceeds from such an
auction.

The methodology used to determine the value of the license is the standard
method of determining the value of any income-producing asset. This value is equal
to the capitalized stream of expected net earnings minus an adjustment for risk or
risk-premium. The net earnings or profitability are determined on the basis of the

micro-economic theory of the firm under monopoly or oligopoly. The adjustment
for risk is measured as a residual after subtracting the annual interest charges
of the market value from the expected profitability; its determinants are found
as extensions of the profitability estimates. The basic tool is least squares
regression.

The results obtained may be summarized briefly as follows: CATV profits de-
pend on the size of the franchise (measured in terms of potential subscribers),
the subscription price allowed by the regulator, and a number of other secondary
terms, among which local programming has a negative effect on profitability. A
number of these factors also affect the observed risk-premium. It was found that
the CATV systems in our sample were quite profitable, but they also were perceived
by the market as being quite risky. This risk was not found to come from portfolio
effects, and we interpreted it as being due to institutional instability and juris-
dictional or regulatory uncertainty.

Profitability in radio broadcasting was found to be different between CBC affi-
liates and independents. For the CBC-affiliates the profitability was found to de-
pend on exogenously determined variables (i.e. by the regulator). For independent
radio stations the programming effort appeared as a significant determinant of pro-
fitability. In this case the programming effort was chosen optimally by the broad-
caster. In both CBC-affiliates and independents the average profitability did not
appear to be much higher than the riskless rate of interest. Hence, the "risk-
premium" did not have a uniform sign throughout our sample.

In television broadcasting the regulator-determined variable of the AB contour
population (a function of the allowed power of the station) is the most important
determinant of profitability. Other variables playing a role are an index of the

number of competing stations, and the family income. CTV affiliation also has a significantly positive influence on profitability. The average profitability of TV stations is quite high, both with respect to the fixed investment as well as with respect to the purchase value of the station.

The policy implications to be derived from such a study were discussed earlier. Since CATV profitability is a direct function of regulatory policy, we recommended the transfer of franchise award jurisdiction to local government, with the proviso that the franchises be auctioned and the proceeds used for local government finance. In this sense the recent recommendation that jurisdiction over CATV be transferred to the provinces is a step in the right direction. We recommended a similar auction system for TV and radio, but in case this is thought impractical we recommended that Canadian content requirements be made an increasing function of the size of the AB contour of the station (measured in audience terms).

With additional data the methodology developed in this report may be used to evaluate the following items: a) The impact of the divestiture legislation upon the value of radio and CATV licenses. b) The impact of Canadian content rules upon the profitability of broadcasting stations. c) The valuation of the spectrum in broadcasting as opposed to competing uses, such as, for instance, land mobiles.

CHAPTER I: INTRODUCTION AND
BACKGROUND TO THE STUDY

I. Introduction

In recent years the economic and cultural issues arising out of the regulation of Canadian broadcasting have become the focus of a lively debate. While the cultural issues are primarily of domestic interest, the economic questions raised by the operation of the regulatory process in broadcasting transcend the realm of the country. In Canada, however, the two sets of issues cannot be separated easily, since the cultural guidelines imposed upon broadcasters by the regulatory authority have undoubtedly important economic consequences.

The institutional context of the broadcasting industry in Canada is fairly well-known in its ssalient features and needs to be summarized only very briefly here. The three main components of the industry (AM radio, TV, and Community Antenna Television or CATV) are under the jurisdiction of the same regulatory authority, the Canadian Radio-television and Telecommunications Commission (CRTC). Each component has its own special product and market structure. Thus, AM radio stations operate under the market structure of oligopoly with rigidly controlled entry into the market under the form of licensing by the CRTC. They compete for audience (and, thus, for advertising revenues) primarily with each other, although the "product" that they sell (advertising time) is

a close substitute of products sold by other types of firms (e.g. newspaper and TV advertising). Television stations are also in oligopolistic markets with controlled entry, but the competition in their case is broader and may extend over markets that are considerably less well-defined geographically; this because CATV may bring distant signals into a geographical market, while simultaneously providing access to wider audience than would have been available to a particular TV station on the basis of simple off-the-air broadcasting. Finally, CATV differs substantially from the other two because it is a regulated monopoly rather than oligopoly, with an exclusive franchise over a particular geographical area and revenue raised by the sale of its services to the households located in its franchise area.

In addition to controlling entry in the industry through licensing the CRTC also controls the type of product offered by Canadian broadcasters under the form of various Canadian content regulations. It also controls the type of product offered by CATV through various provisions concerning the type of signals carried by CATV licensees in their areas and through various requirements about local programming and bilingualism. Finally, it regulates the price charged by the CATV licensee to his subscribers.

The questions raised by this type of regulatory setup in a cultural context have been multifold. First of all there has been some concern on the part of broadcasters about the impact of Canadian content regulations upon the profitability of their operations. Second, the impact of CATV upon the size of the audience of Canadian TV stations (the so-called "audience fragmentation") has created pressures on the part of TV broadcasters for a tighter regulation of CATV; the CATV segment of the broadcasting industry has, of course, resisted these pressures. Third the practice of the CRTC of granting its licenses at (virtually) zero price on the basis of regulatory hearings upon specific applications, and of allowing the licensee to sell his license on the open market and realize the profits from this sale, has generated some criticism. Finally, the transfers of broadcasting owner-ship generated by such license sales has created some concern about the concentration of ownership in the broadcasting in-dustry and the implications of such a concentration for polit-ical control [1].

With the exception of this last point, the contents of this study are directly relevant to the above policy questions. The issue of the _profitability_ of the AM radio and TV segments of the broadcasting industry under current regulatory practices is central to the imposition and enforcement of cultural reg-ulatory objectives. The profitability of CATV has obvious implications about the ability of that particular sector to

absorb further regulation, as well as to finance local programming and other cultural activities considered beneficial on grounds of cultural policy. Finally, the profitability of licensees is also central to the issue of the pricing of licenses and the diversion towards private interests of profits that may properly belong to the public at large.

With respect to CATV the profitability question has been the subject of several well-known studies (primarily in the U.S.) as soon as the importance of the sector became obvious [2]. Similarly, the impact of CATV upon local television audiences was already recognized in very early studies (as in the 1966 study by Fisher et al). The current policy of the Federal government via the CRTC towards this important segment of broadcasting that has such a crucial effect upon other segments is very unclear, principally because of jurisdictional debates with the provincial governments. The results of this study will help to highlight the importance (in economic terms) of the jurisdictional debate by establishing what determines the profitability of CATV licensing in Canada.

A final area, in which this study has a direct bearing, is the allocation of electromagnetic spectrum between broadcasting and other competing use. This allocation is done by the Department of Communications (DOC) by an arbitrary segmentation of the sprectrum into zones specifically allocated to broadcasting or "other" uses (chiefly landmobiles in the

VHF and UHF zones of the spectrum). To the extent that this segmentation creates a scarcity of broadcasting spectrum in a given zone and region by allocating "too little" to broadcasting this is going to show up as high profits of the TV stations in those regions. While, in the absence of a similar study for land mobiles, the results here are not sufficient to allow us to resolve the spectrum allocation problem, the profitability of TV and AM radio licenses are certainly an indicator of the extent, to which further increase of the number of such stations in a given region may be considered desirable on economic grounds.

In this chapter we cover the theoretical foundations of the models used in this study, as well as the type of data used. Subsequent chapters will discuss in detail specific characteristics of the estimation as it pertains to each one of the three segments - CATV, AM radio and TV, as well as particular details of the theoretical models. The last chapter will discuss the result and draw the appropriate policy conclusions.

2. The Theoretical Model

Since entry is not free in each one of the segments of broadcasting, it is expected that those firms in the industry will be experiencing economic profits, i.e. income over and above the total costs of production (the latter properly

defined). These profits are rent accruing to the scarce factor possessed by the firms in the industry - namely the license. The purpose of this study is to determine how this rent (the value of the license) varies with the physical and economic characteristics of each type of license.

The conceptual problems in estimating the value of a license directly are fairly serious. According to economic theory, the value of a license (like that of any asset) is equal to the capitalized stream of earnings accruing to it. In practice, since the earnings are never constant over time, this means that an average value has to be estimated and an adjustment for risk applied. This adjustment takes place either by decreasing the average profits in the numerator of the capitalization formula (the certainty equivalent of the random profits) or by increasing the discount rate in the denominator to take risk into account (the risk-adjusted discount rate). However, economic and financial theory are not very helpful in determining the adjustments for risk by either one of these methods, as will be explained below.[3]

Consider a certain asset that produces a random profit π per period. Under certain assumptions it can be shown that the value of this stream of π's over time is equal to the expectation of π minus the adjustment for risk, the latter being related to the general fluctuations of the economy (systematic risk). This body of theory, the so-called capital

asset pricing model or CAPM yields a formula for the adjust-
ment for risk equal to the covariance of π with some general
index of the economy (the return on the "market portfolio"),
times a parameter λ called the market price of risk that is
common to all assets. Analytically, if $\tilde{R}_M$ denotes the return
to the market portfolio, r_F the riskless rate of interest,
V the value of the asset and $\tilde{R} \equiv \frac{\pi}{V}$ is the rate of return on
the asset we know that by CAPM [4].

(1) $E(\tilde{R}) = \frac{E(\pi)}{V} = r_F + b(E(\tilde{R}_M) - r_F)$

where b is systematic risk of the asset, equal to $\frac{Cov(\tilde{R}, \tilde{R}_M)}{\sigma_M^2}$,

σ_M^2 being the variance of $\tilde{R}_M$ and E and Cov denoting the ex-
pectation and covariance respectively. The result becomes,
on setting $\lambda \equiv \frac{E(\tilde{R}_M) - r_F}{\sigma_M^2}$ and $\tilde{R} \equiv \frac{\pi}{V}$ in (1).

(2) $\frac{E(\pi)}{V} - r_F = \lambda \frac{Cov(\pi, \tilde{R}_M)}{V}$,

from which we derive the valuation equation

(3) $V = \frac{E(\pi) - \lambda Cov(\pi, R_M)}{r_F}$

Since, in theory at least, π and r_F are observable, while $\tilde{R}_M$
can be represented by a suitable proxy, the above equation
(3) can be used as a basis for license valuation, since λ is
also derived from the parameters of the distribution of $\tilde{R}_M$.

Unfortunately, the application of CAPM to Canadian data
has not yielded very good results to this date. For one thing,

there is a serious question about the index to be used
as a proxy for $\tilde{R}_M$. Some studies[5] have used the Toronto
Stock Exchange (TSE) index returns, although as Grant
implies (p. 3), CAPM was not intended to be applied with
a market index consisting of listed securities in a single
organized index. More recently a lengthy critique of
CAPM by Roll has raised serious questions about the empir-
ical relevance of CAPM with any by necessity incompletely
representative index of market return. These comments are
particularly relevant to the Canadian context, since a sig-
nificant proportion of the total financial investment in
Canada takes place in the organized stock exchanges in
the U.S. Whether Canada and the U.S. are part of a single
capital market or not is a significant theoretical question
whose answer would necessitate a major research on its own.
Unfortunately, the answer to such a question is central to
the valuation equation (3) since both λ and the covariance
term depend on it: clearly the choice of an index of "market
return" would be different in a single rather than a segmented
capital market.

Fortunately, an alternative approach to the estimation of
(3) exists that does not need data on $\tilde{R}_M$. According to the
CRTC policies, the licensees may sell their assets (including
the license) in the open market. The sales price (adjusted
for liabilities) represents then an estimate of the value V,
no matter what the market return is. In other words, the sales

price is the sum of the value of the physical assets <u>plus</u> the economic rent accruing to the license. On the basis of (3), this sales value, together with independent observations on the operating profit of the licensee, can be converted into an estimating model for the <u>risk premium</u> $\lambda \text{Cov}(\pi, \tilde{R}_M)$ without any data on λ or $\tilde{R}_M$.

The basic methodology and modelling of this report, therefore, proceeds as follows: on the basis of the market and cost characteristics of the licensed operation an estimating equation with π as the dependent variable is developed, covering a pooled cross-section and time series model. Given this model for π, a second estimating equation for the risk premium is developed, in which the premium is the dependent variable and is measured by the quantity $E(\pi) - Vr_F$, which by (3) is equal to $\lambda \text{Cov}(\pi, \tilde{R}_M)$. The sample in this second estimation is cross-sectional and consists of licenses that were sold and bought. The expectation $E(\pi)$ comes from the first estimating equation, while V is measured by the sales price. The independent variables in this second equation have to conform to the fact that the dependent variable is proportional to a covariance between two terms, one of which was estimated by another equation.

The estimation model based on the CAPM is one of several possible explanatory models for the risk premium. As a matter of fact, the CAPM has, until now, been applied only to short-term (month-to-month or, at most, year-to-year) transactions, in a universe of frequently traded assets, namely the financial

assets of corporations. Here the transactions are much more infrequent, the transferred assets are not as easily marketable as financial securities, and the risk considerations are, perforce, of a long-term nature. For this reason we shall examine briefly the implications of some alternative hypotheses in the context of our estimation model.

To begin with, the estimation method is based on the assumption that a risk premium exists, i.e. that the sales price V is less than the capitalized expected profits. The model is also consistent with the (unlikely) event that the risk premium is uniformly negative, i.e. that the license-holders' profits move countercyclically with the market portfolio returns. It is not quite clear what the situation is if the observed risk-premia in our sample are partly positive and partly negative. Presumably, this can be interpreted as consistent with the fact that $\frac{E\ (\pi)}{r_F} = V$, or that π and R_M are uncorrelated. Hence, a first test is whether the risk premium, $E\ (\pi) - Vr_F$ is significantly different from zero in our sample.

A second concern is with the other types of risks faced by licenses and not taken into account by the CAPM. Such risks are the long-run, institutional change-type riks, and they are particularly important in the case of CATV. These changes, although they certainly decrease expected profit, are unrelated to economic fluctuations as represented by R_M and, as such, are not estimable by our model. We shall try a number of alternative formulations, although the precise identification of the determinants of risk-premium is rather difficult from our limited data base.

The above general model will be applied succes-
sively to CATV, AM radio and TV. In subsequent chapters the
particular specifications of the estimating equations will be
developed for each one of these segments.

3. Data Considerations

For the application of the valuation model we need a
sample of sales prices of broadcasting and CATV firms,
together with the corresponding profit data on these firms.
For TV stations the sales prices were collected from the
CRTC's public files, and cover the period 1967-1977. This
period was not uniform in regulatory policies. In
addition, the impact of CATV was not felt yet in all TV
markets in Canada. Finally, the CRTC obliged all foreign
firms to divest themselves of their broadcasting assets; this
divestiture took place between 1970-72. For this reason the
TV sample is not considered as good from the point of view of
uniformity as the other two samples. Further discussion of
the sample will take place in Chapter IV.

For the CATV and AM radio the basic sales data was
provided by the CRTC's Background Study 5, and covered the
period 1972-77. Each cross-sectional sample was further
reduced in size by eliminating simultaneous sales of more
than one CATV system, for which a single price was provided,
as well as separating the AM radio sample into CBC affiliates
and independent stations; the reasons for this separation will
be discussed in chapter III. The CRTC data also provided sev-
eral characteristics of the market and operating structures
of the firms, that played a role in our regressions.

For all firms included in the three samples the profitability data, as well as other pertinent data, came from files held by DOC. The data available covered the period 1972-1977. This data was used for the estimation of the profit equations.

Clearly, the data limitations came primarily from the side of the sales price. The cross-sectional samples were rather small and (in the case of TV) non uniform. By contrast, the profitability equations had six times as many observations and, consequently, yielded considerably better statistical results.

Footnotes

1) For a good summary of these issues see the article by Robert Babe and the references cited in that article.

2) See, for instance, the articles by Comanor and Mitchell, and Crandall and Fray.

3) The model below was first presented in the study by Perrakis, Silva and Zerbinis (hereafter PSZ report).

4) Equation (1) is a fundamental equation of financial theory. See, for instance, Weston & Brigham, Ch. 11.

5) See, for instance, the relevant comments in the article by Dwight Grant.

CHAPTER II: THE VALUATION OF CATV LICENSES

I. Introduction

    We shall develop a model that allows the estimation of
the value of a CATV license, based on the CAPM theory developed
in Chapter I, and using data on the sale prices of CATV systems.
Although the ultimate estimating method for the CATV license
values is very similar to the one that will be developed for
broadcasting, the theory leading to it is somewhat different
and will be formulated in some detail below. It relies
fairly substantially on recently developed econometric models
that have been used to estimate the demand for CATV services
in Canada by Munasinghe and Corbo (MC). That study, in turn,
was an adaptation to Canadian conditions of the well-known
work by Noll, Peck and McGowan, Economic Aspects of Television
Regulation (Washington DC, The Brookings Institution, 1973).
Our problem is to reconcile theoretically the estimating model
based on CAPM, which refers to the value of the license, with
that of MC, which refers to the demand for CATV services.
Alternatively, if the CAPM is not accepted or if it is felt that
other sources of risk are also important, we must infer plausible
hypotheses about these sources.

In Chapter I the value of a broadcasting license
was shown to be equal to

(1) $V = \dfrac{E(\Pi) - \lambda \text{Cov}[\Pi, R_m]}{r_F}$

where V is the value, Π the annual profit, R_m the return (or
earnings) of the market portfolio, r_F is the risk-free rate
of interest, E and Cov denote expectation and covariance res-
pectively, and λ is a parameter interpreted as the "market
price of risk", whose separate estimation is not needed for
our purposes. The crucial question is what variables are
going to be used as estimators of $E(\Pi)$ and $\text{Cov}[\Pi, R_m]$. The
market demand as well as the cost conditons for a CATV licensee
are quite different from those faced by radio or TV broad-
casters.

In what follows we shall outline the various elements of
the CATV model, namely the demand and cost, as well as the
way they are combined into the license valuation equation (1).
In addition to the studies mentioned above, we shall also rely
on the doctoral dissertation by Leonard McRae Good "An Econo-
metric Model of the Canadian Cable Television Industry and
the Effects of CRTC Regulation". The first step,
however, is an outline and discussion of the available data,
since our estimation model will have to be "tailored" some-

what to this data.

II. Basic Data Sources

The necessary data for the final estimation of the value equation can be classified under three possible headings: a) Economic characteristics of the performance of a particular CATV licensee b) Technical characteristics of a CATV system c) Observed transfer price of a particular CATV system. Of these data (a) and (b) are of a pooled cross-sectional and time-series nature, while (c) is purely cross-sectional, covering scattered CATV asset and license transfers over a time period from 1972 to 1977. Since this was numerically the weakest data set, the entire estimation procedure evolved around it.

The data on transfer prices of CATV licenses was drawn from CRTC's Ownership Study Group study, published in 1978. In it a sales price series was derived, corresponding to a 100% transfer price, i.e. adjusted for liabilities and for partial equity transfer (provided the transfer exceeded 50% of the total equity). This series had a total of 27 observations of individual licenses and group transfers, of which 26 were with complete data. 20 of these prices were for individual licenses, and the remainder were sales of groups of two or more CATV systems. The data base for the CRTC's study included also some of the technical cha-

racteristics of the systems that will be used in the subsequent estimation. Although the definitions used in the CRTC's study are far too restrictive for our purposes, it was felt at this point that the collection of additional primary data was simply not worth the effort, given the well-known state of the CRTC's files. The 20 (or 26) data points would be sufficient for estimating purposes, provided the number of explanatory variables is kept down to manageable proportions.

The rest of the data, pertaining to the economic characteristics of CATV operations were extracted from the DOC's files. The years that were included in our estimation were 1972-1977. Further discussion of the data will take place after the estimating equation has been developed.

III. The Demand Model

The CATV licensee is basically a regulated monopolist, to whom a franchise is granted over a given geographical region. The choice of the region is an exogenous policy decision, hence the monopolist has no say as to the number of his potential subscribers. Given the franchise, the licensee has an incentive to wire the entire area of his franchise starting from the most "profitable" region (the area with the highest population density), assuming that the anticipated

revenue exceeds the annual cost of wiring. Hence, system age is expected to be a factor in estimating expected profitability and risk. Fortunately, in our case the system age is quite high, always at least equal to four years, which implies that the systems in our data base are almost at steady state as far as installation and expansion are concerned.[1]

The demand for CATV services is measured by the penetration ratio (PR), a variable that is equal to the number of actual subscribers as a proportion of potential subscribers. The value of this variable is clearly dependent on the alternatives offered by the presence of CATV vis-à-vis over-the-air broadcasting, the subscription price relative to the subscribers' family income, and the effort that CATV licensees make in trying to recruit more subscribers, as well as in trying to improve their own programming.

In the aforementioned MC study the following estimating equation was developed:

$$(2) \quad \frac{\ln[(I-P)/I]}{\ln(PR)} = a_0 + a_1 \ln \overline{C}_A + a_2 \ln \overline{C}_P + a_3 \ln f(T) + F(X) + \varepsilon \quad ,$$

where I represents the disposable family income, P is the subscription price, $\overline{C}_A \equiv 1 + C_A$, and C_A are the advertizing and promotion costs per potential subscriber, $\overline{C}_P \equiv 1 + C_P$, and C_P are the live programming costs per potential subscriber, T is the system age with f(T) being a fitted function, and F(X) is a function of a set of technical variables measuring

the quality and variety of CATV television programs relative to the programs available over the air. Equation (2) is based upon the following assumptions: the subscriber has a choice between better programming (through CATV), and higher income (through not paying the subscription price). His utility function is assumed to be log-linear in income and programming quality. He will choose to subscribe to CATV if the value of his utility, evaluated at family income I-P and the CATV programming quality, exceeds the value of his utility at income I and over-the-air programming quality. The importance of TV programming relative to income is measured by the ratio of their exponents in the utility function (the "taste" parameter, characteristic of the individual subscriber). This ratio has a probability distribution (assumed exponential) over the population of potential subscribers, and a potential subscriber will become an actual subscriber if the "taste parameter" has a value larger than a given function of relative income $\frac{I-P}{I}$, and relative programming quality (with and without CATV). The penetration ratio will be measured by the proportion of those potential subscribers whose "taste parameters" satisfy the above inequality. The assumption of an exponential distribution allows us to reduce the complex algebraic manipulations into the relatively simple estimating formula (2).

In our case we shall adopt the above MC formulation in its general lines, except that the relative programming quality function F(X) will assume a simpler form, insofar that fewer channel classifications will be included. Thus, we shall distinguish only Canadian and U.S. channels received over-the-air or over-cable, without any disaggregation into primary, and duplicate networks, or independent stations. The data provided in the CRTC study for the 27 systems has only three variables, total number of stations available over-the-air, number of US stations, and number of Canadian stations available over cable. In order to disaggregate the over-the-air reception into US and Canadian channels we shall assume that all over-the-air channels are Canadian if the total over-the-air number is $\leq$ the number of Canadian over-cable stations, the difference being made-up of US stations whenever the number of over-the-air stations exceeds the over-cable Canadian stations. Given the current CRTC channel allocation policy, this assumption is probably not very far off the mark.

The subscription price variable is an exogenous variable in the demand specification, but in the profit equation it cannot be used as an independent variable if it is under the control of the licensee. Since the CATV firms are regulated by the CRTC, the choice of the subscription price is not free.

Traditionally in cases of regulated monopolists we assume either price or rate-of-return regulation. The consensus seems to be that the type of regulation in CATV is price regulation, or, as Good says (p. 104) quasi-price regulation, insofar that the subscription rate once chosen cannot be changed unilaterally or without extensive justification. We shall adopt for our purposes the assumption of an exogenous price, outside the influence of the firm.

IV. The Cost Model

The cost function must relate the size of the operating costs of a CATV system to the "output" of the system, namely the number of actual subscribers. The number of actual subscribers, on the other hand, is equal to the number of potential subscribers times the penetration ratio. An additional variable that may conceivably affect the cost function is the technical size of the system, under the form of cable miles. In other words, the hypothesized form of the cost function is:

(3) $C = C(Q, CM)$,

where Q are the actual subscribers and CM the cable miles. This equation will not be estimated separately as such, but it serves as a convenient analytical device, together with

(2), in order to analyze the profit equation (1).

In earlier work the form of the cost function fitted to CATV data followed more or less similar specifications. Thus, in the International Institute of Quatitative Economics' (IIQE) Final Report under the title "Economic Study of the Financial and Market Characteristics of the 16 Largest CATV Companies in Canada" (June 1974) the estimated equation was a third degree polynomial in Q and linear in CM, but the coefficient of CM was not significant and that variable was eventually dropped. In Good's dissertation, on the other hand, separate equations were fitted in the various cost components containing polynomials of Q, of CM, or of both. Since our eventual estimation is going to have operating profit as a dependent variable, we do not find this disaggregation meaningful in our case.

A final remark on the cost side concerns the inclusion of depreciation in the total operating costs. In the IIQE report it is pointed out that several CATV systems rent or lease cable and headend equipment instead of owning them, so that the rental charges are part of the technical costs, while no similar cost element appears in the case of companies owning their own equipment. For this reason the IIQE report includes depreciation as part of the estimated cost function. In our case the purpose of the estimation is to find the value of the CATV license, which is equal to the

capitalized risk-adjusted expected cash flow according to (1), hence the depreciation should not be subtracted since it forms part of the cash flow to the licensee. On the other hand, this will clearly introduce a discrepancy between the owning and renting CATV systems. To eliminate this discrepancy we shall subtract from the annual operating profit a charge equal to the total investment (fixed assets) times the riskless rate of interest. This will give us an estimate of the economic profit (net of capital costs). Since the systems that own all their equipment have a higher fixed cost than those who rent it, the subtraction of the fixed asset charges will put both systems on an equal footing in the estimation.[2]

V. The Profit Model

In putting together the results of the two previous sections we denote by Q_P the potential subscribers of the CATV system, implying that $Q = (PR)Q_P$. The operating profit of the system is then equal to $P(PR)Q_P - C$. The licensee wants to maximize this operating profit by an appropriate choice of the variables under his control. From equation (2) C is similarly a function of the product $(PR)Q_P$, as well as CM, hence the licensee maximizes profits through his influence on the penetration ratio PR. This influence is exercised by means of the promotion and adver-

tising costs per potential subscriber, i.e. $\bar{C}_A$ of (2). Another possible variable through which the licensee affects PR is $\bar{C}_P$, the programming costs per potential subscriber. However, although the MC study showed a positive and significant relationship between $\bar{C}_P$ and PR, there is some question as to whether $\bar{C}_P$ is controlled by the licensee or reflects the desires of the regulator. The CRTC's interest in local programming is well-documented and long-standing, and Good's results seem to imply clearly (p. 110) that local programming is done primarily because of regulatory preferences. We shall treat $\bar{C}_P$ as an exogenous variable.

From (2) it is clear that PR is a continuously increasing function of $\bar{C}_A$, $\left(\dfrac{\partial PR}{\partial \bar{C}_A} > 0 \right)$. Hence, the licensee by choosing $\bar{C}_A$ effectively chooses the level of the penetration ratio PR. Therefore, the first-order conditions (assuming $\bar{C}_P$ exogenous) are

$$(4) \quad \left[P - \frac{\partial C}{\partial Q} \right] Q_P = 0$$

corresponding to the familiar equality of price and marginal cost, even though the licensee is essentially a regulated monopolist. This marginality condition arises from the fact that through promotion and advertising the licensee is able to affect his own demand even though the price is fixed.

The first-order condition (4) yields an implicit expression for the actual number of subscribers Q, which is a function of the subscription price P and the cable miles CM. Since Q is equal to (PR)Q_P, and Q_P is exogenous, the choice of the optimal Q determines automatically the optimal PR. From equation (2), on the other hand, the optimal PR is in a one-to-one correspondence to an optimal value of the promotion and advertising expenses per potential subscriber $\bar{C}_A$, which are thus determined from the first-order conditions (4). Since all other variables in (2) are exogenous, they would also enter into the expression for the maximum profit that the licensee will realize. After substituting the optimally determined $\bar{C}_A$ as a function of the other variables, the expression for the CATV profit becomes

(5) $\quad \Pi = \Pi\left[P, \ Q_P, \ \dfrac{I-P}{I}, \ CM, \ \bar{C}_P, \ T, \ F(X)\right] \qquad ,$

where all the variables entering the profit function have already been defined in the demand and cost sections. A closed form analytical expression for (5) is not feasible, due to the highly non-linear nature of (2) and (3). Instead, we shall try to adopt one of the well-known flexible forms of the profit function, such as the transcendental logarithmic or translog or the generalized Leontief.[3] It has been shown that these forms correspond to a second order approximation to an arbitrary function, and as such are considered

satisfactory for our purposes. The only reservations arise
with respect to the necessary degrees of freedom, since the
available sample size is of necessity rather limited.

VI.   The Estimating Model

Let the subscripts i,t indicate the CATV system and the
time period respectively. The available data consists of
the cross-sectional sales value observations over the limited
sample described earlier, plus the six-year data for pro-
fits, costs and technical characteristics available from the
DOC files. As explained earlier, the relative quality
function F(X) will have the following form:

(6) $F(X) = F(X_c, X_u)$

where the variables X_c and X_u are defined as

$$X_c = \frac{1+N_{CC}}{1+N_{AC}} , \quad X_u = \frac{1+N_{CU}}{1+N_{AU}} , \text{ and}$$

$N_{CC} \equiv$ number of Canadian stations available over cable.

$N_{AC} \equiv$ number of Canadian stations available over-the-air.

$N_{CU} \equiv$ number of U.S. stations available over cable.

$N_{AU} \equiv$ number of U.S. stations available over-the-air.

For notational economy denote by $Y_{it} \equiv [y_{1it}, y_{2it}, \ldots, y_{8it}]$ the vector of values of the exogenous variables of equation (5) for system i at time t, where in terms of our notation $y_1 \equiv P$, $y_2 \equiv Q_P$, $y_3 \equiv \frac{I-P}{I}$, $y_4 \equiv CM$, $y_5 \equiv \bar{C}_P$, $y_6 \equiv T$, $y_7 \equiv X_c$, $y_8 \equiv X_u$. The general forms of the translog and generalized Leontief profit functions are as follows:

$$(7a) \quad \ln\Pi = a_0 + \sum_{i=1}^{8} a_i \ln y_i + \sum_{i,j=1}^{8} a_{ij}(\ln y_i)(\ln y_j) + \varepsilon \quad \text{(translog)}$$

$$(7b) \quad \Pi = b_0 + \sum_{i=1}^{8} b_i y_i + \sum_{i,j=1}^{8} b_{ij}(y_i y_j)^{\frac{1}{2}} + \varepsilon \quad \text{(gen. Leontieff)}$$

where ε is an error $i \neq j$ term subject to the usual assumptions.

Since we have only 20 cross-sectional data points and 120 pooled cross-sectional-time series, the number of parameters is too large, especially for the cross-sectional model. For purposes of illustration, we examine the full estimation model under the assumption that all a_{ij}'s are equal to zero. Then, we have a profit estimating equation of the form:

$$(8) \quad \ln\Pi_{it} = a_0 + a_1 \ln P_{it} + a_2 \ln Q_{P_{it}} + a_3 \ln\frac{I_{it}-P_{it}}{I_{it}} +$$

$$+ a_4 \ln(CM)_{it} + a_5 \ln\bar{C}_{P_{it}} + a_6 T_{it} + a_7 \ln X_{ci} +$$

$$+ a_8 \ln X_{ui} + \varepsilon_{it} \quad ,$$

where ε_{it} is the error term.

For the risk-adjustment factor $Cov[\Pi, R_m]$ the dependent variable is given by $E(\Pi_i) - V_i r_F = \lambda Cov[\Pi_i, R_m]$. On the basis of (8) a possible estimating equation is:

$$(9) \quad E(\Pi_i) - V_i r_F = b_0 + b_1 \ln Q_{Pi} + b_2 \ln(CM)_i + b_3 T_i + b_4 \ln X_{ci} +$$
$$+ b_5 \ln X_{ui} + \ln Cov\left[P_i^{a_1}\left(\frac{I_i - P_i}{I_i}\right)^{a_3}\left(\bar{C}_{Pi}\right)^{a_5}, R_m\right]$$
$$+ e_i \quad ,$$

where e_i is a random term. This form was adopted because the factors included in the Cov term on the RHS of (9) are the only ones that are presumably correlated with R_m, the others being independent of it. If the same independence assumption is made for P_i and $\bar{C}_{Pi}$ (since they are policy variables determined by the regulatory authority) then the terms $b_6 \ln P_i$ and $b_7 \ln \bar{C}_{Pi}$ are added to the RHS of (9).

Finally, if it is assumed that $Cov\left[\left(\frac{I_i - P_i}{I_i}\right)^{a_3}, R_m\right]$ is proportional to the expectation of $\frac{I_i - P_i}{I_i}$ we can have an estimating equation of the form:

$$(10) \quad E(\Pi_i) - V_i r_F = b_0 + b_1 \ln Q_{Pi} + b_2 \ln(CM)_i + b_3 T_i + b_4 \ln X_{ci}$$
$$+ b_5 \ln X_{ui} + b_6 \ln P_i + b_7 \ln \bar{C}_{Pi} +$$
$$+ b_8 E\left[\ln \frac{I_i - P_i}{I_i}\right] + e_i$$

which, together with (8), can serve as the first set of estimating equations. This formulation adapts the valuation model of Chapter I to the demand for CATV services model of MC and the cost models of MC and Good.

Unfortunately, a covariance equation cannot be easily derived from the complete profit equation (7a). For this reason the main estimation method will be the one based on (7b), although results using (8) - (10) will also be provided. If (7b) is the appropriate profit equation, and if the same probabilistic assumption made in the derivation of (10) are adopted, we have:

$$(11) \quad \lambda Cov(\Pi, R_M) = b_3 Cov(y_3, R_M) + \sum_{\substack{i=1 \\ i \neq 3}}^{8} b_{i3} Cov[(y_i y_3)^{\frac{1}{2}}, R_M] + \varepsilon =$$

$$= C_0 + C_1 E(\frac{I-P}{I}) + [E(\frac{I-P}{I})]^{\frac{1}{2}} \sum_{\substack{j=1 \\ j \neq 3}} C_j y_j^{\frac{1}{2}} + \varepsilon$$

where the y_j's are the remaining exogenous variables entering the profit function (5). Equations (7b) and (11) form another pair of estimating equations alternative to the pair (7a) or (8), and (10). Since (7b) contains only 9 exogenous variables, the size of the cross-sectional sample is adequate for this model.

VII. <u>Data and Results</u>

The data used for the variables was as follows:

$\Pi_{it} \equiv$ operating income of system i <u>minus</u> the historic cost of assets times the riskless rate of interest, all at time t.

For the riskless rate r_F see below.

$P_{it} \equiv$ the subscription price of system i at time t, computed as total subscriber revenue divided by total subscribers, Total subscribers at t computed as the average number of beginning and end of year t.

$Q_{Pit} \equiv$ total potential subscribers for system i at time t, Computed as the average of the total households offered cable service at the beginning and end of year t.

$(CM)_{it} \equiv$ total cable length of system i at time t, computed as the average of beginning and end of year figures.

$\bar{C}_{Pit} \equiv$ total program origination expenses of system i at time t divided by Q_{Pit}, plus one.

$T_{it} \equiv$ age of cable system in years.

$X_{ci}, X_{ui} \equiv$ relative availability of Canadian and U.S. stations (see previous section).

$r_{Ft} \equiv$ the average annual yield on 3-5 year Government of Canada securities.

$I_{it} \equiv$ average disposable family income for the appropriate province in which the system is located.

$V_i \equiv$ the sales price of the system adjusted to reflect a 100% transfer of the station's asset. Details of the adjustment were provided in Background Study 5 of the CRTC's Ownership Study Group.

With the above definitions of the variables the results of the regressions (7a,b) to (11) were as shown below, in both linear and log-linear form each. The expectations in (iii)-(vi) were estimated as averages across all six sample years. The figures below the coefficients indicate the t-statistics. For each regression we also provide the R^2, the number of observations N_0, and the F-ratio.

(i) $\log \Pi = -9.329 + 0.400 \ln P + 1.650 \ln Q_P -$
$\qquad\qquad (-1.647)\ (0.374)\qquad\ (3.896)$

$\qquad - 328.715 \ln \frac{I-P}{I} + 0.507 \ln CM - 1.278 \ln C_P +$
$\qquad\ (-1.497)\qquad\qquad (1.096)\qquad\quad (-3.36)$

$\qquad + 0.447 \ln T - 0.033 \ln X_c - 0.234 \ln X_u$
$\qquad\ (0.620)\qquad (-0.078)\qquad (-0.76)$

$\qquad R^2 = 0.442, \qquad N_0 = 114, \qquad F(8,105) = 10.49$

(ii) $\Pi = 2.387037 + 578.521P + 24.242Q_P - 2463549\frac{I-P}{I} -$
$\qquad\quad (0.582)\qquad (1.595)\qquad (16.884)\qquad (-0.596)$

$\qquad - 622.057\ CM - 4023.95\ \bar{C}_P + 564.8\ T + 7998.023\ X_c -$
$\qquad\ (-3.346)\qquad\ (-1.409)\qquad\ (0.405)\qquad (1.866)$

$\qquad - 2842.27\ X_u$
$\qquad\ (-1.122)$

$\qquad R^2 = 0.888 \qquad N_0 = 114 \qquad F(8,105) = 104.01$

(iii) $\ln |E(\Pi_0)-rV| = -18.511 + 6.133 \ln\bar{P} + 0.865 \ln \bar{Q}_P +$
$\qquad\qquad\qquad\qquad (-1.403)\ (2.534)\qquad\quad (1.285)$

$\qquad + 812.903 \ln \frac{\overline{I-P}}{P} + 0.390 \ln \overline{CM} + 0.334 \ln \bar{C}_P -$
$\qquad\ (2.074)\qquad\qquad (0.634)\qquad\qquad (0.699)$

$\qquad - 0.049 \ln T + 0.203 \ln X_c - 0.648 \ln X_u$
$\qquad\ (-0.046)\qquad (0.487)\qquad\ (-1.653)$

$\qquad R^2 = 0.843, \qquad\qquad N_0 = 20, \qquad F(8,11) = 7.38$

(iv) $\ln[E(\Pi_0)-rV] = 4.665 + 3.328 \ln\bar{P} - 0.346 \ln \bar{Q}_P +$
                $(0.452) \quad (1.854) \qquad (-0.615)$

           $+ 906.249 \ln \overline{\frac{I-P}{P}} + 0.777 \ln \overline{CM} +$
            $(3.184) \qquad\qquad (1.800)$

           $+ 1.584 \ln \bar{C}_P - 1.101 \ln T - 0.137 \ln X_c -$
            $(3.309) \qquad (-1.384) \qquad (-0.48)$

           $- 1.016 \ln X_u$
            (-3.702)

     $R^2 = 0.915 \qquad N_0 = 18 \qquad F(8,9) = 12.08$

(v) $E(\Pi) - rV = -21,427,817 + 2950.17 \bar{P} + 15.805 \bar{Q}_P +$
              $(-2.225) \qquad (3.069) \qquad (7.191)$

          $+ 21329040 \overline{\frac{I-P}{I}} - 417.097 \overline{CM} + 4282.4 \bar{C}_P +$
           $(2.207) \qquad\quad (-1.617) \qquad (0.772)$

          $+ 2400.43 T + 9732.64 X_c - 5789.74 X_u$
          $(1.131) \qquad (1.903) \qquad (-1.639)$

     $R^2 = 0.966 \qquad N_0 = 20 \qquad F(8,11) = 39.49$

(vi) $E(\Pi)-rV = -25,793,875 + 3307.27 \bar{P} + 15.089 \bar{Q} +$
             $(-2.722) \qquad (3.266) \qquad (6.756)$

         $+25698672 \overline{\frac{I-P}{I}} - 441.43 \overline{CM} + 11080.44 \bar{C}_P +$
         $(2.703) \qquad\quad (-1.794) \qquad (1.564)$

         $+ 1943.43 T + 9415.68 X_c - 6133.70 X_u$
         $(0.944) \qquad (1.901) \qquad (-1.706)$

     $R^2 = 0.9737 \qquad N_0 = 18 \qquad F(8,9) = 41.72$

In equations (iv) and (vi) we have included, for purposes of comparison, only those observations, in which the risk-premium $E(\Pi)-rV$ is positive, while (iii) and (v) included the entire sample.

From the above results it appears that the log-linear form of the estimating equation for the profit Ⅱ is inferior to the linear one, since the explanatory power of the regressions (as measured by the R^2 and F ratios) is smaller. More important, the explanatory variables all have the correct sign. Thus the profit is increasing in the potential subscribers Q_P and the subscription price P and decreasing in the cable-miles CM. There is no evidence of a significant time trend, while the signs of relative availability of Canadian and U.S. stations are positive and negative respectively, but the coefficients are not significant. Finally, the relative income and the local programming expenses have negative, but not significant coefficients.

Further results obtained here were those based on the generalized Leontief model. Thus, the risk-premium equation (11) was estimated in (VII) below.

$$
\begin{aligned}
\text{(vii)} \quad E(\Pi)-rV = {} & -26137226.60 + \underset{(4.347)}{3057.69}\left(\frac{\overline{I-P}}{I}\right)^{\frac{1}{2}}\overline{Q}_P^{\frac{1}{2}} + \\
& + \underset{(0.143)}{3505.14}\left(\frac{\overline{I-P}}{I}\right)^{\frac{1}{2}}\overline{C}_P^{\frac{1}{2}} + \underset{(2.347)}{52159.53}\left(\frac{\overline{I-P}}{I}\right)^{\frac{1}{2}}\overline{P}^{\frac{1}{2}} - \\
& - \underset{(-1.690)}{11817.23}\left(\frac{\overline{I-P}}{I}\right)^{\frac{1}{2}}\overline{CM} + \underset{(1.864)}{38340.05}\left(\frac{\overline{I-P}}{I}\right)^{\frac{1}{2}}X_c^{\frac{1}{2}} - \\
& - \underset{(-1.596)}{29442.15}\left(\frac{\overline{I-P}}{I}\right)^{\frac{1}{2}}X_u^{\frac{1}{2}} + \underset{(1.029)}{24920.62}\left(\frac{\overline{I-P}}{I}\right)^{\frac{1}{2}}T^{\frac{1}{2}} + \\
& + \underset{(1.913)}{25723264.0}\left(\frac{\overline{I-P}}{I}\right)
\end{aligned}
$$

$$R^2 = 0.9383 \qquad N_0 = 20 \qquad F(8,11) = 20.92$$

All five risk premium equations (iii)-(vii) are highly significant and with several coefficients having significant t-values. Since the above results indicate clearly the superiority of the Leontief model, we produced some more results for the estimation of Π.

One of the drawbacks of the flexible estimation forms (whether translog or generalized Leontief) is the substantial collinearity that exists between the explanatory variables. For this reason, the addition of more variables along the lines of (7b), while undoubtedly improving the explanatory power of the regression, would also dilute the significance of the coefficients of individual variables. Our approach here was based on the "best results" philosophy, since there is really no theoretical justification for truncating in one rather than another way the flexible Leontief form.

Since the time trend T is persistently non-significant, we eliminate it from the list of explanatory variables. As mentioned earlier, all systems in our sample had been established for a long time (more than four years) prior to their sale, so that the operation had probably reached steady state.

The following extensions of the truncated Leontief model were also estimated.

(viii) $\Pi = 1582849 + 1010.25P + 35.355Q_p + 91.46CM-$
$\quad\quad\quad (0.559) \quad\quad (2.147) \quad\quad (4.825) \quad\quad (-0.070)$

$\quad\quad - 39026.59X_c + 13767.42X_u - 1651171\frac{I-P}{P} -$
$\quad\quad\quad (-2.118) \quad\quad (1.298) \quad\quad\quad (-0.581)$

$\quad\quad - 13852.68\bar{C}_p + 11.738P^{\frac{1}{2}}Q_p^{\frac{1}{2}} -$
$\quad\quad\quad (-0.981) \quad\quad\quad (0.100)$

$\quad\quad - 14762.64(CM)^{\frac{1}{2}}\left[\frac{I-P}{I}\right]^{\frac{1}{2}} + 12559.28X_c^{\frac{1}{2}}\bar{C}_p^{\frac{1}{2}} +$
$\quad\quad\quad (0.866) \quad\quad\quad\quad\quad\quad (0.276)$

$\quad\quad + 6465.21X_u^{\frac{1}{2}}\bar{C}_p^{\frac{1}{2}} - 99.36Q_p^{\frac{1}{2}}CM^{\frac{1}{2}} - 641.33Q_p^{\frac{1}{2}}X_c^{\frac{1}{2}}$
$\quad\quad\quad (0.337) \quad\quad\quad (-0.516) \quad\quad\quad (0.382)$

$\quad\quad - 582.59Q_p^{\frac{1}{2}}X_u^{\frac{1}{2}} + 6043.93X_c^{\frac{1}{2}}X_u^{\frac{1}{2}} +$
$\quad\quad\quad (-1.117) \quad\quad\quad (0.257)$

$\quad\quad + 26320.32CM^{\frac{1}{2}}X_c^{\frac{1}{2}} - 6186.55CM^{\frac{1}{2}}X_c^{\frac{1}{2}}$
$\quad\quad\quad (1.475) \quad\quad\quad (1.025)$

$R^2=0.9178,$ $\quad\quad\quad\quad N_o=120$ $\quad\quad\quad\quad F(17,102)=66.98$

(ix) $\Pi = -470993.0 + 267.98P + 23.1091Q_p +$
$\quad\quad\quad (-0.155) \quad\quad (0.787) \quad\quad (18.71)$

$\quad\quad + 435093.940\frac{I-P}{I} - 532.024CM - 3222.02\bar{C}_p +$
$\quad\quad\quad (0.143) \quad\quad\quad (-3.424) \quad\quad (-1.156)$

$\quad\quad + 8101.61\,X_c - 2090.33X_u$
$\quad\quad\quad (1.888) \quad\quad (-1.024)$

$R^2=0.8792$ $\quad\quad\quad\quad N=120$ $\quad\quad\quad\quad F(7,112)=116.48$

(x) $\Pi = -224042 + 1063.30P + 37.757Q_p +$
$\quad\quad\quad (-0.082) \quad\quad (3.132) \quad\quad (12.767)$

$\quad\quad + 222323.13\frac{I-P}{I} - 203.98CM - 4471.02\bar{C}_p +$
$\quad\quad\quad (0.081) \quad\quad\quad (-1.341) \quad\quad (-1.782)$

$\quad\quad 6320.30X_c + 29.44X_u - 2738.46(\frac{I-P}{I})^{\frac{1}{2}}Q_p^{\frac{1}{2}}$
$\quad\quad\quad (1.638) \quad\quad (0.016) \quad\quad (-5.341)$

$R^2=0.9039$ $\quad\quad\quad\quad N=120$ $\quad\quad\quad\quad F(7,112)=116.48$

(xi) $\Pi = -2478.413 + 1052.52P + 37.779Q_p - 204.99CM$
$\quad\quad (-0.113)\quad\quad (3.382)\quad\quad (12.883)\quad\quad (-1.357)$

$\quad\quad -4437.23\bar{C}_p + 6288.89X_c + 77.115X_u -$
$\quad\quad (-1.802)\quad\quad (1.645)\quad\quad (0.044)$

$\quad\quad -2739.07(\frac{I-P}{I})^{\frac{1}{2}} Q_p^{\frac{1}{2}}$
$\quad\quad (-5.366)$

$R^2 = 0.9039 \quad\quad\quad\quad N=120 \quad\quad\quad F(7,112)=150.52$

(xii) $\Pi = -862.154 + 1029.31P + 37.55Q_p - 430.892CM$
$\quad\quad\quad (-0.039)\quad\quad (3.297)\quad\quad (12.765)\quad\quad (-1.561)$

$\quad\quad -9598.63\bar{C}_p + 5805.60X_c - 77.662X_u -$
$\quad\quad (-1.648)\quad\quad (1.506)\quad\quad (-0.044)$

$\quad\quad -2752.83(\frac{I-P}{I})^{\frac{1}{2}}Q_p^{\frac{1}{2}} + 2713.00(CM)^{\frac{1}{2}}(\bar{C}_p)^{\frac{1}{2}}$
$\quad\quad (-5.39)\quad\quad\quad\quad\quad (0.978)$

$R^2 = 0.9047 \quad\quad\quad\quad N=120 \quad\quad\quad F(8,111)=131.77$

In examining the results of (ii) and (viii) - (xii) we note a number of important facts. First of all there is a lot of instability in the coefficients, due to the non-linearity of the flexible form and the collinearity of the explanatory variables mentioned earlier. Second, in spite of this instability a number of salient features appear consistently: potential subscribers and subscription price have a positive and signi- ficant effect on profitability; cable length has a negative (but not always significant) effect; local programming costs per subscriber are negatively related to profitability (although not always significantly). This last remark is important, because it confirms our assumption that local programming is exogenously imposed upon the licensee, over and above the amount that would increase his profits.

If one were asked to choose from among the seven explanatory equations (i)-(ii) and (viii)-(xii) then it would appear that (xi) dominates most of the others. With seven explanatory variables the statistical results in terms of R^2 and significance of coefficients are better than for (i)-(ii) and (ix)-(x), while the addition of the eighth variable in (xii) does not turn out to be significant. Equation (viii) has a higher R^2 but at the expense of sharp dilution of the significance of individual coefficients.

The discussion of the risk-premium equation (vii) is deferred till the next section, since it raises several important theoretical questions.

VII. Discussion and Conclusions

The statistical results for CATV are extremely significant and it is worthwhile expending some effort in interpretation. While there is little doubt that our choice of profitability explanatory variables was very adequate, the equations for the risk premium are amenable to several possible explanations. In Table 2-1 below we display the average economic profit for each system in our sample over the 6 years, as well as the risk premium. Keeping in mind that the latter was equal to $\overline{\Pi}-rV$, while the average economic profit is equal to $\overline{\Pi}-\overline{rF}$, we note that the difference of the two is equal to $rV-\overline{rF}$. This represents the annualized purchase price <u>over and above</u> the average annual cost of fixed assets.[4]

Table 2.1 [5]

(1) System #	(2) $\overline{\Pi}-rV$	(3) $\overline{\Pi}-r\overline{F}$	(1)	(2)	(3)	(1)	(2)	(3)
1	58123	38741	11	18646	16732	16	12560	10735
2	35843	27862	12	17240	19077	17	25684	51226
3	30784	53303	13	8383	19843	18	281094	420505
4	26186	20804	14	144288	172094	19	96422	82755
5	9035	9153	15	29723	28109	20	59618	73156
6	12545	14881						
7	-1080	2249						
9	61430	57604						
10	174945	214500						
8	-12575	-48312						

We remark the following on Table 2-1: (i) the CATV operations are highly profitable on the average, since nineteen out of twenty systems had a positive economic profit. More important, in the underlying data 115 out of 120 observations were positive. (ii) this economic rent to the CATV license was not capitalized entirely by the original licensee. In other words, the purchaser would also realize economic profits on average. To see this, we first note that eighteen out of 20 systems also reported positive economic profits net of purchase costs. Then, in comparing columns (2) and (3) we note that the difference $(3)-(2) = rV-r\overline{F}$ is positive twelve out of twenty times, and negative the remaining eight. In other words, in several instances the purchaser paid an amount below the average annualized (undepreciated) cost of the fixed assets. This does not imply that the seller realized losses out of the sale (since the profits from the year of the license award till the year of the sale were not considered)

but that he was unable to recoup the economic value of the
license by selling it in the open market (iii) The above two
remarks imply that CATV operations are perceived by the
"market" as highly risky.

What are the reasons for this perceived risk? The CAPM
model developed in Chapter I considers all risk as portfolio
risk and estimates it by the covariance with market return.
This was the approach that was followed basically in our
estimations. Although all equations (iii)-(vi) gave good
results, there are alternative explanations that may be more
persuasive. Like all economic models, CAPM assumes basically
a certain fixed and stable institutional environment, including
regulatory behavior. The Canadian regulatory environment
concerning CATV has not been (and still is not) stable in
recent years. Repeated concerns have been expressed about the
effects of CATV on television audience fragmentation, about
the necessity to regulate profit rates of CATV operations,
to expand local programming and to rebate some of the profits
to broadcasters. Finally, there is the ongoing jurisdictional
dispute with the provinces. All these are factors that affect
the long-terms profitability of investment in CATV, and are
thus, perceived as contributing to the risk of the profit
stream.

Consider the following model: the current expected profit
is denoted by $\overline{\Pi}$. Assume that $Cov(\Pi, R_M) = 0$, but that there
is a positive probability p that the regulators will reduce

the profit on an "ability to pay" basis, for instance by expanding local programming. Hence, the expected profit under such an alternative would be equal to $k\bar{\Pi}$, where $k < 1$. The expected profit for a prospective buyer, therefore, is $\bar{\Pi}$ with probability $1-p$ and $k\bar{\Pi}$ with probability p, or $\bar{\Pi}(1-p) + pk\bar{\Pi} = \bar{\Pi}[1-p(1-k)]$. The sales price, therefore, is strictly proportional to $\bar{\Pi}$, and the same explanatory variables used in estimating would also be used here.

The validity of the portfolio risk <u>vis-à-vis</u> the regulatory risk hypothesis may be examined by means of a direct estimation of the covariance between the profit for each system, and an index of the return on the market portfolio. We chose the returns of the Toronto Stock Exchange (TSE) index (adjusted for dividends) as index $\tilde{R}_M$ of returns on the market portfolio. The returns on the market portfolios were:

were.

1972	1973	1974	1975	1976	1977
20.13%	3.86%	-25.4%	16.08%	5.28%	0.44%

In Table 2.2 below we display the results of a regression of Π_{it} on $\tilde{R}_{Mt}$. A significant regression is to be interpreted as evidence of the presence of portfolio risk.

Table 2.2

(1)	(2)	(3)	(4)
System #	R^2	Slope	Intercept
1	0.0012	-2116.7	14952.76
2	0.0348	-62200.13	55410.64
3	0.11526	-35244.35	20274.77
4	0.005	5488	27675.61
6	0.0119	-10075.19	28451.56
8	0.0043	20026.46	72475.24
9	0.0186	-12757.49	17164.95
11	0.0541	-114317.55	424389.26
13	0.077	35331.33	-9252.85
14	0.00896	-10933.97	51597.49
16	0.1577	-104021.06	175629.43
17	0.2014	143756.28	77869.29
20	0.6420[*]	35355.90	7951.92
21	0.1397	16030.00	10190.11
22	0.0055	42629.37	213051.24
23	0.0876	26038.73	37855.72
24	0.2764	37293.72	19536.25
25	0.02628	17882.55	56995.74
26	0.0743	-6.232	21512.87
27	0.0341	-1701.32	2306.95

Note * denotes significance at 10% or better.

Table 2.2 shows that the evidence of portfolio risk is very

weak indeed. Only one out of 20 regressions is significant

at 10%, and this is no better than one would expect on the

basis of chance alone. The drawbacks of the use of the TSE as
an index of R_M have already been stated in the previous chapter.
Hence, the results of Table 2 are to be interpreted only as lack
of evidence about the existence of portfolio risk.

The results for regressions (iii)-(vi) also indicate some
support for the regulatory risk hypothesis. If the sales price V
is equal to $\bar{\Pi}[1-p(1-k)]$ then $\bar{\Pi}-rV = \bar{\Pi}[1-r(1-p(1-k))]$, and
the risk-premium regression should be broadly in agreement
with the profitability regression. A comparison of the linear
equations (ii) and (v) shows that the non-economic variable
Q_P (the potential subscribers) retains its high degree of
significance that it had in (ii) in the risk-premium equation
(vi). If the validity of the linear model as an "acceptable"
approximation is established, than $\bar{Q}_P$ can enter the risk-
premium equation only through the above indicated regulatory
risk model. This is only a tentative conclusion, however,
and additional testing is warranted.

For a systematic testing of the regulatory risk hypothesis
we examine whether $\bar{\Pi}$ and $\bar{\Pi}-rV$ have significantly different
coefficients. The profit equation that is used as a basis of
comparison is equation (xi), which, as discussed earlier, gave
the best statistical results. Thus, (xi) was reestimated using
only the cross-sectional data, and with all exogenous variables
set equal to their mean. For the risk-premium $\bar{\Pi}-rV$, however,

we apply the following transformation. Suppose $\bar{\Pi}$ is used as an estimate of the "long-run" expected profit. Then, at any year t the sales price is going to be equal to $\bar{\Pi}$ minus the long-run expected risk premium divided by the riskless rate. If all sales prices V referred to the same year then the estimation model would have been well-specified. However, the years of the sales ranged from 1972 to 1977, hence, they have to be compounded and/or discounted in order to be brought to a common year. We chose 1975 as this common year, and the riskless rate as the theoretically correct rate for this compounding and discounting. Hence, the dependent variable in regression (xiv) was $\bar{\Pi}-rV_{75}$, where, for a 1972 sale for instance $V_{75}=(1+r_{72})(1+r_{73})(1+r_{74})$ V, while for a 1977 sale $V_{75} = \dfrac{V}{(1+r_{77})(1+r_{76})}$. The two regressions are shown

below.

(xiii) $\bar{\Pi}$ = -37488.95 + 1421.18$\bar{P}$ + 40.77$\bar{Q}_p$ -
       (-0.474)   (1.456)   (4.892)

$-242.64C\bar{M} - 3128.35\bar{C}_p + 5233.10X_c +$
(-0.623)   (-0.317)   (0.584)

$+669.96X_u - 2275.84 \left(\dfrac{\overline{I-P}}{I}\right)^{\frac{1}{2}} (\bar{Q}_p)^{\frac{1}{2}}$
(0.147)   (-1.435)

R^2=0.9622,   N=20,   F(7,12)=43.63

(xiv) $\bar{\Pi}-rV_{75}$ = -9044.04 + $829.83\bar{P}$ + $24.498\bar{Q}_p$ -
$\quad\quad\quad\quad\quad\quad\quad$ (-0.188) $\quad\quad$ (1.396) $\quad\quad\quad$ (4.826)

$\quad\quad$ $-27.89\overline{CM}$ - $2294.70\bar{C}_p$ - $676.32X_c$ - $1270.05X_u$
$\quad\quad$ (-0.118) $\quad\quad$ (-0.382) $\quad\quad\quad$ (-0.124) $\quad\quad$ (-0.458)

$\quad$ $-1493.07(\frac{\overline{I-P}}{I})^{\frac{1}{2}}(Q_p)^{\frac{1}{2}}$
$\quad$ (-1.546)

$R^2=0.9621,$ $\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad$ $N=20$ $\quad\quad\quad\quad\quad\quad$ $F(7,12)=43.51$

To test whether (xiii) and (xiv) have the same coefficients we apply the well-known __Chow test__, achieved by pooling both regressions together, and forcing the coefficients to be equal. The resulting regression (xv) is shown below

(xv) $\bar{\Pi}$ or $\bar{\Pi}-rV$ = -23266.43 + $11.25.50\bar{P}$ + $32.635\bar{Q}_p$ -
$\quad\quad\quad\quad\quad\quad\quad\quad$ (-0.311) $\quad\quad$ (1.219) $\quad\quad$ (4.142)

$\quad\quad$ $-135.26\overline{CM}$ - $2711.52\bar{C}_p$ + $2278.39X_c$ - $300.04X_u$
$\quad\quad$ (-0.367) $\quad\quad$ (-0.291) $\quad\quad$ (0.269) $\quad\quad$ (-0.070)

$\quad$ $1884.46(\frac{\overline{I-P}}{I})^{\frac{1}{2}}(Q_p)^{\frac{1}{2}}$
$\quad$ (-1.257)

$R^2=0.8734,$ $\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad$ $N=40$ $\quad\quad\quad\quad\quad\quad$ $F(7,32)=31.53$

For the Chow test we need the sums of squared residuals of (xiii), (xiv) and (xv), denoted by Q_{13}, Q_{14} and Q_{15} respectively. The test statistic is $\left[\left. \frac{Q_{15}-(Q_{13}+Q_{14})}{(Q_{13}+Q_{14})} \right. \right]$ x $\frac{24}{8}$

Our results yield $Q_{13}=0.1153$ E+11, $Q_{14}=0.4276$ E+10, $Q_{15}=0.5495$ E + 11, and the test statistic value is 7.43. This, under the null hypothesis of equality of coefficients, has an $F(8,24)$

distribution, hence the hypothesis is <u>rejected</u> at a better than 1% significance level. Hence, we cannot say that all risk is regulatory risk (although strong presumptions for such a statement exist), and the matter is in need of further study.

Footnotes

1. In the MC study the age of the system was not significant
   in determining the penetration ratio. Crandall and Fray
   assume (p.283) that full maturity is reached by the end
   of year 5. On the other hand, although Comanor and Mitchell
   estimate that the final penetration ratio is only reached
   after 10 years, they find (p. 161) that 82% of final
   penetration is reached by the end of year 4.

2. Note that in estimating the risk premium (which is measured
   by the average profit minus the annualized cost of purchase)
   the value of the fixed assets has to be added back to the
   operating income, since the transfer clearly includes the
   fixed assets as well as the capitalized economic profit.

3. See, for instance, Diewert.

4. There is an asymmetry in our computations insofar as the
   fixed assets are valued at current prices (interest rate),
   while the purchase price is valued at the cost of funds at
   the purchase date. The procedure used is, however, defen-
   sible, insofar as the funds invested by the license buyer

corresponded to a point input-annual output investment. As for the fixed assets, the current interest rate is to be interpreted as an opportunity cost. A second approximation involves our use of the government borrowing rate for valuing funds. This is an understatement of the private cost of funds, but good estimates for the latter are not easily available.

5. The systems in Table 2.1 have been randomly re-ordered to prevent disclosure of data which could be related to a particular system.

CHAPTER III: THE VALUATION OF LICENSES IN RADIO BROADCASTING

1. Introduction

In this section we shall report upon the results of an estimation of the value of a commercial radio broadcasting license. The model on which the estimation was based is the one developed in chapter one, with a few important modifications. The basic data, on which the model was applied consisted of extracts from DOC files, as well as sales prices for individual broadcasting stations transfers collected by the CRTC. These sales prices covered scattered years between 1972 and 1977 and were initially contained in the Background Study 5 of the CRTC's Ownership Study Group (published in 1978). More detailed presentation of the data will take place in a subsequent section.

The realities of the estimation process necessitated the introduction of important modifications to the basic model. The precise form of the estimating equation had to be determined empirically on the basis of a predetermined set of independent variables. For this reason a detailed specification of the equation used in the estimation process is given in the next section.

The principal modification had to do with the use of a different model, depending on whether the station was an affiliate

of CBC, or an independent station. In the case of the affil-
iates, programming effort is not a factor in attracting
audience, while for an independent station it is the major
element determining the station's popularity. The estimated
equations for a station's profit had to take this into account,
and for this reason a different form was used for affiliates
and independents.

Overall, the results were not as satisfactory as in the other
sections. Although the explanatory power was quite good and
most variables had the predicted sign, the risk-premium equa-
tions were difficult to rationalize. This is because many stations
showed a relatively poor average profit performance relative to
the purchase price for the entire period 1972-77. There are several
possible explanations for this: a) Although expected profita-
bility is low the stability or counter-cyclical variation of
broadcasting profit makes them attractive to investors. b) The
sample of stations that was used was "atypical" insofar as it
is primarily unsuccessful stations that are sold. c) The
sales price reflects not only the station's economic value
(as measured by the risk-adjusted discounted profits), but also
non-economic benefits such as prestige or political control.
The method used for the estimation assumed automatically that
(a) was correct, since otherwise we do not have a valid applica-
tion of the Capital Asset Pricing Model (CAPM), that formed

the cornerstone of our estimation. Nevertheless, we
believe that (b) is easy to check (on the basis of a random
sample or aggregate statistics), and we also believe that
research in that direction should be undertaken.

The organization of this part of the report is as follows.
We first present some general considerations; then the estimating
model together with the modifications is introduced in section 3.
The empirical results are shown in section 4, followed by a dis-
cussion in section 5. Several estimation refinements are also
mentioned, although in our opinion the effect of these refinements
on the results will be minimal and not worth the effort at this
stage.

2. Preliminary Considerations

Our sample had a total of 38 stations, of which 10 were CBC-
affiliates and the remaining 28 independent. Among the independent
radio stations 24 were AM and 4 FM. The estimations were done with
the entire sample, as well as with the AM subsample only.

In tables 3.1 and 3.2 below we show the average profit, the
annual average economic profit (computed as $\bar{\pi}-\overline{rF}$, the average oper-
ating profit minus average annual cost of invested capital, evaluated
at the riskless rate of return), and the annual excess price paid
by the purchaser over and above the average annual cost of the fixed
assets (computed as $rV-\overline{rF}$), for the CBC-affiliates and the indepen-
dents respectively.

Table 3.1[1]

(1)	(2)	(3)	(1)	(2)	(3)
System #	$\overline{\pi}-\overline{rF}$	$\overline{rV}-\overline{rF}$			
1	-5,627	16577	22	-25,609	3758
2	20,565	-11309	23	327,900	-6863
3	464,335	73436	24	37,099	91116
4	-76,552	13425	25	135,734	195193
5	-133,305	163035	26	23,833	206892
6	206,140	40413	27	450,280	-40511
7	117,439	-24569	28	36,080	13386
8	49,829	37364			
9	-11,049	4866			
10	-18,307	29556			
11	79,326	114267			
12	-10,167	1297			
13	-14,407	9044			
14	-4,045	3704			
15	-139,199	-8650			
16	-76,552	31382			
17	50,693	14112			
18	-133,315	73060			
19	269,387	109673			
20	-139,892	41110			
21	13,565	27880			

Table 3.2 [1]

(1)	(2)	(3)
System #	$\pi-\overline{rF}$	$rV-\overline{rF}$
1	28,916	24383
2	-23,621	-8366
3	104,724	24331
4	41,078	-1665
5	4,237	9719
6	20,921	13557
7	4,236	18755
8	-6,181	12841
9	41,078	38680
10	203	28352

The tables show clearly that the operation of a radio license is not, on the average, very profitable. Thirteen out of the 28 independent stations did not make sufficient profits to cover the average cost of the invested capital. This situation for the CBC-affiliates was somewhat better (only two out of 10 had economic losses on the average), but the sample size is too small to allow for any firm conclusions. These results are in stark contrast to those of the previous chapter, as well as those of the subsequent chapter referring to TV licenses.

A rather more surprising result, however, comes out of table 3.1 and 3.2. Although the operation of a radio license does not appear to have been very profitable over the period 1972-77, the sale of radio broadcasting licenses appears to have been considerably more rewarding. Thus, all but five purchasers of independent

stations, and two purchasers of CBC-affiliates paid more for the license than the cost of the fixed assets purchased with the license, sometimes a lot more. In other words, although the financial realities of a radio operation do not seem to justify the investment, there are purchasers willing to pay the price. In the previous section we presented a number of possible explanations for this phenomenon, which need not be repeated here. It suffices to say that the application of the CAPM is of dubious validity in such a sample, and that the empirical results concerning the risk-premium are difficult to interpret.

3. The Theoretical Model

Let the subscripts j and t denote the station and year respectively for each of the variables. We define the variables to be used as follows:

$\pi \equiv$ operating profit of the station

$r \equiv$ riskless rate of interest

$Q \equiv$ the station's <u>potential</u> audience

$N \equiv$ the number of other stations competing for the same audience in the market

$Y \equiv$ the average income per household

$R \equiv$ the "price" of advertising, in \$ per unit of <u>actual</u> audience

$P \equiv$ programming expenses of the station

$V \equiv$ the <u>value</u> of the station

$\lambda \equiv$ the "price of risk

$R_M \equiv$ the return to the market portfolio

As described in detail in Chapter 1, the value of a broadcasting station in equilibrium is, according to CAPM, equal to the capitalized stream of its risk-adjusted expected profits, the risk premium being proportional to the covariance of the profit with the market portfolio. If the sales price of a station is identified with the equilibrium value as if it had been auctioned freely in the market, then, given the existence of independent data for the station's profit, it is possible to develop estimating equations for both profit and risk-premium, allowing, in turn, an estimating equation for the value of the station. The equation was shown to be

(1) $V = \frac{1}{r} [E(\pi) - \lambda Cov(\pi, R_M)]$.

We want to find the independent variables that determine the values of the expectation and covariance in the RHS of (1). This will be done separately for the CBC - affiliates and the independents. A common estimating equation on the lines of the one used for the CBC - affiliates failed completely to yield significant results in the case of the independents.

A) CBC - affiliates: In the case of a CBC - affiliated station the parameters of its operations are exogenously fixed. The stations competes for advertising revenue with the other stations in its market. The "price" of its product R is assumed given (perfectly competitive assumption). This is not a bad assumption (even though there may be only a few radio stations in the market), because the stations compete also with all other

advertising media, as well as with each other. The size of the market (as measured by the station's <u>potential</u> audience), as well as the "quality" of the market (measured by the average income of the audience) are also expected to influence the station's profitability. Analytically, this means that $\pi = \pi(Q,N,R,Y)$. If a log-linear form is assumed for this relationship then the estimating equation becomes

(2) $\quad \log \pi_{it} = a_0 + a_1 \log Q_i + a_2 \log Y_{it} + a_3 \log R_{it} + a_4 \log N_i + \varepsilon_{it}$,

where ε_{it} is a random term subject ot the usual assumptions.

From equation (1) we get immediately that the risk-premium $\lambda Cov(\pi,R_M) = E(\pi) - rV$. Hence, if the expectation of π can be estimated then we have an indirect observation of the risk-premium implied by the observed sales price. This in turn, leads to an estimating model, as explained in chapter 1. Unfortunately, with a risk-premium that changes signs it is not clear what the economic interpretation really is.

From (2) it follows that $\pi = AQ^{d1} Y^{d2} R^{d3} N^{d4}$, and A varies ramdomly across firms and time periods. Clearly, Q and N are non-economic variables and, therefore, appear as multiplicative constants in the covariance. Y and R are, of course, correlated with R_M. Hence, $\lambda Cov(\pi,R_M) = Q^{d1} N^{d4} Cov(\lambda AY^{d2} R^{d3}, R_M)$. For the estimation of the latter covariance we assume the following structure. Let $\bar{Y} \equiv E(Y)$, $\bar{R} \equiv E(R)$, and assume that λ and $E(R_M)$ are the same across the stations in our sample. Since the expectations and covariances are subjective estimates of the long-term value of the parameters, this latter assumption is probably valid, given the short period covered by our sample. Next we assume that $Cov(\lambda AY^{d2} R^{d3}, R_M) = \bar{Y}^{b1} \bar{R}^{b2} Be^{\varepsilon}$, where Be^{ε} is a

random term whose distribution needs to be specified for estimation purposes.

In general, the covariance term assumes positive as well as negative values in our sample. In the previous section we indicated that in the context of the CAPM the negative values (corresponding to "low" expected profitability relative to the sales price) are interpreted as a "countercyclical" behavior of broadcasting profits, justifying a negative risk-premium according to portfolio theory. The multiplicative nature of the estimating equation imposes upon us the estimation of an equation with $|\lambda Cov(\pi,R_M)| = |E(\pi) - Vr|$ as a dependent variable. The random element is then represented by a term of the form $|B|e^\varepsilon$, with $\log(|B|e^\varepsilon) = b_0 + \varepsilon$, where $|B| = e^{b_0}$, and ε is assumed to be a standard normal random variable.

This does not end the estimation, however, since we need to specify the distribution of the <u>sign</u> of B. It is assumed that B is >0 with probability p and < 0 with q = 1 - p, and the sign distribution is independent of the distribution of the error term ε. Hence, the sign is binomially distributed, and a maximum likelihood estimates of p and q can easily be derived dependent on the sample size and the observed proportions of positive signs in our sample. Summarizing all these, we have as an estimating equation for the risk-premium:

(3) $\log |\lambda Cov(\pi_i,R_M)| = \log |E(\pi_i) - V_i r| = b_0 + b_1 Q_i + b_2 N_i + b_3 \bar{Y}_i + b_4 \bar{R}_i + \varepsilon$

(B) <u>Independent stations</u>: These stations differ from the CBC affiliates insofar as they choose on their own some of the parameters of their operations. Thus, the broadcasters determine optimally the size of their programming effort, as measured by their programming expenses. These expenses contribute to both

the revenue side (through increased audience _ceteris paribus_)
and the cost side. Analytically, this takes place as follows.

Denote by A the total audience of station. The corresponding
advertising revenue is RA. The profit, therefore, is equal to
π = RA - P - F, where P are the programming and F the "other"

(non-programming) costs. The crucial question is how A varies
across firms. Clearly, A depends on the programming effort P,
the size of the market (potential audience) Q, the "quality"
of the market as measured by the average income per household
Y, and the strength of the competition as measured by the
number of other stations N. This means that A = A(P,Q,Y,N).
Let X denote the vector [Q,Y,N] of exogenous variables deter-
mining the station's audience. As an analytical form of the
function A we use the expression A = $\Phi(X)P^{\alpha}$, where α is a param-
eter between 0 and 1. This means basically that an increase in
the programming effort will increase the audience but at a
decreasing rate. The function $\Phi(X)$ will be left unspecified,
although it will be eventually assumed log-linear for estimation
purposes.

The profit-maximization conditions yield $\frac{d\pi}{dP}$ = 0, or
$R\frac{dA}{dP}$ = 1. If A = $\Phi(X)P^{\alpha}$ then the solution of the first-order
necessary condition is P = $[\alpha R\Phi(X)]^{1/1-\alpha}$. This equation,
assuming a log-linear form of $\Phi(X)$, yields an estimating equation
for several parameters of the system. On the other hand, the
broadcasting firm's profit equation is clearly dependent upon
both the programming effort _and_ the exogenous parameters of the
firm's operations Q and N, since the latter affect the firm's
"other" costs as well.

For analytical reasons that will become clear shortly we shall

use a linear form of the profit equation. This involves some approximation, but there is no theory establishing the dependence of the "other" costs upon the exogenous variables, while the expressions for the operating revenue net of the programming costs become highly complex and nonlinear. At any rate, the approximation is considered sufficiently accurate for our purposes.

Summarizing the above, we use the following system of equations for the independent stations instead of (2)

(4)
(i) $\log P_{it} = a_0 + a_1 \log Q_{io} + a_2 \log Y_{it} + a_3 \log R_{it} + a_4 \log N_i + \varepsilon_{it}$

(ii) $\pi_{it} = b_0 + b_1 P_{it} + b_2 Q_i + b_3 N_i + \eta_{it}$

where ε_{it} and η_{it} are random terms subject to the usual assumptions. We note that the fact that P_{it} enters in linear form in (4ii), and log-linear form in (4i) necessitates the use of the instrumental variables technique for (4(ii)), combined with ordinary least squares (OLS) for (4i).

The next step is the estimation of the risk-premium equation as in (3) for the affiliates. We shall show that (3), when applied to the subsample of independent radio stations is quite adequate as an estimating equation. Indeed, from (4ii) we note that $\text{Cov}(\pi, R_M) = b_i \text{Cov}(P, R_M)$, since Q and N are clearly uncorrelated with R_M and we assume that the random error term η is independent of R_M. However, we note that the form of equation (4i) is the same as (2) as far as the RHS is concerned, hence the same estimating equation (3) may be applied there as well.

4. Data and Results

In the sample of 38 observations there were 10 CBC - affiliates and 28 independent stations.

For each subsample the profit equation was estimated with pooled cross-section-time series data over the 6 years, 1972-77. The covariance term, on the other hand, was estimated with the cross-sectional subsamples. The data used for the various variables in the previous section is as follows:

π_{it} ≡ operating income of station i at time t.,

r_t ≡ the average annual yield on 3-5 year Government of Canada securities.

Q_i ≡ the potential audience, measured by total hours tuned in BBM coverage area.

N_i ≡ the number of other stations competing for audience with station i.

Y_{it} ≡ average disposable family income for the appropriate province in which the station is located.

R_{it} ≡ the "price" of advertising, estimated as the total annual advertising revenue divided by the actual audience in hours tuned, adjusted for annual growth by the province-wide rate of population growth.

P_{it} ≡ the program expenses of the station.

V_i ≡ the sales price of the station, adjusted to reflect a 100% transfer of the station's assets. Details of the adjustment were provided in the Background Study 5 of the CRTC's Ownership Study group.

The use of the above data items implies several less than fully satisfactory assumptions, coming primarily from the fact that the estimation involved a synthesis of a pooled cross-sectional-time series sample with a cross-sectional sample scattered randomly across the years. Given the time pressure and the difficulties of access to all data sources, this represented probably the best compromise under the circumstances. A number of minor modifications are possible, although in our opinion they will not change the nature of the results.

The regressions below are presented separately for affiliates and independents. The expectations have been estimated as averages across all six sample years. This again is less than fully satisfactory, since at the time of the sale the formation of the expectations for each station was probably based on the most recent years prior to the sale. Nevertheless, using a three or even two-year average would reduce the size of our cross-sectional sample, which was already rather small to begin with.

The figures below the coefficients indicate the t-statistic.

For each regression we also provide the R^2, the number of observations N_o, and the F-ratio.

A) CBC - affiliates

(i) $\log \pi = - 9.465 + 1.612 \log Q_i + 1.391 \log N_i +$
$\quad\quad\quad\quad (-1.018) \quad (4.31) \quad\quad\quad (-2.292)$

$\quad\quad + 0.583 \log R - 0.505 \log Y$
$\quad\quad\quad (0.772) \quad\quad\quad (0.848)$

$\quad\quad R^2 = 0.2552, \ N_o = 60, \ F(4,55) = 4.71$

(ii) $\log |\tilde{\pi} - rV| = \log |\lambda \text{Cov}(\pi, R_M)| = 94.132 + 1.894 \log Q +$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad (2.348) \quad (7.019)$

$\quad\quad + 0.587 \log N + 0.229 \log \bar{R} - 11.828 \log \bar{Y},$
$\quad\quad\quad (1.231) \quad\quad\quad (0.288) \quad\quad\quad (-2.665)$

$\quad\quad R^2 = 0.9283, \ N_o = 10, \ F(4,5) = 16.18$

The quality of the results differs quite a bit between regressions (i) and (ii). Thus, we note that, although (i) is significant in terms of its F-ratio, the coefficients of $\log N_i$ and $\log Y$ have the wrong sign, although only the first one is significant. The coefficient of $\log Q_i$, on the other hand, has the correct sign and is highly significant. Regression (ii), on the other hand, has an extremely good fit, in terms of R^2, F-ratio and significance of coefficients. We shall return to these results in the next section.

Because of the unsatisfactory nature of (i) we also tried a linear form of π, presented below.

(iii) $\pi = -86191.56 + 0.0913Q + 335.997N +$
       $\quad\quad (-2.072) \quad (4.95) \quad (0.127)$

$\quad\quad + 62477.64R - 1.844Y$
$\quad\quad\quad (2.889) \quad (-0.600)$

$R^2 = 0.3646, N_o = 60, F(4,55) = 7.89$

This regression is considerably better in goodness of fit terms than (i): both the R^2 and F are larger, the coefficients of Q and R have the correct sign and are highly significant, while the other two have the wrong sign but are not significantly different from zero. The trouble with this specification is that it is not consistent with equation (ii): the covariance of the linear profit function in (iii) with R_M (which variable is clearly statistically independent of Q and N) will make both these variables disppear as explanatory variables from the covariance estimation. If a flexible additive form like the generalized Leontieff is used instead of (iii) or (i) then additional terms should be introduced as explanatory variables (cross-products of Q, N, R and Y) in both π and $\lambda Cov(\pi, R_M)$. Unfortunately, the small size of our samples precludes such refinements for the present time.

B) Independent radio stations

As explained in the previous section, the estimation of the profit equation (4i) and (4ii) is a combination of OLS for 4(i) and instrumental variables for (4ii). The results are:

(iv) $\log P = 2.062 + 0.4084 \log Q - 1.058 \log N +$
            (0.369) (3.338)   (-2.808)

$+ 0.066 \log R + 0.6658 \log Y$
(0.542)   (1.120)

$R^2 = 0.092$, $N_O = 168$, $F(4,163) = 4.12$

In spite of the low R^2 these results are acceptable, insofar as all coefficients have the correct sign, and two of them are significantly different from zero.

(v) $\pi = 54343.89 + 0.8626P - 0.005Q - 7406.93N$
        (0.719)   (2.914) (-1.884)   (-2.322)

$R^2 = 0.244$, $N_O = 168$, $F(3,164) = 17.60$

(vi) $\log |\bar{\pi} - rV| = \log |\lambda Cov(\pi, R_M)| = 54.786 + 0.6021 \log Q$
                                        (1.619) (2.752)

$0.2315 \log N - 0.1289 \log \bar{R} - 5.5902 \log \bar{Y}$
(-0.321)   (-0.546)   (-1.508)

$R^2 = 0.3206$, $N_O = 28$, $F(4,23) = 2.71$

As mentioned in the previous section, the sign of the covariance terms in (ii) and (vi) is assumed binomially distributed. A maximum likelihood estimator of the probability p that the covariance is positive under the binomial assumption is given by the proportion of positive terms within our sample. For the affiliates there are 6 positive terms, hence $\hat{P}_A = 0.6$, while for the independents there are 10 positive terms, i.e. $\hat{P}_i = \frac{10}{28} \doteq 0.357$.

Since the estimates for the independent radio stations were rather weak, we tried to improve them by eliminating the four FM stations from the sample. The results were better, in some cases significantly better. We present them below.

(vii) $\log P = -14.013 + 0.399 \log Q - 1.235 \log N+$
$\qquad\quad (-2.325)\ (3.006) \qquad\quad (-2.949)$

$\qquad\qquad\qquad\quad - 0.144 \log R + 2.478 \log Y$
$\qquad\qquad\qquad\quad\ (-1.061) \qquad\quad (3.808)$

$R^2 = 0.1738$, $N_o = 144$, $F(4,139) = 7.31$

The profitability equation was fitted by a number of methods. We report the results below for the instrumental variables and autoregressive methods.

(viii) $\pi = 82071.1 + 0.473P - 0.005Q - 5146.93N$
$\qquad\qquad\ (1.630) \quad (4.631)(-2.222) \quad (-1.673)$

<u>Autoregressive</u>, $R^2 = 0.1840$, $N_o = 143$, $F(3,139) = 10.44$

(ix) $\pi = 91362.56 + 0.436P - 0.005Q - 5372.9N$
$\qquad\quad (1.554) \qquad (2.402)\ (-2.008)\ (-1.735)$

<u>INVAR</u>, $R^2 = 0.1832$, $N_o = 144$, $F(3,140) = 10.46$

These two results are virtually indistinguishable from each other. In addition to them, we also ran estimating with ordinary least squares and various translog or truncated translog forms. Neither one of these alternatives produced any significant improvement in the estimation results.

5. Discussion of Results

As mentioned already, the part of the econometric work presented in this chapter is the least satisfactory of the entire report. The adequacy of the estimating model (especially with respect to the risk-premium, which did not seem to exist) is somewhat in doubt. The discussion is limited to the profitability estimation, which was the more

reliable of the two.

For the CBC affiliates we would like to point out again the fact that the linear form (iii) yields considerably more satisfactory results than the log-linear form (i). The correct form is probably a flexible form of the truncated generalized Leontief type. This flexible form appears to give the best results in all parts of the empirical work of this report. We did not seek better estimating forms, since the lack of a satisfactory explanation for the risk-premium performance is a serious drawback in applying the general model to the radio samples.

The independent radio stations also had results of varying quality. The programming expenditure equations (iv) and (vii) have the predicted coefficient signs with the exception of R in (vii), which is not significant. We note that the negative sign for log N (predicted by our model) may, at first, appear paradoxical: it implies that as competition increases (N increases) the station's optimal programming effort (expenses) would decrease. This comes from the fact that the marginal audience response to higher programming expenses was assumed to be decreasing as the programming expenses increased. Competition, on the other hand, dilutes audience in the same way no matter how strong the programming effort. This counter-intuitive prediction seems to be confirmed by our results.

The profitability equations (v), (viii) and (ix) have a similar structure and similar coefficients. As predicted by the model, the coefficients of the programming expenses P, as well as the number of competing stations N had positive and negative signs respectively. For the potential audience Q the model does not predict a sign, since Q is also a determinant of the programming expenses. We also note

that these profitability equations could have been enriched by means of cross-product terms, but in such a case the application of elaborate econometric techniques such as the instrumental variables raises delicate problems of estimation and interpretation that may not have an easy solution.

Footnotes

[1] The stations have been randomly re-ordered to prevent disclosure of data which could be related to a particular station.

CHAPTER IV: THE VALUATION OF

TV BROADCASTING LICENSES

1.   Introduction

Television broadcasting differs from radio broadcasting
insofar as the geographic dimensions of the market for its adver-
tising time are much less well-defined. Consequently, the dimen-
sions of the effective competition for a given TV license are
much harder to define.

A TV signal originates in a certain geographical point
and provides off-the-air broadcasting within an area, measured
by the AB contour. The size of the contour depends on the power
of the station, as well as the physical characteristics of the
area. The audience of the station in most cases, however, extends
well beyond the contour, because most stations have CATV headends
located within the contour, that transmit the signals beyond the
contour boundaries. Although the CRTC regulations oblige the
CATV systems to give priority to local signals, in practice the
development of CATV has contributed to an increased effective
competition for television audience in most geographical areas of
Canada. Thus, the nature and extent of competition between
stations is considerably more pronounced in any given area for TV
than for radio.

A second important characteristic of TV licensing is the
fact that, in contrast to radio, the importance of independent

stations is much less for TV than for radio. Most television
stations are affiliated with one of the domestic networks (CBC,
CTV, Global or TVA). Consequently the importance of programming
expenditures as a means of attracting audience is very much
reduced.

The expansion of CATV in recent years does create some
problems for our estimation. In contrast to radio and CATV,
the CRTC's Ownership study did not find enough data for their
purposes. Hence, the relevant sales data had to be collected
by the research team from the CRTC's public files. In order to
assemble sufficient data for a "meaningful" estimation the
research team had to survey the years from 1967 to 1977. This
procedure had the following undesirable effects:

1) Television station sales before 1972 were influenced by the
implementation of the divestiture rules decreed by the CRTC,
following government legislation excluding foreign ownership in
the communications sector. Post 1971 sales prices may, thus,
come from a different sample.

2) The years of the sample were precisely those witnessing the
spectacular growth of CATV. For this reason, the "market" for
a particular station did not remain stable in the period surveyed.

It is expected that the first effect will have no influence
on the profitability equations, but it will certainly bias the
sales prices. For this reason, dummy variables will be included
in the covariance equation to capture any such effect, if it
exists. As for the second factor, it will certainly show up in

the profit equation, by expanding both the potential audience and the competition. We shall take these into account by including a time trend in the AB contour population, as well as by having a time-varying index of competition.

Except for these complications, the estimations of this chapter follow fairly closely those of the two previous chapters. The sales price is supposed to conform to the CAPM model of Chapter I, and the expected profit minus annualized sales price represents the risk premium. The significant effects of the changing economic environment make the interpretation of the results considerably more difficult.

2.   Preliminary Considerations

Our sample had a total of 18 sales prices ranging from 1967 till 1978. However, two of the stations in the sample were sold twice, leaving a total of 16 stations. In Table 4.1 below we show the average economic profit (on an annual basis) for the stations in the sample for the period 1972-77. This was defined as $\bar{\Pi} - \overline{rF}$, where rF is the annual cost of the undepreciated total investment, valued at the riskless rate of interest. This turns out to be positive in 14 systems, and negative in the remaining two. Hence, television broadcasting is quite profitable on average, significantly more so than radio broadcasting, but not as profitable as the operation of a CATV system.

Table 4.1[1]

System #		System #	
1	-214,037	10	494,651
2	103,121	11	6,093
3	630,498	12	280,398
4	-11,432	13	1,081,666
5	107,030	14	2,087,362
6	611,140	15	47,768
7	949,075	16	4,489,856
8	131,294		
9	234,330		

For the economic value of the license to be capitalized by the original licensee we would expect that the value paid by the buyer should be in excess of the value of the fixed assets, the latter having been shown in Table 4.1 to be below the average profit. Given the wide dispersion in the years of the sale in our sample, we divided the sample in two groups: the first contained stations sold before 1972, while the second comprised the stations after (and including) 1972. The first had 12 sales prices representing 10 stations, while the second had only 6 sales prices and stations. For the first group we compounded the sales prices from the sale year to the year 1972 (the first year, for which data on invested capital existed) at the riskless rate of interest, and compared the compounded value to the total invested capital. For the second group we simply compared the value of the station to the total invested capital at the

year of the sale. The results are shown in Table 4.2 and 4.3
respectively.

Table 4.2[1]

System #	F_{72}	V_{72}	$V_{72}-F_{72}$
1	913,507	633,300	-280207
2	2,481,000	10,234,128	7753128
3	1,431,660	4,102,362	2670702
4	2,154	1,521,125	1518971
5	919,975	979,251	59276
6	1,725,313	4,116,432	2391119
7	648,929	2,260,800	1611871
8	5,698,000	3,699,376	-1998624
9	6,365,000	20,771,265	14406265
10	6,365,000	20,347,200	13982200
11	2,249,861	1,592,496	-657365
12	437,137	750,714	313577

Notes: a) Compounding factor is $\prod_{t=t_o}^{t=1972}(1+r_t)$, where t_o is the year
of the sale.

Table 4.3

System #	F	V	V-F
1	2,771,408	282,432	-2488976
2	437,137	664,114	2226977
3	2,813,153	5,983,210	3170057
4	2,458,724	481,874	-1976850
5	874,750	1,206,000	3331250
6	585,279	330,000	255279

A comparison of Tables 4.2 and 4.3 is very illuminating.
Thus, only three out of twelve sellers before 1972 received prices
that were less than the value of their fixed assets. By con-
trast, fully one half of the post-1972 sellers did not manage to
recoup the value of their investment, although this statement
is not to be interpreted as meaning that the seller realized
losses from the TV operations (since the profits during the years
of operation were not taken into account). This may mean that
the operation of a TV license became progressively riskier with
the passage of time, although the sample is too small for any
firm inference. The two factors that may account for this in-
creased risk are the divestiture rules and the Canadian content
regulations, although the number of observations is too small

to be able to disentangle the two effects. In the empirical
work in the following sections we expect because of Tables 4.2
and 4.3 that the time-period dummy variable in the risk-premium
equation will show a significant difference between the two
periods.

3.   The Model

The model specification is very simple. As with the CBC
affiliates in radio broadcasting, the parameters of a radio
station's operations are fixed exogenously by the nature of the
franchise and the market environment, in which it operates. The
stations compete with each other in the rather loosely defined
"market" for advertising revenue. The "price" of the product R
is assumed given, according to the perfectly competitive assump-
tion followed for radio. In the case of TV this assumption is,
if anything, even more justified. The size of the market (poten-
tial audience) is measured by the AB contours population Q. Although
this seems to neglect the potential audience reached by CATV,

there was so much change and development in the CATV industry over the period in question that the inclusion of population reached by the station through CATV would have necessitated a major search for data. In addition, the error created with this approximation would not be significant if (as it seems reasonable to hypothesize) the population reached by CATV beyond the AB contour is proportional to the AB contour population.

The "quality" of the market is again captured through the household income variable Y. As for the size of the competition, we used data from the Bureau of Broadcasting Measurement (BBM) surveys. For each station an index N of competing stations was computed on the basis of the BBM areas reached by the station. Details of the computation are presented in a subsequent data section. Finally, dummies Da denoting the affiliation status, as explained above were also included among the exogenous variables.

(1) $= F(R,Q,Y,N,Da)$,

where the exogenous variables were defined above. Equation (1) can be estimated by a log-linear or flexible form. In the results presented below the estimating equations are linear, log-linear, and generalized Leontief.

From (1), depending on the form of the estimating equation one can proceed to the estimation model for the risk-premium term $E(\Pi)-rV$. As discussed earlier, such an estimating model would also be log-linear if the profit model is log-linear, while in the case of a linear profit function a linear risk premium equation cannot be easily rationalized in terms of the CAPM.

On the other hand, a generalized Leontief forms gives rise to
a similar form for the risk-premium.

4.   Data and Results

In our sample there were a total of 18 stations, resulting
in 18 values for the sales price. However, two of these sta-
tions were sold twice, so that the profit equations derived from
(1) had 6 x 16 = 96 pooled cross-section and time series obser-
vations. The sales price was taken from the CRTC's public files
and was adjusted to reflect a 100% transfer of assets. The
details of the adjustment were quite complex, insofar that the
transactions involved quite often consisted of partial transfer
of shares and of liabilities. Full details of the sales price
computations are presented in the Data Appendix.

For the variables used in the regressions the data was
as follows:

$\Pi_{it}=$ operating income of station i at time t

R_{it} = advertising price of station i at time t.

Computed as $\dfrac{A_{it}}{U_{it}}$

A_{it} = advertising revenues

U_{it} = total actual audience of station i in year t.

Q_{it} = AB contour population, computed from census data and adjusted for a time trend.

N_{it} = "State of competition" variable. This was computed from the BBM circulation reports for each station i and year t as follows. For all non-overlapping BBM areas, for which a report existed for the station we separated in each area all those stations, for which an audience was repor- ted. Then we excluded from them those that had less than 5% of the audience in the area provided station i had more than 5%; otherwise, we excluded those that had less percent audience than station i. The number of the remaining sta- tions in each non-overlapping BBM area was multiplied by the audience of the area, the products were summed over all areas reached by station i, and the sum was divided by the total audience in all areas reached by station i.

Y_{it} = average disposable family income for the appropriate province, in which the station is located.

r_t = average annual yield on 3-5 year Government of Canada securities.

V_i =   the sales price of station i, adjusted for 100%
transfer as described above.

The regressions below provide the t-ratios below the
coefficients, as well as the R^2 and the number of observations.
Da_1 and Da_2 were 1 for CBC and CTV respectively, 0 otherwise.
The expectations were again estimated as averages across all
six sample years. As before, this is less than fully satis-
factory, but in this case we simply have no choice, given the
wide spread between the years of the cross-sectional sample.

(i) $\log \Pi$ = 8.251 + 1.769 log R + 0.59 log Q − 0.586 log N
        (0.615) (4.243)   (1.87)   (−0.694)

   − 1.872 log Y + 3.831 Da_1 + 2.824 Da_2
     (−1.232)   (2.631)   (2.213)

R^2= 0.2067 N_o= 96 $F(6,89)$ = 3.86

(ii) Π = −253433 + 601.22R + 0.606Q − 90262.38N −
        (−0.675)   (2.204)   (9.062)   (−2.464)

   − 7.601Y + 300721.38Da_1 + 923529.06Da_2
     (−0.202)   (1.192)   (3.606)

R^2= 0.5996 N_o = 96 $F(6,89)$ = 22.21

In comparing (i) and (ii) we note immediately the supe-
rior quality of the linear form (ii). For this reason, we did
not attempt an estimation of a translog form. Instead, we
considered (ii) as a truncated generalized Leontief. Here

there are only four exogenous variables, so that the full generalized Leontief estimating form may be applied. Regression (iii) below presents such a full Leontief model.

(iii) $\Pi = -170161.94 - 275.14R + 1.519Q + 98501.88N -$
$ (-0.511) \quad (-0.389) \quad (6.612) \quad (0.445)$

$ -102.27Y \quad -19.36R^{\frac{1}{2}}Q^{\frac{1}{2}} + 11387.03R^{\frac{1}{2}}N^{\frac{1}{2}} +$
$ (-1.008) \quad (-0.831) \quad (0.557)$

$ +139.77R^{\frac{1}{2}}Y^{\frac{1}{2}} -1932.45Q^{\frac{1}{2}}N^{\frac{1}{2}} + 30.18\,Q^{\frac{1}{2}}Y^{\frac{1}{2}} +$
$ (0.346) \quad (4.492) \quad (2.317)$

$ +997.16N^{\frac{1}{2}}Y^{\frac{1}{2}} + 346700.75Da_1 + 826517.69Da_2$
$ (0.116) \quad (1.598) \quad (3.578)$

$R^2 = 0.7457 \qquad\qquad N = 96 \qquad\qquad F(12,83) = 20.28$

The explanatory power of (ii) or (iii) is quite good. In (ii) R, Q and N have the predicted sign and are highly significant, while Y has the wrong sign but is not significantly different from zero. In (iii) the same conclusions are maintained, only now the variables N and Y have the predicted influence (in a non-linear form, in conjunction with Q), while R's influence is uncertain and non-significant. A better non-linear equation could be developed by dropping some terms of (iii), but for projection purposes both (ii) and (iii) are considered adequate.

The affiliation dummies are both positive, although Da_2 is both higher and significant. This means that both CBC and CTV affiliation have a positive contribution to profitability, but CTV more so than CBC.

For the risk-premium we can generate a co-variance equation with the following reasoning: of the four variables that are in (ii) and (iii) it is clear that Q and N are independent of the market return $\tilde{R}_m$. Hence, the only items that will enter the co-variance equation are R, Y and the cross-products with R and Y. If a bar over a variable denotes its projected expectation then we may use the estimating equation (2) below, in which $D_T=1$ when the sale was in 1972-78, 0 otherwise.

$$(2)\quad \bar{\Pi} - rV = a_o + a_1\bar{R} + a_2\bar{Y} + a_3\bar{R}^{\frac{1}{2}}\bar{Q}^{\frac{1}{2}} + a_4\bar{R}^{\frac{1}{2}}\bar{N}^{\frac{1}{2}} +$$
$$+ a_5\bar{Y}^{\frac{1}{2}}\bar{Q}^{\frac{1}{2}} + a_6\bar{Y}^{\frac{1}{2}}\bar{N}^{\frac{1}{2}} + a_7\bar{R}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}} + a_8 Da_1 + a_9 Da_2 + a_{10}D_T + \varepsilon$$

Applying (2) to the cross-sectional sample we get:

$$(iv)\quad \bar{\Pi} - rV = 2254273.00 - 6639.27\bar{R} - 1306.51\bar{Y} + 275.96\bar{R}^{\frac{1}{2}}\bar{Q}^{\frac{1}{2}}$$
$$(0.920)\qquad (-0.720)\qquad (-1.786)\qquad (2.369)$$

$$- 214818.44\bar{R}^{\frac{1}{2}}\bar{N}^{\frac{1}{2}} - 64.55\bar{Y}^{\frac{1}{2}}\bar{Q}^{\frac{1}{2}} - 45281.93\bar{Y}^{\frac{1}{2}}\bar{N}^{\frac{1}{2}}$$
$$(-1.113)\qquad (-1.972)\qquad (1.163)$$

$$+ 655.44\bar{R}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}} + 1375348Da_1 + 1074994Da_2 - 664096.12D_T$$
$$(1.517)\qquad (0.941)\qquad (0.760)\qquad (-1.462)$$

$R^2 = 0.8693 \qquad N_o = 18 \qquad F(10,7) = 4.66$

Although the CAPM does not allow for a linear term in the state of competition variable N, we applied also (2) with $\bar{N}$ replacing $\bar{Y}$. The rationale for this was that the "state of competition", being variable over time because of the changes in CATV, affected the long-run riskiness of the investment in the TV license. The results are shown in (v) below.

(v) $\bar{\Pi}-rV$ $= -$ 502869.88 $+$ 3929.92$\bar{R}$ $+$
$\phantom{(v) \bar{\Pi}-rV = -}$ (-0.209) (0.421)

$+$ 1851938$\bar{N}$ $+$ 255.51$\bar{R}^{\frac{1}{2}}\bar{Q}^{\frac{1}{2}}$ $-$ 270131.44$\bar{R}^{\frac{1}{2}}\bar{N}^{\frac{1}{2}}$
 (1.786) (2.214) (-1.261)

$+$ 3089.14$\bar{R}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}}$ $-$ 64.65$\bar{Q}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}}$ $-$ 19103.80$\bar{N}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}}$
 (1.089) (-1.975) (-0.644)

$+$780951.06Da_1 $+$ 525411.25Da_2 $-$ 938339.25D_T
 (0.510) (0.353) (-2.243)

R^2=0.8693 N_o=18 $F(10,7)=4.66$

The results of (iv) and (v) turn out to be quite satis-
factory. In spite of the small number of observations both
regressions are significant at better than 2.5%. The empirical
work could probably be continued in follow-up work, by dropping
some of the insignificant terms and introducing both $\bar{Y}$ and $\bar{N}$
in the same regression.

There are three significant variables in (iv) and four
in (v). In the latter equation we note that, as expected, the
coefficient of average competition $\bar{N}$ is positive, i.e. the risk-
premium increases[2]. In (iv), again as expected, a high average
income $\bar{Y}$ also decreases the risk premium. Finally, the affi-
liation dummies are positive but insignificant, but the time
period dummy is negative and highly significant in (v). This
may be due to the fact that the large time spread between the
years of sale, and the high concentration of observations in the
pre-1972 period have imported a bias in the risk-premium esti-
mation. To correct this bias we re-estimate the equation by
replacing rV by the compounded and discounted values to a com-

mon year. The year chosen was 1972 if V_{72} denotes the compounded or discounted sale values at the riskless rate of interest from year of sale till 1972 then we have, instead of (iii) - (iv):

(vi) $\bar{\Pi}-rV_{72}$ = 2602431.00 − 6663.27$\bar{R}$ − 1414.12$\bar{Y}$ +
(1.257) (−0.856) (−2.290)

+ 260.15$\bar{R}^{\frac{1}{2}}\bar{Q}^{\frac{1}{2}}$ − 195127.38$\bar{R}^{\frac{1}{2}}\bar{N}^{\frac{1}{2}}$ − 58.46$\bar{Q}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}}$
(2.643) (−1.196) (−2.114)

+42590.00$\bar{N}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}}$ + 6462.54 $\bar{R}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}}$ + 1907859Da_1 +
(1.295) (1.771) (1.545)

+ 1995209Da_2 − 556607.5D_T
(1.669) (−1.450)

$R^2=0.9025$ $N_o=18$ $F(10,7)=6.48$

(vii) $\bar{\Pi}-rV_{72}$ = 974775.06 − 1256.92$\bar{R}$ +
(0.362) (−0.121)

14976.98$\bar{N}$ + 227.55$\bar{R}^{\frac{1}{2}}\bar{Q}^{\frac{1}{2}}$ + 41586.18$\bar{R}^{\frac{1}{2}}\bar{N}^{\frac{1}{2}}$ −
(0.013) (1.765) (0.174)

−53.08$\bar{Q}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}}$ − 9462.28$\bar{N}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}}$ − 681.83$\bar{R}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}}$ +
(−1.450) (−0.285) (−0.215)

2192004Da_1 + 2355058Da_2 −901976.38D_T
(1.280) (1.417) (−1.929)

$R^2=0.8294$ $N_o=18,$ $F(10,7)=3.40$

In these new results regression (vi) turns out to be superior to (vii), as well as to (iv) and (v) in explanatory power and significance of results. The difference between (iv) and (vi), however, is minor: with the exception of the coefficient of $\bar{N}^{\frac{1}{2}}\bar{Y}^{\frac{1}{2}}$ which has a sign reversal all the other variables retain their signs and (roughly) the same order of magnitude. The t-ratios of several coefficients have increased, but the dummy variable D_T retains its counter-intuitive negative sign. We defer discussion of the results till the next section.

5. Discussion of Results

Overall, the results of the estimation for TV appear to be quite good. In spite of the manner of data collection and the widely scattered observations, the model developed in Chapter I seems to fit the data quite well. For the profitability equations (ii) and (iii) the R^2 are quite satisfactory. The signs of the coefficients are the predicted ones in (ii), while in (iii) the non-linearity of the estimating equation precludes any kind of inferences. The one exception is family income in (ii), which has the wrong sign but is not significant. This seems to be a persistent pattern in our results. It is possible that the choice of data for Y (the provincial average) was not appropriate, due to the wide intraprovincial differences. On the other hand, since our sample was not necessarily located in metropolitan areas, there was no way of specifying any better the income variable.

For the risk-premium equations (iv) and (vi) the results are also quite good. To begin with, the risk-premium $\bar{\bar{\Pi}}-rV_{72}$ was _positive_ in all but one of the observations in our sample. For such data the estimating model of Chapter I is more valid. The various elements of the regulatory environment - Canadian content programming regulations, competition from CATV, technological developments - all contribute to increasing the risk of investment in television broadcasting.

A priori we expected that this risk would have been higher in more recent years. Yet this did not turn out to be the case; the coefficient of D_T turned out to be negative, implying that

the risk-premium was lower in the post-1972 period. It is possible that the early years (1967-71), characterized as they were by considerable regulatory instability due to the introduction of divestiture and Canadian content regulations, were interpreted by the market as being more ominous in their implications for the long-term profitability of TV broadcasting, than the reality turned out to be.

FOOTNOTES

1. The stations have been randomly re-ordered to prevent disclosure of data which could be related to a particular station.

2. This statement should be qualified somewhat, since $\bar{\bar{N}}$ also enters in the cross-product terms.

CHAPTER V: CONCLUSIONS AND POLICY IMPLICATIONS

I.   General remarks

The common methodology developed in the first chapter of this report allowed us to examine the investors' perception of the prospects for investment in the broadcasting and CATV fields. This perception was revealed through the prices paid for broadcasting assets and licenses. The stream of profits generated by assets and licenses during a given time period represented the return to the investor. This return was compared to what would have been earned had the investor chosen instead to put his money in a "riskless" asset.

The investor has his own subjective evaluation of a given licensee's prospects. In the research of this paper it was assumed that these evaluations were "unbiased", in the sense that there is no tendency to be systematically optimistic or pessimistic. Hence, the investor's evaluation of a licensee's profitability can be represented by the average profitability over a number of years.

This kind of assumption has many pitfalls, especially if the investors' perceptions were recorded (through the realized sales) over a period of a six-year length. Events that are thought to alter the institutional structure of the broadcasting or CATV operations (and there were many such events in the period of our observations) are recorded by the investors and reflected in the sales prices of the licenses. Our estimation is correct only if

these events occurred randomly, and were not uniformly favorable or unfavorable to the proposed investment. It is our general impression that this condition was fulfilled. Where there were reasons to believe that it was not (as in the case of TV) the sample was segmented appropriately.

The models developed in this report have a projection purpose as well as a hypothesis-testing purpose. The profitability and risk-premium equations, when combined together, may provide an estimate of the sales value of a particular operation. On the other hand, each one of these equations may be used on its own to investigate various postulates, as, for instance, the regulatory risk hypothesis in the case of CATV.

Of the two parts of the estimating model the profitability equations were undoubtedly better, in statistical quality as well as in microeconomic consistency. The estimating equations were solidly grounded in microeconomic theory, with the particular market structure taken explicitly into account (regulated monopoly in CATV, oligopoly in the other two). The number of observations was quite adequate, and the significance of the estimates fairly high. Even in the case of radio, the weakest part of the empirical work, the methodology that was developed through the segmentation of the sample into independents and CBC-affiliates yielded ultimately acceptable results.

For the risk-premium, on the other case, we were on weaker theoretical grounds. In spite of the widespread acceptance of

the CAPM the method of application to Canada has not been developed satisfactorily to this date. In the single instance, in which we attempted a direct estimation of the risk-premium according to CAPM (the case of CATV) the results failed to show any evidence of risk if the TSE returns are used as a proxy for the return on the market portfolio. Hence, the estimation of the risk-premium equation was, by necessity, ad hoc, with all the attendant draw-backs. Nevertheless, the results were adequate, especially in CATV and television; we found no evidence of a risk-premium in radio, and the meaning of the reported results is not very clear. It should be noted that if the CAPM is correct and if the lack of correlation between the "correct" market index (whatever that may be) and the stations' profits is validated, then there is no reason for the license-holder to earn a risk-premium over and above the riskless rate of interest.

In reviewing the results in all three sectors examined in this report we remark that a consistent feature in all of them is the strong influence of regulatory policy in determining the licensee's profitability. Indeed, the most important variable in explaining profitability is the "size" of the franchise, whether measured by potential subscribers in CATV, total hours tuned in its coverage area (which is clearly proportional to the power of the station) for radio, or AB contour population for TV. These all-important parameters are set by the CRTC and no information was found about the manner in which they are determined.

For an economist the whole issue of regulation and license award as currently practiced in the three sectors examined in this report appears as a needless exercise in bureaucratic proliferation. While there may be sound reasons for close supervision of broadcasting content, and while there are undoubtedly compelling reasons for the imposition of minimum Canadian content regulations in programming, we could find no logical justification for the arbitrary award of the licenses to private groups after lengthy and cumbersome hearings, instead of having the licenses auctioned periodically by sealed tenders to the highest bidder. In such a case, while the regulator would still regulate the licensee's operations on the basis of well-defined and stable policies, the license award process would be entrusted to the market mechanism.

For whatever reasons one may think of, this procedure is not followed. Regulatory action rather than market auctions determine the licensee, and we were forced to go to the resale market for broadcasting licenses for the empirical work. In the sections that follow we will summarize briefly the results for each one of the three sectors studied, and we will draw the appropriate policy conclusions, if any.

2. CATV: Results and Policies

Of all the sectors examined in this report CATV is the most intensely involved in the regulatory debate. There are currently proposals to regulate their income on a rate-of-return basis, to expand their local programming, to force them to pay royalties to

broadcasters, to bring them under provincial jurisdiction, etc.,
etc. All this institutional instability has taken its toll: we
have already seen that investment in CATV license is perceived
as highly risky. From another point of view, these proposals
and debate are not new. In the Comanor-Mitchell and Crandall-
Fray articles the central subject was the economic ability of
the CATV sector to absorb further regulation. These two studies
reached opposite conclusions on the subject.

In examining the results of our "best" profitability equa-
tion (xi) with respect to its implications for regulatory policy
we note a few salient facts:

    a) The regulatory variables of subscription price and (espe-
cially) size of the franchise as measured by the potential
subscribers are by far the most important determinants of
the profitability of CATV operations.

    b) Local programming decreases profitability.

    c) There is no evidence that the availability of extra US
channels improves profits.

The effect of an increase in the subscription price is pro-
bably to improve profitability. Although in (x) an increase in
P reduces the term $\frac{I-P}{I}$, this is overshadowed by the linear term
and the interaction with Q_p term. Similarly, an increase in Q_p
raises profits. It should be noted that the variance of the
term $\frac{I-P}{I}$ is very small, since these ratios are close to 1. The
high collinearity between the variables precludes any separate

examination of them.

For the local programming $\overline{C}_p$ the Munasinghe-Corbo study found that an increase in $\overline{C}_p$ improved the penetration ratio. Apparently, this improvement is not sufficient to compensate for the extra costs involved. Our decision to consider $\overline{C}_p$ exogenous appears correct in retrospect.

Finally, the lack of significance of the extra US channels variable X_u is also consistent with the Munasinghe-Corbo results. In that study this counter-intuitive effect was interpreted as due to the low dispersion of the values of the variable in the sample, since most systems carried all three US networks.

The important questions of the regulation of profitability of CATV operations do not have a unique answer. Recent recommendations seem to point towards some form of rate-of-return regulation. The drawbacks of this method of regulation (rate base-padding, service deterioration, etc.) are too well-known to be repeated here, not to mention the lengthy and cumbersome rate-setting hearings. There are a number of alternative methods of reducing the profitability of CATV (if this is the goal of regulation), such as expansion of local programming and the auctioning of franchises, the takings of the auction being used in order to reduce local taxes. All these are questions of income re-distribution: there is no question that the CATV profits are the result of monopoly franchising. Given this, they properly belong to the public. The latter can receive them either through lower charges

for the same service (rate-of-return regulation), or local tax
rebates from the auctioning of the franchise. Since the right
to award a franchise belongs to everybody (and not just to those
who choose to subscribe) we believe that the auction is superior
on equity terms, as well as being easier to administer. For this
reason, we believe that an optimal regulatory policy is the trans-
fer of jurisdiction of award of CATV franchises to local govern-
ment, with the proviso that the licenses be auctioned off to the
highest bidder. In this respect the recent recommendations that
jurisdiction over CATV be transferred to provincial governments
represents certainly a move in the right direction. An additional
advantage of transfer to local jurisdiction is that it would
allow the public to choose its own preferred mix of local program-
ming and revenue.

The last conclusion refers to the effect of CATV on television
audiences and revenues. The results of the estimations of Chapter
IV demonstrate that, on the one hand competition decreases TV
profitability, but on the other hand the original "size" of the
franchise (AB contour population) remains the most powerful
influence on television profitability. This is probably due to
CRTC policy of compelling cable operators to give priority to
local signals. Overall, it does not look as if the TV broadcas-
ting industry is in poor shape due to CATV. As a matter of fact,
the few recent sales figures show that the value of TV stations
has been rising (relative to their profitability) when compared
to earlier years. The proposals that CATV operators pay royalties

to broadcasters for the right to carry their signals do not appear reasonable, since broadcasters are as likely to benefit as to be hurt from CATV. The most important reason, however, for which we do not recommend any such payments is that TV profits are also the result of franchising and entry restriction and, consequently, the economic benefits properly belong to the public.

3. Radio

As mentioned in Chapter III, the radio results were average in terms of fit to our model. The sample was segmented into CBC affiliates and independent radio stations. Exogenous, economic or regulatory variables determined the profitability of the affiliates, while the programming activity (itself determined optimally by the firm on the basis of the regulatory and economic variables) was the main factor determining the profitability of the independents.

The operation of a radio license did not appear to be very profitable in terms of required fixed investment. The risk-premium, on the one hand, hovered around zero. On the other hand, these "average" considerations do conceal large individual differences. Thus, as Table 3.1 shows the average annual profit net of fixed investment costs ranged from a high of ca. $450,000 to a low of ca. -$140,000. The firm's programming effort is the most important determinant of profitability in the independent stations. Although regulatory variables are important in determining programming activity, the relatively low explanatory power of our

regressions shows that there is a large unexplained variation between stations (managerial skill?).

We have no clear idea of the current demand for new radio stations and the extent of rivalry during the new license awards. The results seem to imply that the economic profitability of radio broadcasting is not very great on the average. All in all, radio broadcasting is the only sector where the regulatory practice of not auctioning the licenses does not seem to have resulted in diverting public funds to private use. In spite of this, our previous comments about the desirability of auctions hold here as well.

4.   Television

In television the empirical results of the model were quite satisfactory, in spite of the scattered nature of the observations. In the best one of the profitability equations, equation (iii), the regulatory variable of the size of the AB contour has the highest (positive) influence. Similarly, the competition has the expected negative influence and income a positive one, both in conjunction with the AB contour population (we ignore non-significant variables). CTV affiliation increases profits significantly. These results are in full agreement with our intuition. The major effect that the "size" of the franchise has upon profitability is all the more surprising, since CATV influence was not explicitly taken into account. We interpret this result as meaning that the CRTC's regulation of CATV has (consciously or unconsciously) tried to maintain each station's pre-CATV share of

the potential audience. In the absence of any information about
the method of determining the "size" of the franchises the above
conclusion has to remain tentative.

For the risk-premium equation (vi) the empirical results are
also quite good. As with the other sectors, there is always a
question of interpretation of the risk-premium which, in this case
and in contrast to radio, is positive. In characterizing it as
"risk-premium" we immediately make a value judgement, insofar as
we attribute the entire excess of revenues over costs of invest-
ment to a reward for risk. This may be true in a large, efficient
capital market, but is of dubious validity in the case of a market
that is oligopolistic - oligopsonistic, and has controlled entry.
In the latter case it could very well be an aggregate of risk-
premium and economic profit.

The basic features of the risk-premium equations have already
been discussed in Chapter IV. We would like at this point to
add one more possible explanation of the seemingly perverse sign
of the time-period dummy D_t, implying a lower risk-premium for
more recent years. This is simply that the pre-1972 years were
dominated by the "forced" sales through the divestiture rules.
These sales increased the supply and, consequently, depressed the
price. If that is so (and we are inclined to believe that this
is a more attractive explanation than the others), then these
divestiture rules conferred economic profits upon the buyers at
the time. These profits were sufficiently large to overcome any
increased riskiness in more recent years, through the Canadian

content rules or through the expansion of CATV.

The remarks made about the wide variations in profitability for radio are valid here also. With respect to investment the average annual profit net of investment costs ranged from a high of ca. $4.5 million to a low of $-200,000 approximately. With respect to the financial outlay of the buyer the profitability results (net of investment costs) ranged from a high of ca. $3.5 million to a low of -$400,000, annually, but only one station in 18 showed a loss. As mentioned already, the determinants of these wide variations are primarily regulatory variables.

The policy recommendations are in line with those of previous chapters. We believe that licenses should be auctioned under clearly spelled and stable regulatory operational rules. However, given the current environment, there is a second best solution that can be proposed with respect to Canadian content regulations. We recommend that Canadian content and required programming effort be explicitly tied to the size of the franchise as expressed by the AB contour. If the broadcasters believe that Canadian programming is unprofitable then it is only fair and rational that those on whom the regulatory rewards of a larger profitability (franchise) are bestowed carry also the larger responsibility of promoting Canadian programming.

On the subject of spectrum allocation between television and competing uses (primarily land-mobiles) the policy implications must await further study. The valuation of an additional license in a given area gives us an estimate of the value of an addition

to the TV portion spectrum as a function of the regulatory and economic characteristics of the area. This must be compared to the value of an addition to the land-mobile portion of the spectrum, which is still awaiting study. The methodology was presented in the PSZ report.

5. Conclusions

Since this report contained a number of criticisms of current or proposed regulatory policy, we wish to close it on a positive note. We share the regulators' concern about the impact of broadcasting policy on Canadian cultural identity. We believe that the active encouragement of Canadian content in programs is highly desirable, and that it should be, if anything, accelerated. Our recommendations were made in the spirit of the above long-term objectives. We differ from regulatory thinking in believing that reliance on market forces (properly defined and understood) can achieve the same objectives at a lower cost.

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DATA APPENDIX

TABLES

The following tables contain non confidential data obtained or generated from public files.

G: GENERAL DATA

G1: Average Disposable Income of Families and
     Unattached Individuals per Province (current $)
G2: Riskless Rate of Interest

C: CABLE DATA

C1: Relative Income
C2: Quality Index relative to Programs over the
     Air

R: RADIO DATA

R1: Potential Audience – Independent Stations
R2: Potential Audience – Affiliated Stations

T: TV DATA

T1: Value of Stations
T2: AB Contour Population

TABLE G.1

AVERAGE DISPOSABLE INCOME OF FAMILIES AND UNATTACHED INDIVIDUALS
PER PROVINCE (CURRENT DOLLARS)

YEAR	AV. DISPOSABLE INCOME BY PROVINCE									
	NEWFOUND-LAND	P. EDWARD ISLAND	NOVA SCOTIA	NEW BRUNSWICK	QUEBEC	ONTARIO	MANITOBA	SASKATCHEWAN	ALBERTA	BRITISH COLUMBIA
1968	$3,641^2$	$3,251^2$	$4,350^2$	$4,181^2$	$5,150^2$	$5,784^2$	$4,671^2$	$3,510^2$	$4,982^2$	$5,180^2$
1969	$3,223^2$	$3,789^2$	$4,900^2$	$4,749^2$	$5,740^2$	$6,464^2$	$5,231^2$	$4,140^2$	$5,632^2$	$5,842^2$
1970	$4,899^2$	$4,416^2$	$5,520^2$	$5,395^2$	$6,398^2$	$7,224^2$	$5,858^2$	$4,883^2$	$6,368^2$	$6,590^2$
1971	$5,754^1$	$5,267^1$	$6,180^1$	$6,241^1$	$7,312^1$	$8,240^1$	$6,658^1$	$5,781^1$	$7,393^1$	$7,775^1$
1972	$6,591^2$	$5,999^2$	$7,004^2$	$6,963^2$	$7,772^1$	$8,893^1$	$7,346^2$	$6,792^2$	$8,140^2$	$7,793^1$
1973	$7,456^1$	$6,677^1$	$7,985^1$	$7,629^1$	$8,666^1$	$9,850^1$	$7,986^1$	$7,951^1$	$8,728^1$	$9,590^1$
1974	$8,868^2$	$8,149^2$	$8,886^2$	$8,986^2$	$9,990^1$	$11,357^1$	$9,212^2$	$9,449^2$	$10,405^2$	$10,777^1$
1975	$10,416^1$	$9,719^1$	$9,949^1$	$10,394^1$	$11,096^1$	$12,711^1$	$10,470^1$	$11,186^1$	$12,080^1$	$12,069^1$
1976	$12,049^2$	$11,234^2$	$11,359^2$	$11,822^2$	$13,520^1$	$14,380^1$	$11,988^2$	$13,376^2$	$13,908^2$	$14,506^1$
1977	$12,677^2$	$11,837^2$	$11,859^2$	$12,383^2$	$13,821^2$	$14,970^2$	$12,395^2$	$13,950^2$	$14,417^2$	$14,674^2$

SOURCE: STATISTICS CANADA CAT. 13-210

1. 'Income after tax, distribution by size, in Canada', Statistics Canada, Cat. 13-210

2. Extrapolation projected from 1.

TABLE G.2

RISKLESS RATE OF INTEREST (Y_t)[1]

YEAR	AVERAGE YIELD OVER THE YEAR (%)	YIELD AS OF JAN. 31st. (%)
1967	5.64	5.20
1968	6.68	6.53
1969	7.66	6.99
1970	7.10	8.23
1971	5.55	5.37
1972	6.26	5.50
1973	7.03	6.25
1974	8.12	6.99
1975	7.68	6.32
1976	8.31	8.20
1977	7.79	7.62
1978	8.82	8.36

SOURCE: BANK OF CANADA REVIEW
1969-1978

1. The annual yield on Govt. of Canada securities with
    terms to maturity of 3-5 years have been taken to be
    the riskless interest rate.

TABLE C.1

CABLE: RELATIVE INCOME $(\frac{I-P}{I})$

SYSTEM#	1972	1973	1974	1975	1976	1977
1	.992	.993	.995	.995	.996	.995
2	.989	.993	.993	.994	.994	.993
3	.991	.992	.993	.994	.995	.995
4	.994	.994	.996	.996	.996	.995
6	.993	.993	.993	.993	.993	.994
8	.993	.994	.995	.996	.994	.995
9	1.000	.995	.996	.996	.996	.996
11	.994	.995	.996	.996	.997	.996
13	.993	.994	.995	.995	.995	.995
14	.994	.994	.995	.995	.995	.996
16	.992	.994	.995	.995	.996	.995
17	.994	.995	.996	.996	.996	.996
20	.994	.994	.995	.995	.995	.996
21	.994	.996	.995	.995	.996	.997
22	.994	.995	.995	.995	.995	.995
23	.990	.992	.992	.993	.994	.994
24	.992	.993	.994	.994	.996	.995
25	.994	.994	.995	.995	.995	.995
26	.993	.993	.994	.993	.994	.994
27	.995	.995	.995	.995	.996	.996

TABLE C. 2

CABLE: QUALITY INDEX RELATIVE TO PROGRAMS OVER THE AIR
$$(X_c, X_u)$$

SYSTEM #	X_c (CANADIAN)	X_u (US)
1	1.333	1.000
2	1.000	3.000
3	1.000	1.714
4	1.000	6.000
6	1.000	1.666
8	1.000	1.750
9	1.800	8.000
11	1.000	1.500
13	1.500	5.000
14	1.143	6.000
16	1.000	1.000
17	1.286	4.000
20	1.125	3.000
21	0.875	4.000
22	2.666	4.000
23	1.000	0.800
24	3.000	1.000
25	1.000	4.000
26	4.000	4.000
27	1.200	2.000

TABLE R. 1

RADIO: POTENTIAL AUDIENCE – INDEPENDENT STATIONS[1] (Q_{it})

STATION #	1972	1973	1974	1975	1976	1977
1.	1,357,200	1,378,915	1,400,097	1,423,393	1,446,167	1,469,306
2.	6,989,000	7,142,758	7,299,898	7,460,496	7,624,627	7,792,369
4.	5,921,700	6,002,369	6,124,749	6,228,870	6,334,761	6,442,452
5.	1,366,600	1,389,832	1,413,459	1,437,488	1,461,925	1,486,778
6.	34,961,200	35,205,928	35,452,370	35,700,536	35,950,440	36,202,093
7.	2,662,100	2,744,625	2,829,708	2,917,429	3,007,869	3,101,113
10.	624,200	622,952	621,706	620,462	619,221	617,983
11.	3,495,000	3,544,245	3,604,497	3,665,773	3,728,091	3,791,469
12.	12,928,800	13,329,592	13,742,810	14,168,837	14,608,071	15,060,921
13.	6,989,000	7,142,758	7,299,898	7,460,496	7,460,496	7,624,369
14.	5,956,400	6,087,441	6,221,364	6,358,234	6,498,115	6,641,074
16.	5,646,772	5,686,300	5,726,104	5,766,186	5,806,550	5,847,196
19.	799,016	812,600	826,414	840,416	854,751	869,282
20.	1,822,496	1,835,253	1,848,100	1,861,036	1,874,064	1,887,182
21.	683,561	695,182	707,000	719,019	731,242	743,673
22.	2,456,597	2,451,694	2,446,800	2,441,906	2,437,022	2,432,149
23.	2,800,103	2,886,906	2,976,400	3,068,668	3,163,797	3,261,874
24.	7,483,190	7,543,055	7,603,400	7,664,227	7,725,541	7,787,345
25.	497,215	500,695	504,200	507,729	511,284	515,862
26.	4,382,135	4,412,810	4,443,700	4,474,806	4,506,130	4,537,672
27.	573,387	572,242	571,100	569,958	568,818	567,680
29.	994,661	1,004,607	1,014,653	1,024,800	1,035,048	1,045,398
31.	1,369,474	1,392,755	1,416,432	1,440,511	1,465,000	1,489,905
32.	384,131	386,820	389,527	392,254	395,000	397,765
33.	3,407,326	3,465,251	3,524,160	3,584,070	3,645,000	3,706,965
34.	1,060,006	1,067,426	1,074,898	1,082,423	1,090,000	1,097,630
36.	2,309,383	2,304,773	2,300,173	2,295,582	2,291,000	2,286,418
38.	3,826,499	3,891,550	3,857,706	4,024,987	4,093,412	4,163,000

SOURCE: CRTC Files and Statistics Canada Census Reports.

1. The above table was obtained from the CRTC data projected along with the population growth rate (by province) estimated from Statistics Canada Census Reports.

TABLE R.2

RADIO: POTENTIAL AUDIENCE - AFFILIATES[1] (Q_{it})

STATION #	1972	1973	1974	1975	1976	1977
3	513,900	529,831	546,255	563,190	580,648	598,648
8	606,600	625,406	644,792	664,780	685,389	706,635
9	283,500	292,288	301,349	310,690	320,322	330,252
15	1,696,000	1,725,747	1,755,085	1,784,921	1,815,265	1,846,125
17	529,500	533,207	536,939	540,698	544,482	548,294
18	168,000	173,208	178,577	184,113	189,821	195,705
28	206,100	212,489	219,076	225,867	232,869	240,088
30	518,000	534,058	550,613	567,682	585,280	603,424
35	564,000	567,948	571,923	575,927	579,958	584,018
37	1,263,000	1,284,471	1,306,307	1,328,514	1,351,098	1,374,067

SOURCE: CRTC FILES AND
STATISTICS CANADA CENSUS
REPORTS

1. The table above was obtained from the CRTC data projected
alongwith the population growth rate (by province) estimated
from Statistics Canada Census Report.

TABLE T.1

TELEVISION: VALUE OF STATIONS

STATION #	VALUE OF STATION ($)	YEAR OF SALE
1	2,991,150[1]	1967
2	714,000[2]	1967
3	16,000,000[3]	1968
4	3,040,000[4]	1969
5	1,250,000[5]	1969
6	2,000,000[6]	1970
7	664,114[7]	1970
8	18,000,000[8]	1970
9	600,000[9]	1971
10	1,508,760[10]	1971
11	3,899,988[11]	1971
12	9,696,000[12]	1971
15	664,114[15]	1972
16	333,000[16]	1972
17	1,206,000[17]	1976
19	282,432[19]	1977
20	481,874[20]	1977
21	6,511,274[21]	1978

SOURCE: CRTC PUBLIC FILES

The above values were calculated as follows:

1. 34,500 shares were outstanding.

    29,900 shares were sold for $2,592,488. The average value of a share was, therefore, $86.70.50, the value of 34,500 shares was estimated at $2,991,150.

2. 50% of the ownership was transferred for $357,000.

3. 15,000 common shares were outstanding.

    3,750 common were sold for $4,000,000 in chash. Another 3,750 common were exchanged for 4,629 common of a second company plus $1,946,112.70 in cash. Share per share price was at $443.70 each. So 50% of the ownership was transferred for $8 million.

4. Total ownership was transferred for $2,350,000 in cash plus 30,000 shares (worth $23.00/share at that time). $23.00/ share

5. The total ownership was transferred for $1,250,000.

6. Total ownership was transferred for $2,000,000.

7. Total ownership was sold for $664,114.

8. Out of 15,000 outstanding common shares, 12,766 were transferred at $1200 each.

9. Total ownership transferred for $600,000.

10. Out of 2,286 outstanding common, 200 were transferred at $200 each.

11. Out of 11,355 outstanding common, 3,785 were exchanged for $343.46 each.

12. 50,000 common issued were sold for $9,696,000.

15. Total ownership was transferred for $664,114.44. (Note that the transfer was made in 1970 also at the same price).

16. 3,330 shares (2,664 preferred and 666 common) were sold for $100 each.

17. Ownership was transferred for a total of $1,206,000.

19. Total ownership of the TV station was transferred for a net value of $282,432.

20. Total ownership transferred for $481,874.

21. 2,713,031 common shares were outstanding. The transactions were: 995,414 common at $2.26 each.

153,000 common at $2.50 each.

125 special shares at $5,650 each.

75 special shares at $6,250 each.

One special share = 2,500 common shares.

All shares were converted into common and the average price per share calculated. The total value was computed on the basis of this average price.

TABLE T. 2

TELEVISION: AB CONTOUR POPULATION (Q_{it})

STATION #	AB CONTOUR POPULATION					
	1972	1973	1974	1975	1976	1977
1.	671,471	685,572	699,969	714,668	729,676	745,000
2.	115,427	116,157	116,887	117,617	118,347	119,077
3.	5,187,593	5,434,193	5,680,793	5,927,393	6,173,993	6,420,593
4.	1,352,031	1,392,592	1,434,369	1,477,400	1,521,723	1,567,374
5.	291,750	291,166	290,584	290,003	289,423	288,844
6.	117,149	116,149	115,149	114,149	113,149	112,149
7.	38,500	39,655	40,844	42,070	43,332	44,632
9.	133,425	135,693	138,000	140,346	142,732	145,158
10.	170,904	172,613	174,340	176,083	177,844	179,622
11.	2,770,512	2,817,610	2,865,510	2,914,223	2,963,765	3,014,149
12.	210,108	214,088	218,068	222,048	226,028	230,008
16.	3,125	3,145	3,165	3,186	3,207	3,228
17.	90,078	91,610	93,167	94,751	96,362	98,000
19.	156,520	158,555	160,617	162,705	164,820	166,962
20.	30,402	30,341	30,280	30,220	30,160	30,100
21.	2,972,243	3,048,723	3,125,203	3,201,683	3,278,163	3,354,643

SOURCE: CRTC Files and
Statistics Canada
Census Reports.

PERRAKIS, S.
--The profitability and value of
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