An Exploratory Study of the USA Demand for Pay T.V. in the Mid-1970's

H. S. HOTH* and R. G. BODKIN**

Some years ago, pay television (which may be defined as television programming which the subscribers can only obtain upon payment of a fee for the service) was tried experimentally in Canada. Specifically, International Telemeter offered pay T.V. off a cable television service for the period between 1960 and 1965, in Etobicoke, a suburb of Toronto, Ontario. This experiment was not a success financially and eventually died due to lack of consumer interest. In part as a result of this experience, the Canadian regulatory authorities have not permitted pay television in Canada since that time. Nevertheless, pay T.V. continues to exert an attraction for some portion of the Canadian viewing public, especially in recent years following its apparent commercial viability in the United States. In consequence, proposals to allow a reappearance of this service are made from time to time. One aspect of the reinstitution of pay T.V. is the question of the potential demand for such a service. Accordingly, a study of the demand of the American public for this service was thought to be of interest to Canadian policy-makers, and so this study was undertaken within the Research Branch of the Canadian Radio-television and Telecommunications Commission.

The plan of this paper is as follows. After a brief review of some of the relevant literature, we proceed in Section 2 to a discussion of the regression models that serve as the basis of our analysis of a body of data referring to the continental U.S.A. at the end of the first quarter of 1976. The data employed are the sales discussed in the subsequent section, with the results which we have obtained presented in tabular form and summarized in Section 4. The concluding section restates our major conclusions and presents certain qualifications regarding the study.

1. A Brief Look at the Literature

The professional discussion of this area has been somewhat limited to date, although the literature has been growing. One theme of this discussion has been the welfare implications of pay television; this theme figured prominently in a session on “The Economics of Broadcasting and Advertising,” held during the December 1965 meetings of the...
American Economic Association; see the contributions by R. H. Coase, David M. Blank, and Lester Tetteh (1966). Later contributions to the discussion of this issue are the papers by Barnett and Greenberg (1968) and Spence and Owen (1977). The general conclusion of these discussions appeared to be that, under some circumstances (including a monopolistically competitive structure of the broadcasting industry), the implementation of pay television can indeed improve economic welfare.

A second theme of the literature has been the empirical estimation of the demand for cable television, which, as Hyman S. Goldin (1966) pointed out, in a form of pay television (although not in the sense in which the term is used in this paper). These studies are interesting because they attempted to apply received demand theory to a particular service, namely the product delivered by cable television companies; in general, they postulated that quantity demanded (in a mature system) is a function of price charged, household income, various measures of the "quality" of the service, and usually some other "nuisance" variables (e.g., Park's (1972) proportion of color television sets among subscribers, which could be interpreted as a measure of tastes, in standard demand theory. A pioneering study in this field was that of Comanor and Mitchell (1971); other studies with American data include those of Park (1972); Noll, Peck, and McGowan (1973); Cramall and Fray (1974); and Edwards (1975). Park's study is interesting because it contained a careful (though controversial) formulation of the quality of the service received by the typical subscriber and also because the use of the logit formulation, while entailing a nonlinear specification, assures appropriate lower and upper limits for the proportions of potential subscribers who actually take the service. While demand was only a secondary focus of Leonard Good's study (1974) with Canadian data, his principal conclusions are broadly consistent with those drawn from the American evidence.

The demand for pay television (in the strict sense) has not been studied empirically to any large extent, due to a relative paucity of data. This paper attempts to fill this lack. A partial exception to this assertion is the 1975 study of Pasko et al. for the Stanford Research Institute, however, this study was primarily an inferential analysis of the determinants of the demand for pay television, utilizing surveys and a variety of data sources, as the principal objective of this study appeared to be the projection of upper-bound limits of the demand for pay T.V. for the decade following the publication of SRI. Among the major conclusions of the study was the assertion that what they called "demographics" (household income, age of the respondent, and household size) were not major influences on the demand for pay T.V. Although they asserted that the influence of price as a determinant of demand is largely unknown at this point, at one point in their study they suggested that prices for this service are high because the demand is quite inelastic in the range of low prices. Another important conclusion was that the earlier pay T.V. experiments had shown a considerable "novelty effect"; demand for pay T.V. appears to be abnormally high during the first year of operation.

2. The Regression Models Studied
a. The Dependent Variable

Following received demand theory and the studies summarized above, we constructed a number of multiple regression models. In this study, we considered and then discarded the use of a logit formulation employed by Park (1972). We did this for two reasons: first, we wished to consider some specification for the dependent variable in another form, in this exploratory study, second, the bulk of our observations were well away from the limiting properties of zero or 100 per cent of all potential subscribers and so this refinement seemed less important for our purpose.

The independent variables of the regressions of this study were as follows:
1. Price (denoted by the symbol PR). The revenue of a system which operates on the basis of pay-per-channel are generated by a monthly subscriber fee. In the U.S.A., the rates varied, at the time of this study, from a low of $3.75 for a relatively simple operation (entailing a small stand-alone system that permitted the reception of the pay channel) to a high of $10.00 for a more sophisticated system. The price variable in the estimated equations is defined as the monthly rate of payment. Following received demand theory (in which perverse cases the Giffen good case) are considered very unusual), we anticipate a negative sign for the coefficient of this variable.

2. Income (denoted by the symbol I). As income rises, it is hypothesized that the demand for pay T.V. would generally increase, holding constant other relevant explanatory variables. In other words, we anticipate that pay T.V. should be a "normal good" in the language of conventional demand theory. The income data on the dependent variable were obtained from the 1970 U.S. Census, which provides median income by urban area. One problem with such a measure is the inability to take into account the phenomenon of income dispersion. This limitation aside, median income would appear to be about as good as any other measure for this sort of exercise.

3. Age of system (denoted by the obvious symbol AGE). It might be hypothesized that the number of subscribers (or, alternatively, the pay penetration ratio) will tend to grow over time, as potential subscribers learn about the new service and/or change their habits in a manner to accommodate its consumption. However, as Pasko et al. (1975) have emphasized, the introduction of a pay T.V. system in an area may bring in some initial subscribers who want the service because of its novelty. Some of these subscribers will tend to drop...
the service within the first year. Consequent-
ly, we have studied only systems which have
been operating for at least one year, as it was
felt that start-up biases could result from the
inclusion of systems where demand is still in
an exploratory stage. Beyond the one-year
experimental period, it is possible that there
might still be some positive growth before the
system reaches maturity, as the operator of a
pay T.V. service gains more experience and
understanding of the nature of his operations.
Like many of the explanatory variables, age
(measured in months) is specified as several
alternatives, in order to capture the most
accurate effect of this general phenomenon on
the demand for pay T.V.

Population (denoted by the symbol POP).
We have included, in some variants of the
regression equation, a population variable,
which is measured as the total number of
people in the area of the pay system. If the
system is part of a metropolitan area, we have
taken the population of the entire metropoli-

tan area as being the appropriate measure for
this variable. We conceive of this variable as
being a proxy for the availability of alterna-
tive entertainment facilities (such as films,
legitimate theatre, and live sports) within the
range of easy urban travel. Therefore, one
might hypothesize, the greater the value of
this population variable, the less should be
the demand for pay T.V.

5. Channels Available on Cable System
(several variables). It is hypothesized that,
the greater the number and variety of chan-
nels available on the basic cable system, the
less will be the demand for pay T.V., which of
course is an additional service. Moreover, it
appears that network and independent chan-
nels are, in general, preferred to duplicate
and educational channels, as are of course chan-
nels with good technical reception quality to
those with poor technical quality. Thus it
would be erroneous to consider all channels as
equals and to lump them together in an unre-
finned measure. Instead, an index (CH) that is
both qualitative and quantitative was derived
by assigning different weights to different
channels, depending on their type and the
quality of their technical reception. The
weights were assigned on the following basis:
(i) A weight of 1.0 was tentatively
assigned to all network and independent
channels;
(ii) A weight of 0.2 was tentatively
assigned to all duplicate, educational, and
Canadian channels;
(iii) To account for variations in the tech-
nical quality of reception, the weight first
assigned to a particular channel in steps (i)
and (ii) was multiplied by 0.5 if the recei-
ting cable headend was located in grade C (infe-
rior reception) of that channel and also if the
channel signal was picked up off the air.
(However, in the case of micro-wave recep-
tion, we considered the technical quality
adequate and did not in consequence make
this adjustment.)

The index CH was then derived by
summing the weights assigned to all channels
of the host cable T.V. system. As our measure
of the total amount of substitute program-
ming available on the host cable system is
somewhat arbitrary, we also considered an
alternative specification of this phenomenon.
Specifically, let  the variables N, D, I, E, and
P represent the raw numbers of unduplicated
network channels, independent channels, edu-
cational channels, and network duplicate
channels, respectively. Since almost all
systems used in the analysis had all three U.S.
networks available to subscribers, network
and independent channels were subsequently
combined into one variable, NL which is the
raw sum of the number of these two types of
channels. No weighting scheme for quality
was used with these more detailed channel
availability variables.

6. Quality of Service (HBO). Although
feature films are the major attraction of a pay
T.V. service, there is a fair degree of variation
in the number and type of films that are
shown by different pay T.V. systems. We,
have included a crude measure of the
quality of the service by differentiating
between service provided by the Home Box
Office company and all others; this variable is
obviously a dummy variable assigned a value
of unity if the system in question is affiliated
with the Home Box Office system; otherwise,
a value of zero is assigned. The Home Box
Office company is a major supplier of pay
programming and is often considered, in trade
circles, to supply a premium grade of
programming. In any case, one can test
whether demand is sensitive to this kind of
quality difference, although we have not
unfortunately been able to measure other
kinds of variation in the quality of program-
ming available to pay subscribers.

7. Number of Cable Subscribers or
Cable Penetration Ratio (CS and CP,
respectively). For the dependent variable in
absolute form (PS), we almost always included
the number of cable subscribers (CS) as an explanatory variable, in order to
gauge the size of the potential market. When
the dependent variable was in relative form
(i.e., we were attempting to explain the vari-
able PP), we noticed very early a strong
inverse correlation between the pay penetra-
tion ratio, PP, and the cable penetration ratio
CP, defined as the number of cable subscrib-
ers as a percentage of the number of homes
passed. (In symbols, CP = (CS/HYP) X 100.)
This correlation, which persists into the
multiple regressions and indeed improves the
fits dramatically, is very difficult to explain in
ea natural, enforced fashion. One view might
be that those who are cable subscribers when
objective circumstances are less favorable to
the consumption of this product (i.e., when
demand factors are such that CP is low) tend
to be very much oriented toward this type of
programming and hence tend to subscribe in
much higher proportions when an additional
service (such as pay T.V.) becomes available.
Viewed in this light, the variable CP becomes
a sort of taste variable, about which we
received no positive reactions (and of course
that this factor can shift the demand
functions). An alternative interpretation
might be that this result is a statistical arti-
fact which results from the facts that (1) homes
that are already members of the cable system
are more likely to subscribe to a new
pay T.V. system than those who are not, as
these latter homes would have to pay fees for
both the basic cable system and the pay T.V.

service; and (2) we have no way of identifying
old and new subscribers to the basic cable
system, as our data are simply cross-section
observations and hence simply represent a
slice of "reality" frozen at a moment of time.

Despite the possibility that this effect may
well be an artifact, we have included this
explanatory variable in several regressions
because we thought that this variable might
standardize on initial conditions to a certain
effect.

Finally, we observe that, to the extent that
we have omitted relevant explanatory vari-
ables, our results will in general be biased.
One such possibility is a variable on marketing
and sales promotion expenditures of pay T.V.
operators; if such publicity campaigns were
successful, they would presumably shift the
demand curve rightward. Unfortunately, data
on this variable are quite difficult to obtain.

3. The Data Employed
All of the non-standard data used in this
study were obtained from the "Pay T.V. Newsletter" of August 1976 of Paul Kagan

If we assume that the probability that an already
existing cable subscriber will take the pay T.V. service is
higher than the probability that non-cable subscriber will
be induced to buy the pay T.V. service (and take the
regular cable T.V. service in the bargain), then it is not
difficult to construct numerical examples which display a
negative correlation between pay penetration and cable
penetration (with both uncorrelated as defined above).
The difficulty, of course, that we do not possess data on the
ideal explanatory variables, namely the cable penetration
rate before the introduction of pay television.
4. Results of the Regression Analysis

More than 35 variants of the demand equation were specified and estimated. The results of only 26 equations are reported in Tables 1a and 1b; the remaining equations were discarded as being quite unreasonable specifications after the preliminary results were examined. In Tables 1a and 1b, the upper number in each cell is the estimated regression coefficient while the lower figure is the estimated "t" ratio, in the columns headed by the variable symbols. It should be observed that in Table 1a the regression equations are formulated in arithmetic terms, while in Table 1b all the variables (except, of course, the dummy variable HBO) appear in logarithmic form, so that this formulation yields elasticity estimates by inspection. The coefficient of multiple determination, \( R^2 \), is already corrected for degrees of freedom used up in the estimation procedure, while the symbol NOB refers to the number of observations underlying the regression equation estimated in the particular row under study. The final column, "Dependent Variable," refers to the variant of the demand variable that has been employed for the particular regression equation under examination; this variable is in arithmetic form in Table 1a and in logarithmic form in Table 1b. We have tentatively selected two regression equations as most suitable for the extrapolation of American experience to the Canadian scene; these equations, Equation 8 (with the logarithm of absolute numbers of pay subscribers as the dependent variable) and Equation 22 (in which the pay penetration ratio is the dependent variable) are starred in Table 1b. Equation 22 is the one to be retained for extrapolation purposes.

We may now turn to an examination of the results obtained, paying particular attention to our starred equations. Passing over the scale variable CS (which will be the subject of some comment below), we note that the effect
### Table 1b: Results of the Regression Analysis, Variables in Logarithmic Form (except HBO)

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- **PS**: Positive System
- **PP**: Positive Policy
of the price variable is negative 24 out of 26 times. Hence this might be thought to be a perfect information of the importance of price in influencing demand quantity. However, when we look at the associated "t" ratios, the evidence is very much weakened. Under classical assumptions, the critical value for this "t" ratio is 1.67 for 60-70 degrees of freedom, using the 5 per cent level of statistical significance with a one-tailed test. Accordingly the coefficient of the monthly pay rate variable is significantly negative in only three out of the 24 cases. (In the two cases in which the coefficient on relative price is positive, it is statistically insignificant.) This is not particularly strong evidence for the importance of relative prices in influencing the demand for pay T.V. particularly when we note that in all three cases where the price coefficient is statistically significant, the income coefficient is not. Thus a result observed at times with aggregative time series studies of demand appears to characterize these results as well. For Equations 8 and 22, we note that the point estimates of the price elasticity of demand are well in the inselistic region (.02 or -.03), although it must be conceded that these estimates are also statistically insignificant.

For the income variable, the results are more encouraging. The coefficient of this variable is statistically significant 13 times out of 26 or, if one insists on using a two-tailed test (on the grounds that pay T.V. could conceivably have proved to be an inferior good) 10 out of 26 times. Moreover, in the final equations selected, the effect of this variable is highly significant. Income appears to influence appreciably the outlays on this form of entertainment, and it appears quite possible that pay T.V. is a "luxury" good, in the sense that expenditures on this service increase even more rapidly than income when income itself rises. (However, it must be admitted that the income elasticity coefficients are not significantly different from unity, in the case of both Equations 8 and 22.)

The wage variable (or a variant of this variable) is expected to have a negative effect on demand 11 out of 13 times; in the cases with negative coefficients, the influence is statistically significant (using a two-tailed test) in five cases and "almost" statistically significant (the "t" ratio being between 1.9 and 2.0) in another three cases. (Neither of the two positive coefficients is statistically significant.) We had originally expected that more "mature" systems would experience steady, if slow, growth, as operators discovered more of the nature of their market and worked on the factors that would be particularly pleasing to their customers. However, it appears that the "novelty effect," discussed above, lasts longer than the twelve month period conjectured by Panko et al., or, in any case, that this type of service appears to be more "initializing" and less "habit-forming" (in the terminology of Houthakker and Taylor (1970)) than one might have initially conjectured. (In the case of Equation 8 and also of Equation 22, the negative effects are of marginal statistical significance.)

Turning to the population variable, we note the presence of a perverse effect that is apparently highly significant statistically, according to conventional criteria. We had anticipated that the demand quantities would fall off (other determinants remaining the same) in the large population centers, as presumably alternative sources of entertainment would be more readily available. Instead, the regression equations suggest that demand is actually higher, in these large population centers! After some consideration, we believe that the POP variable is very likely serving as a proxy for the cable penetration (CP) variable; these two variables are moderately correlated, with a simple correlation coefficient equal to -.38. This interpretation as a proxy is corroborated by a comparison of the regressions obtained by substituting the CP variable for the POP variable (see, for example, Equation 8 in comparison with Equation 7, or Equation 13 compared to Equation 12.) We note the coefficient of multiple determination is considerably higher when the variable CP is introduced, although it must be admitted that the qualitative results (for the other variables) change somewhat with this introduction. In any case, the rate of cable penetration appears to be a powerful determinant (with a negative coefficient) of the demand for pay T.V.; hence two possible explanations of this phenomenon were presented in the preceding section. We should note that, as judged by the "t" ratio, this variable is one of the single most important explanatory variable in the two equations in which it appears as an explanatory variable of the pay penetration rate, while in Equation 8 it is the second most important explanatory variable, after the scale variable CS (number of cable subscribers) itself. The effect would appear, therefore, to be ineradicable; whatever interpretation one wishes to give to it.

Looking at substitute entertainment possibilities available on the parent cable system itself, we note that the variable CH has the expected negative sign in only four cases out of 11; it is never statistically significant. The break-down into separate categories (network and independent stations, educational channels, and duplicate stations) would appear to indicate why this somewhat disappointing result is obtained; the effects of an additional channel appear to be quite heterogeneous and depend rather importantly on the nature of the channel itself. According to the regression coefficients of Tables 1a and 1b, it would appear that educational channels are gross complements (rather than substitutes) for the services rendered by pay T.V., while duplicate stations appear to stand in the more expected substitute relationship with pay T.V. Interestingly, variation in the standard product offered by cable T.V. services (the number of network and independent channels) appears to be independent of the demand for pay T.V. (except for the "tentatively best" equation, Equation No. 22, singled out above, where the effect is barely statistically significant at the 5 per cent level, with a one-tailed test). Whether this is a genuine characteristic or due simply to relatively little variation in this explanatory variable is difficult to asser with great confidence at this time. Finally, the trade reputation of the Home Box Office Company appears to be shared by the clients of pay T.V. services. The regression coefficient of this variable is positive in 25 out of 26 cases. Of these 25 positive coefficients, eight are unambiguously statistically significant at the 5 per cent level with a two-tailed test, while another five regression coefficients of this variable are "almost" so, with "t" ratios equal to or slightly larger than 1.6. The effect is strongly pronounced in the tentatively "best" equation singled out above.

4. Qualifications and Conclusions

This has been a preliminary study of the demand for pay T.V. in the U.S.A. and the tentative nature of the conclusions should be noted. We thus feel that a certain surprise at the broad drift of these results is general. In particular, the expected coefficients are the least important to the typical consumer since they offer essentially the same programming as the primary networks and hence their addition brings relatively little new programming. In Godd's study (1974) of the Canadian Cable Television industry, the availability of these channels was found to have virtually no effect on the demand for cable services. Accordingly, the strong effect of the duplicate stations variable is somewhat puzzling, especially in view of the apparent (mis)interpretation of the variable representing primary network and independent channels. We note, however, that these effects appear to be reversed in Equation (22), which we have selected as our tentatively "best" regression equation for further use.
underlined. In part, our results might well have been improved by the use of more sophisticated techniques, such as the logit model of Park (1972) or the use of two stage least squares estimates of the parameters, if one believes that the price variable is not truly exogenous. We feel, however, that the biggest return is likely to come from the accumulation of further data on what is essentially an infor- mation industry. Hence future researchers should be in a better position to draw conclusions about the demand of pay T.V. than we are at present.

At the level of substantive results, our prin-
cipal conclusions have been more negative than positive in character. Thus, with regard to the traditional determinants of demand quantities, we found that both price and income variables were relatively unimportant. The central tendency of our point estimates suggests that the demand for pay television is price-elastic (in the observed range), while a case can be made that pay television is a luxury good (in the sense of having an income-elasticity of demand in excess of unity). Both of these conclusions are subject to a considerable margin of uncertainty. We also found a number of additional conclu-
sions, such as the result that the period of "novelty demand" appears to last longer than one year and that our CH variable (con-
structed with some effort) does not appear to

"It is implicitly assumed that owners of the pay T.V. systems are price-makers and that their decisions regarding price are essentially independent of demand quantities, i.e., the price variable is essentially exogenous. If this hypothesis is incorrect (as would be the case, for instance, if pay T.V. were priced in competitive markets), then the technique of ordinary least squares regression is inappropriate and a consistent estimating technique (such as two-stage least squares) should be used. In the context of our problem, a strong argument can be made that price is indeed independent of short-
term fluctuations in demand quantities, in any case, the data required to affect a simultaneous equations estimates of the parameters of our demand equation are not readily available and their collection would be frightfully expensive (if indeed individual system owners would divulge such sensitive internal cost data).

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