THE DEMAND FOR TELECOMMUNICATIONS SERVICES IN RURAL AREAS

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INSTITUTE FOR BEHAVIOURAL RESEARCH
SURVEY RESEARCH CENTRE

667-3022 AREA CODE 416

YORK UNIVERSITY

1700 KEELE STREET,
DOWNSVIEW, ONTARIO M3J 1P3

May 25, 1978.

Ms. Shirley Sarafini,
Economic Analysis Division,
Department of Communications,
The Journal,
30 Slater Street,
18th Floor, North Tower,
Ottawa, Ontario.

Dear Ms. Sarafini:

Enclosed please find a final version of the report titled
"The Demand for Telecommunications Services in Rural Areas".

Yours sincerely,

B. R. Blishen,
Director,
Institute for Behavioural Research

b.r.b./lai

THE DEMAND FOR TELECOMMUNICATIONS SERVICES IN RURAL AREAS

M.D.G. Copeland

The purpose of this paper is to outline a strategy for the estimation of the demand for telecommunications services in rural areas. The services to be considered are telephone and CATV. In rural areas cable is largely non-existent, and telephone services is of lower quality than in urban areas.

It is difficult to estimate the demand for any product or service, particularly for a new or improved one. The demand curve is a function relating the number of people purchasing the service to the price charged for it. The location of this function depends on many variables other than price; incomes, family size, whether the household lives in town or outside, factors specific to telephone and/or broadcasting all are important in determining demand. It is not sufficient to forecast that 40 or 50 or 60% will purchase the service, because in some areas the demand will be lower, in other areas it will be higher. If new facilities are to be installed step-by-step, it makes sense to do so in areas where the demand is strongest (if installation costs are equal).

The reason that it is harder to estimate demand for new service, is that not all consumers are familiar with the new service and so may have only a rough idea about how useful it might be. In this situation measuring the effect of price, income etc. on demand is more difficult than measuring demand in a mature market. In the mature market, you are measuring actual levels of demand. Here we are attempting to estimate what demand will be if and when the service is available.

It is here assumed that consumers are sufficiently familiar with telephone service to know whether they would be willing to pay more per month to move from a multiparty line to one with fewer subscribers, should such service become available to them in the future. After all, telephones have been in use for 100 years. Telephone is practically a necessity for most peopele. Virtually everyone has a phone, but not everyone has the quality of service that he/she wants.

The problem has been that such choices were usually not open to telephone users in rural areas. The lack of supply does not indicate a lack of demand. The demand is there. It can be estimated directly by asking people what they would do if new or improved service were available.

The demand for cable television is more difficult to estimate. Even though cable is a relatively new service, the proportion of urban households with cable has levelled off in recent years. The existing usage in urban areas reflects a mature demand that has developed after ten or fifteen years of availability.

In rural areas too, it will take a period of time for demand to mature. The initial response may be quite strong, but it takes some time for viewing habits to adapt to increased program choice, and for ownership of television sets (particularly colour sets) to rise in response to the availability of cable. What may now seem to be a frivolous luxury to some may in time serve as a valued additional source of entertainment and information to the rural household.

For these reasons I believe that demand estimates should not solely be based on asking those in the rural sample what they would do if cable service

were to become available. Most have not had enough experience with improved TV reception to have a good idea of how much they would be willing to pay for it, if indeed they want it at all. What would have been the response to "Would you pay $7.00 a month for cable service?" had the question been asked of an urban sample in 1965? Demand estimates based on such a procedure will almost certainly be too low. That does not mean that the estimates would be of no value. They can serve as a check for other method of estimating demand and can serve as a lower bound for a range of estimates.

One of the commercial omnibus surveys can be used to produce data useful for the estimation of demand for cable service. These surveys use a sample drawn from all households in Canada, urban and rural. Most of the respondents will be from urban areas where cable service is widely available now. Purchase of a number of questions in one of these surveys will produce data to be used in the estimation of demand for cable service. The results of these questions together with the results of the standard questions of income, family, etc., can be used to estimate demand for cable among the subsection of the national sample who live in areas where cable service is available. While most of these areas will be urban, no doubt the sample will pick up a few rural cable users as well. The responses in the rural areas will be useful as a check on the procedure suggested here.

Since the subsample provides data on the demand for an existing service, demand can be related to income and demographic variables, number of channels and the quality of signal available off-air, ownership of TV sets (B. & W. and colour), size of town, and other household variables. Through techniques such as the Logit Model and Linear Discriminant Analysis it is possible to estimate how these variables are related to the decision to purchase cable service.

The Logit Model[*] is used to determine the probability that an individual with a given vector of household variables $H = (H_1, H_2 \ldots, H_n)$ will make one choice (buy cable service) rather than the alternative. When we have fitted this relationship for the subsample we would then be able to extend the procedure to the rural sample for which the same set of hosuehold variables will have been collected.

An alternative technique is Linear Discriminant Analysis.[**] This technique first divides the subsample into cable user's and non-users. Then the variables $H_1 \ldots H_n$ are examined to see which ones can best serve as an index for differentiating between the two groups. We would then use those variables to differentiate those in the rural sample.

With either of these techniques, we are assuming that the differences in behaviour between urban and rural populations can be explained by differences in the household variables. That is, income, family, size, number and type of TV sets, quality of off-air reception, size of town, etc. are the source of differences in demand. In effect the assumption is that with respect to TV behaviour would be the same for two families, one in an urban area, one in rural area, with matching $H_1, H_2 \ldots H_n$.

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[*] See a) D. McFadden "Conditional Logit Analysis of Quantitative Choice Behaviour" in P. Zarembka (ed.) Frontiers in Econometrics. (Academic Press, 1973)
   b) Pindych and Rubinfeld "Econometric Models and Economic Forecasts" McGraw Hill, 1976

[**] See P. Hoel "Introduction to Mathematical Statistics" 4th Ed. Wiley, P. 181

Telephone Demand Model

Initially we consider improved telephone service in the form of a reduction in the number of parties sharing a loop. The rural survey will produce information on consumer willingness to pay for such an improvement. To do this it will be necessary to ask those on 2-party lines if they would prefer a private line and if so, how much they would be willing to pay extra each month for the improvement. Those on 4-party lines will be asked what they would be willing to pay for 2-party and for private lines. Those on multi-party lines will be asked about 4-party, 2-party and private lines.

With this information it is easy to total up the additional revenue that the respondents would pay at various rates that might be charged for the improvements.

Consider $P_i = f(N_o, N_1)$, where P_i is the amount that the ith respondent is willing to pay for improved service. N_o is the number of parties now on the line, and N_1 is the (reduced) number under consideration. For those with little or no interest in the improvement P_i is a small number or zero. For other P_i is larger.

At any new set of rates only those consumers whose P_i's exceed the scheduled rate increase for a change from N_o to N_1 will be willing to pay the price. Summing the number of households whose P_i's are large enough, and then multiplying by the appropriate rate increase gives an estimate of the revenue potential from this kind of upgrading of service.

The approach described above will produce estimates of the short-run response to the availability of improved service. For example, those on 2-party lines, not now having a private line may underestimate the benefits

therefrom. As more private lines become available in rural areas, knowledge of the benefits to those who do switch usually turns out to be greater than expected. When this information filters back to their neighbours still on 2-party lines, more will opt for private lines (Demonstration effect).

To get an idea how much more those who now have a private line value it, we will ask them what rate increase would cause them to shift back to a 2-party line. Similar questions will be asked of those on 2-party lines, relative to 4-party lines, and those on 4-party lines relative to multiparty lines. The responses to these questions dealing with moving to lower quality service will provide a check on the responses to earlier questions asking about improved service levels.

Obviously there are many other kinds of improvements in telephone service that should be considered. Three will be dealt with here.

(1) Extension of the toll free local calling zone which we denote by Z.

(2) Improved circuit quality, i.e. reduced noise and improved voice reproduction denoted by Q.

(3) More rapid repair and maintenance service denoted by R.

If D.O.C. is interested in the demand for other types of improvement, additional questions can be added to the questionnaire.

The zone, quality and repair improvements are more difficult to quantify than reducing the number of parties on a line. With Z, the value to the respondent of the extension of the zone will depend to a large extent on whether the household is in town or out of town. For those out of town, an extension of

the local calling area to include the nearest town represents a substantial increase in the number of telephones that can be reached toll-free, an important advantage. For those in town, an extension of the zone to include the surrounding farming areas will be of less interest. We will classify the responses by whether the household is in town or not.

For the categories Z, Q and R, respondents will first be asked whether or not they find the level of service adequate. Those satisfied will not be questioned further on this issue. Those not satisfied will be asked how much they would be willing to pay for a satisfactory level of service.

The answers will provide estimates of the number of people wanting improvements, of their relative importance, and of the revenue potential from such improvements. In this case however we cannot simply sum those willing to pay for the changes, since the changes will be provided to all subscribers. The decision to go ahead with the changes will impose the costs on all users, those who were not willing to pay for the changes as well as those who were. Some people will give up the telephone because they are unwilling or unable to pay the higher rates.

If the decision were to be made to go ahead with improvements in Z, Q and R, the survey results would provide an indication of acceptable rates to charge for the changes. It is assumed that the willingness to pay for party line improvements would not be affected, and so the Z, Q and R rate changes would simply be added on. This assumption should be O.K. if the additional charges are not too large.

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Broadcasting Demand Model

The basic assumption is that the estimates produced by asking the rural sample what they would willingly pay for improved TV reception will be unreliable. The problem is that while the rural population knows about Cable Service, they haven't yet "owned" it. The subsample of the national omnibus survey in areas where cable is available provides information on how people choose when they have a choice. Asking a rural sample how they would choose if a choice were available is a different matter. The preferences revealed by actual purchase of cable service by those in the national sample are more reliable than statements of intent by those in the rural sample without access to cable.

In his article "Prospects for CATV" in the Spring 1972 Bell Journal, R.E. Park found that in addition to income and price, demand for cable depended on the number and network affiliation of the additional channels that were on the cable, the distance from the nearest station (i.e. picture quality) and the number of months that the service has been available, the number of channels available off-air, and whether or not the household had a colour or a black and white TV set.

Most of those variables can be obtained through the urban and rural surveys. The relation between cable demand and these variables can be estimated for the urban sample and can then be applied to the rural data to forecast rural demand for cable when it becomes available in rural areas.

Let Y_j be a dummy variable taking the value 1 for a household with cable and 0 for one without it. Let us assume that the national survey gives a vector of responses $H_j = (H_{1j}, H_{2j}, H_{3j} \quad H_{nj})$ for the jth household.

With the Logit Model the elements of H_j are themselves made into categorical variables. The proportion of households with cable in each category is then used to generate the dependent variable to be used in regression analysis. (If there are n_i household in category i, r_i of which have cable, then $\log \dfrac{r_i}{n_i - r_i}$ is used as the dependent variable, with the H_{ij}'s as independent variables.

In Linear Discriminant Analysis, the respondents are broken into two groups, those with cable and those without. The data is then analysed to see which of the H_{ij}'s are most useful as predictors of whether Y_j's will be zero or one.

If the same set of questions were to be asked of the rural sample (among other questions that they will be asked), we can then predict rural demand for cable. These predictions will be contingent on the number of additional channels we assume that the cable will deliver and on how TV ownership is assumed to respond to cable availability.

Skidoo Problem

But you are saying to yourself that rural people are different than urban people, and that their needs are different, living in a different environment. If we were to perform the same analysis to estimate the demand for skidoos in rural areas based on the demand in urban areas, we would come up with far too low an estimate, since city people use their skidoos primarily for recreation, and have to tow them to rural areas to use them, while in rural areas the skidoo is a necessity for some and recreational use is much closer at hand for the remainder.

The differences in urban and rural demand for cable will be much smaller than the demand for skidoos, since the T.V. set is used for entertainment and information in homes in both rural and urban areas. It is not obvious in which direction the differences would go. The greater range of entertainment alternatives in urban areas would suggest lower cable demand there. The tighter knit community life in small towns, and the independent life style and early rising on the farms would argue for lower demand in rural areas. I suspect that the differences must be small in any case since virtually all households own TV sets in both urban and rural Canada.

Demonstration Effect

With any new service, the initial level of demand is likely to be lower than the level when the demand has matured. It takes time for consumers to adjust their expenditure and behaviour patterns to the expanded choice set. The usual pattern is for a small number of people (usually those with higher incomes) to be the first to purchase the service. With the passage of time, others in the community follow.

The main reason for this pattern is that in time information about the benefits of the service spreads throughout the community. This is called the demonstration effect. The rise in income and possible lower prices charged for the service also contribute to the increased demand as the market matures.

Price Effects

Those in the urban sample with cable will be asked how large a
price increase would cause them to give up the service, and those without
cable will be asked whether lower prices would convince them to take cable.
These will produce two estimates of the price elasticity, which will bracket
the actual value.

Having said so much in defense of the strategy of using urban data
to estimate rural demand, I think that the rural sample should be asked what
they would do if cable came to their area and how much they might be willing
to pay for it. I think that this process will produce too low an estimate,
but the cost of adding a few more questions to the rural survey is small.
The estimates so produced will provide a check on the estimates produced
from the urban analysis, and will be of some value as an estimate of the
lower limit of rural demand.

Antenna Systems vs. Cable

Heretofore "cable" has been used to describe the technology for the
delivery of improved TV reception. Satellite technology is another mode for
delivery of the service. As part of the survey respondents will be asked about
the two ways of paying for improved service.

First they will be asked how large a monthly payment they would be
willing to pay for cable service. Then they will be asked what they would
pay for the installation of an antenna which would bring in additional TV
stations. This will be done without reference to satellite delivery of the
signal, since we presume that it is the signal itself that is important to
the consumer, not the mode of delivery.

Is it independent or a branch? If a branch, who is the parent? Where are various decisions on level of telephone service made? What kind of business is this? Annual revenue, profits, value of plant and equipment, employment, etc?

Then a set of questions about the telecommunications services now used by the firm will follow. How many phones? Monthly phone bill? (Long distance and local). Is the phone used primarily for incoming or outgoing calls? C.B.'s and intercom usage, if any? Cable service, if any? etc.

Questions concerning the level of satisfaction with existing services will be asked. Where the service is judged unsatisfactory, there will follow questions about the willingness to pay for improved service.

The techniques used in the estimation of household demand can now be applied to business. The willingness to pay for improved service can be converted into estimates of the additional revenue that could be generated from the improved service. Some of these services are of a type where each individual user makes the decision whether or not to take the service (e.g. private line vs. party line). Other services such as improved voice reproduction must be done for all or none.

A final set of questions will deal with a variety of services widely available in urban areas, not all of which are available in rural areas e.g. WATS, mobile phones, call forwarding, Bellboy, Telex or TWX, broadband and data, and cable TV (perhaps for hotels and hospitals). Levels of interest in such services and willingness to pay will be sought.

In this area the demonstration effect again raises its ugly head. It is hard to know how much you might be able to use these services, when

you have not yet "tasted" them. The use of some of these services may have significant impact on the way you do your business. Revenue projections to be developed for these services will almost certainly be below the actual levels of demand which will be observed when the services do become available since purchases of these services will rise as businesses use some of the new services to replace existing methods of operation.

Appendix A

Sampling Strategy for Demand Survey for

Rural Communication Services

B. Patel

May 25, 1978

Appendix A

Sampling Strategy for the Proposed Study:

Demand Survey for Rural Communications Services

The Demand Survey for Rural Communication Services encompasses, as sample units, both household and business establishments. Difficulties in designing a sample for the latter units necessitate the mixed sampling strategy described in this discussion document.

Without a well defined sampling frame for rural businesses, we propose that an area sampling technique be used for the entire survey. Area sampling techniques are commonly used to select dwellings or other units which could be associated with dwellings (e.g. persons within dwellings, heads of households, various commodities such as television sets, cars etc.). The techniques used in the household survey can be directly applied to business establishments.

There are several advantages in the use of this technique, compared to a partial sampling frame. First, the total of the defined land area can be ensured, since maps are readily available. In this case we could use Enumeration Areas (E.A.s) or Area Aggregates (A.A.s) which are well mapped. An Enumeration Area is a small geographical area containing as many as 300 households (depending on its location). In a rural area, an E.A. will always contain fewer than 100 farms. The Area Aggregate is a small census statistical area of rural or urban type consisting of a group of contiguous Enumeration Areas. The average population of the A.A. is 5,000 persons. E.A.s and A.A.s cover the total land area of Canada. Second, some measure of probability can readily be assigned to the selection of an area (based on the number of households or

persons), and, eventually, to the selection of businesses (i.e. if A.A. χ is selected with probability .0055 and A.A. χ contains 25 businesses of which 10 are to be selected, then the probability of selecting the i-th business in the χ-th A.A. is given by .0055 * 10/25). An ability to assign some measure of probability is essential in order to derive statistical estimates and associated sampling variability. Finally, since the household study would also be based on the area sampling technique, the two studies could be overlapped, which would result in a reduction in costs and in lead time to execute the survey. Therefore, we propose to carry out the two studies as briefly described below. Note that there may be some potential problems in this approach, not obvious at this time, but they would be discussed before the final design is outlined. The following sampling strategy should serve as a point of discussion, prior to the design of a final strategy. The final sample design strategy will be developed once the Rural Communication Survey is fully funded (see Appendix C). The objective of this document is not to provide any clear cut sampling strategy for a household or business survey.

Definition of the Target and Sampled Population

The target population of households (businesses) under study is defined as all households (businesses) located in the rural areas of Canada. The Rural Study Area [1] is defined as follows (see memo, K. Richardson, Februrary 14, 1978):

(a) all incorporated cities, towns, and villages with total populations of less than 2,500;

(b) all incorporated rural municipalities, unincorporated localities, unorganized territories, and Indian reserves having (at the 1971 census) a population density of less than 1,000 people per square mile.

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[1] The exact definition of Rural Study Area, in terms of the E.A.s, cities, towns, villages or municipalities to be included, will be determined in consultation with the Department of Communications at the time the final Sample design is agreed upon.

Note that in the above definition the following points are implied:

(1)   "The Rural Study Area is the continuously
         settled parts of the provinces, excluding
         the urban centres. This area is derived
         by subtracting the remote parts from the
         total provincial area.

(2)   The remote parts of the provinces are all
         areas beyond the limits of the continuous
         population distribution and beyond the con-
         tinuity or regular transportation and com-
         munication system."

The sampled population of households (businesses) from which the sample will be drawn could differ from the target population of households (businesses) in that it will not contain certain units. For example, those households (businesses) belonging to the target population which, at the time of the survey, will be located outside the Rural Study Area.

It should be kept in mind that conclusions drawn from the sample of households (businesses) will apply only to the sampled population (i.e. the population from which the actual sample is selected). Judgments about the extent to which these conclusions can be applied to the target population must depend on other sources of information.

Choice of a Sampling Frame

A sampling frame (i.e., an aggregate of identifiable, tangible physical units of some kind, any or all of which may be selected and investigated), listing the members of the sampled (i.e., the population from which the actual sample is selected) population of households (businesses) is not available. For the survey of households, regular sampling methods using area sampling techniques are usully employed to overcome this problem. However, for the sample of businesses, the correct procedures are not well defined, so that a feasibility study of potential lists was undertaken.

Several lists of business establishments were examined as a possible source to be used in defining the frame. Lists examined included the following:

1. Statistics Canada Business Register;

2. Consumer and Corporate Affairs' Public File;

3. Industry, Trade and Commerce listings;

4. Dun and Bradstreet Business listings;

5. B. J. Hunter listings.

All the lists were thought to be inadequate in terms of content and coverage. The Statistics Canada list could not be separated into urban and rural segments, and it did not contain sole proprietors. The Consumer and Corporate Affairs' Public file only contained the list of federally incorporated businesses, whilst Industry, Trade and Commerce only lists industries. The Dun and Bradstreet business listing provides information on a wide range of businesses (mining, construction, wholesale trade, retail trade, etc.), but it only contains approximately 90 percent of all businesses in Canada. The B. J. Hunter listing contains the same information as the Dun and Bradstreet listing, and coverage embraces 95 per cent of all businesses. The differences in coverage for urban and rural segments are not obtainable from the Dun and Bradstreet or B. J. Hunter listings. However, it is possible to separate the urban and rural businesses by using postal codes and/or names of Towns, Villages or Municipalities.

In summary, a sampling frame listing the members of the target population of households (businesses) is not available. From a practical point of view, it would be too time-consuming and very costly to construct such a frame. However, each individual household (business) can be uniquely identified with an address, which in turn can be uniquely identified with an Enumeration Area (E.A.).

In turn, each E.A. can be uniquely identified with an Area Aggregate (A.A.). In this way, it is possible to regard the sampled population of households (businesses) as being composed of a hierarchy of sampling units of different sizes and types. Note here that we make a plausible assumption that the number of businesses in a given area are proportional to the number of households in that same area.

A sampling frame for the Rural Study Area will be developed by the Survey Research Centre in consultation with the Department of Communications. The frame will consist of a list of A.A.s and E.A.s in the Rural Study Area that are potentially accessible to the Centre's field staff at reasonable cost. These E.A.s are comprised of the E.A.s that are included in the Survey Research Centre's Master Sample Frame (see map on following page). The inaccessible E.A.s are defined as E.A.s with small or zero population counts ($\div$1668), for which Statistics Canada has not released any E.A. data; E.A.s which are located in the excluded areas, due to cost constraints, from the Survey Research Centre's Master Sample Frame. Note that the E.A.s which are inaccesible, in terms of the Survey Research Centre's Master Sample Frame, could be the same as the E.A.s in the Remote Areas, as defined by the Department of Communications.

170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20

60

50

40

ALASKA (U.S.A.)

GREENLAND (Denmark)

YUKON TERRITORY

NORTHWEST TERRITORIES

ARCTIC CIRCLE

BRITISH COLUMBIA

ALBERTA

SASKATCHEWAN

MANITOBA

ONTARIO

QUEBEC

NEWFOUNDLAND

0   200   400   600 Mi.
0 200 400 600 800 1000 Km

Victoria
Vancouver
Edmonton
Calgary
Saskatoon
Regina
Winnipeg
Thunder Bay
Sudbury
Montreal Hull
Quebec
OTTAWA
Oshawa
Toronto
Windsor
Saint John
Halifax
N. B.
P.E.I.
N. S.
St. John's

U. S. A.

MASTER SAMPLE FRAME
SURVEY RESEARCH CENTRE

York University / Université de Montréal
— as based on 1971 census.

Population within frame

Self—representing areas

1. London
2. Kitchener
3. Hamilton
4. St. Catharines

11   100   8   70

-22

Stratification Options

Potential stratification factors have also been examined in this feasibility study. The Rural Study Area could be stratified using one or both of two indices: (i) Socio-Economic Status, and (ii) A Commodity Index. The Socio-Economic Status measure can be derived from Census data from A.A.s (using income, education, and occupation variables). The Commodity Index will also be derived from A.A. Census data, using commodity ownership indicators, such as the number of cars, television sets, refrigerators, etc. In addition, the Rural Study Area will be further stratified by Region (provinces or some other aggregate). The stratification based on one or both of the above indices and on Region will serve to provide the basic requirement of stratification, i.e., grouping the survey population before selection in such a manner that tends to make the characteristics of the groups homogeneous. At the same time, stratification seeks to maximize the heterogeneity of characteristics between strata. This results in a substantial reduction of variance of the sample estimates, since ultimately the sample is representative of all strata.

Multi-Stage Selection

As mentioned previously, it was not possible to list eligible households (businesses) in selecting a sample. Therefore, multi-stage selection techniques will be used. In the proposed design, two stages of selection will be employed for the business sample, and three stages of selection for the sample of rural households.

The first or Primary Stage of selection for both households and businesses will result in a probability sample of A.A.s. The selection of any A.A. will be proportional to its household count (1971 Census). It is suggested that the sampled set of A.A.s be used for both the household and business surveys. However, additional A.A.s may have to be selected for the business sample in order to obtain the appropriate sample size.

In the household survey, the second stage of selection will produce a sample of Enumeration Areas. The E.A.s will be selected with probabilities proportional to household size (1971 Census). The households within the selected E.A.s will be field listed by interviewers, prior to the selection of the third stage units (households).

A systematic sample of households within each E.A. will be drawn from the list of households. Using this area sampling approach, the overall probability of any household being selected, throughout the Rural Study Area, will be approximately equal.

Sample Size

A desired sample size is usually determined by the degree of precision required from the sample estimate and the costs associated with obtaining the sample. In this study, we anticipate that a sample of 400 households and 300 businesses, at the lowest level of analysis (i.e. Regional) would prove to be adequate. However, if national estimates alone are desired, then the size of the sample should be increased to 600 households and 400 businesses. The estimate of sampling errors associated with the multi-stage stratified cluster sampling design, as proposed, are given in Table 1 and 2. Note that two values are given for each estimate (see footnote at the bottom of Table 2).

TABLE 1

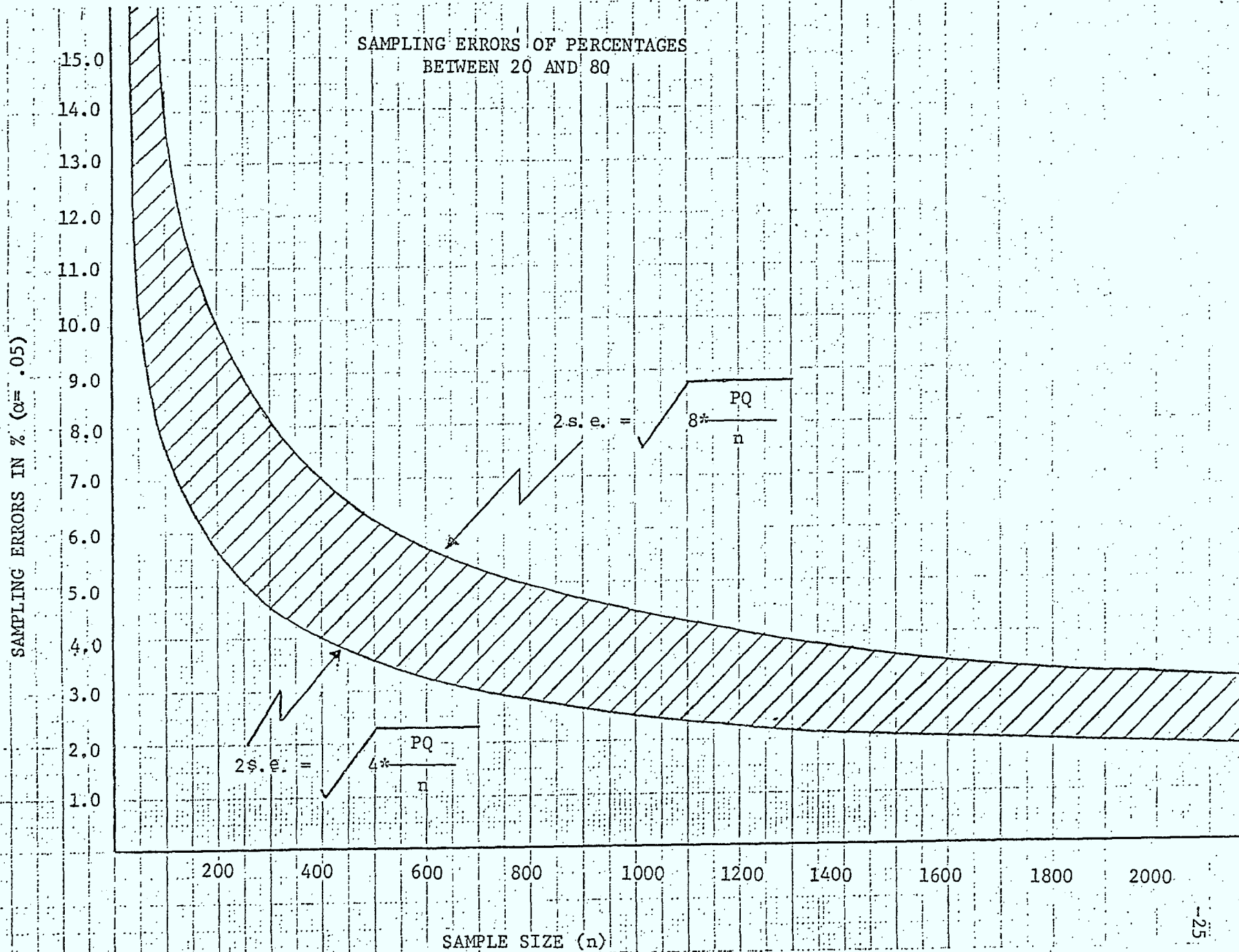SAMPLING ERRORS OF PERCENTAGES
BETWEEN 20 AND 80

$$2 \text{ s.e.} = \sqrt{8 * \frac{PQ}{n}}$$

$$2 \text{ s.e.} = \sqrt{4 * \frac{PQ}{n}}$$

SAMPLING ERRORS IN % ($\alpha = .05$)

SAMPLE SIZE (n)

TABLE 2

The Sampling Errors of Differences

FOR PERCENTAGES BETWEEN 35 - 65 AT α = .05

SAMPLE SIZE m \ n	2000	1500	1000	700	500	400	300	200	100
2000	3.5-4.5	3.3-4.8	3.7-5.5	4.2-6.2	4.8-7.1	5.2-7.7	5.9-8.8	7.1-10.5	9.8-14.5
1500		3.5-5.2	3.9-5.8	4.4-6.5	4.9-7.3	5.4-8.0	6.0-8.9	7.2-10.6	9.9-14.6
1000			4.3-6.3	4.7-7.0	5.2-7.7	5.6-8.4	6.3-9.3	7.4-11.0	10.0-14.8
700				5.1-7.6	5.6-8.3	6.8-8.9	6.6-9.8	7.6-11.3	10.2-15.1
500					6.0-8.9	6.4-9.5	7.0-10.3	8.0-11.8	10.4-15.5
400						6.7-10.0	7.3-10.8	8.3-12.2	10.7-15.8
300							7.8-11.5	8.7-12.9	11.0-16.3
200								9.5-14.1	11.7-17.3
100									13.5-20.0

FOR PERCENTAGES AROUND 20 OR 80 At α = .05

m \ n	2000	1500	1000	700	500	400	300	200	100
2000	2.5-3.6	2.7-3.9	3.1-4.4	3.5-5.0	4.0-5.7	4.4-6.2	5.0-7.0	5.9-8.4	8.2-11.6
1500		2.9-4.1	3.3-4.6	3.7-5.2	4.1-5.8	4.5-6.4	5.1-7.2	6.0-8.5	8.3-11.7
1000			3.6-5.1	3.9-5.6	4.4-6.2	4.7-6.7	5.3-7.4	6.2-8.8	8.4-11.9
700				4.3-6.0	4.6-6.6	5.0-7.1	5.5-7.8	6.4-9.1	8.6-12.1
500					5.1-7.2	5.4-7.6	5.8-8.3	6.7-9.5	8.8-12.4
400						5.7-8.0	6.1-8.6	6.9-9.8	8.9-12.6
300							6.5-9.2	7.3-10.3	9.2-13.1
200								8.0-11.3	9.8-13.9
100									11.3-16.0

FOR PERCENTAGES AROUND 10 OR 90 AT α = .05

m \ n	2000	1500	1000	700	500	400	300	200	100
2000	1.9-2.7	2.0-2.9	2.3-3.3	2.6-3.7	3.0-4.2	3.3-4.6	3.7-5.3	4.4-6.3	6.1- 8.7
1500		2.2-3.1	2.4-3.5	2.7-3.9	3.1-4.4	3.4-4.8	3.8-5.4	4.5-6.4	6.2- 8.8
1000			2.7-3.8	3.0-4.2	3.3-4.6	3.5-5.0	3.0-5.6	4.6-6.6	6.3- 8.9
700				3.2-4.5	3.5-5.0	3.8-5.3	4.1-5.9	4.8-6.8	6.4- 9.1
500					3.8-5.4	4.0-5.7	4.4-6.2	5.0-7.1	6.6- 9.3
400						4.2-6.0	4.6-6.5	5.2-7.3	6.7- 9.5
300							4.9-6.9	5.5-7.7	6.9- 9.8
200								6.0-8.5	5.5- 7.7
100									8.5-12.0

The values shown are the estimates of the sampling errors of differences between percentages. Therefore, the difference required for significance (at two standard errors) for a comparison of two different subgroups would need to be greater then those shown in the table.

NOTE: two values are given - low and high - for each cell.

$$\text{low} \longrightarrow 2\left[PQ\left(\frac{1}{n} + \frac{1}{m}\right)\right]^{\frac{1}{2}} \qquad \text{high} \longrightarrow 2\left[2(.5)^2\left(\frac{1}{n} + \frac{1}{m}\right)\right]^{\frac{1}{2}}$$

Summary

Several options have been outlined. Given the feasibility of obtaining up-to-date lists of business establishments, the survey strategies are now subject to future discussion.

The 'typical area' survey method was also examined, but it was not considered as a viable option for the purpose of this study. The major objection to this method is that there is no way of assigning an overall probability to the ultimately selected units (since the selection of a "typical area" is not random). Hence the precision of the sample estimate cannot be computed, which implies that the results cannot be generalized beyond the 'typical area'. Second, no two experts can agree on what a 'typical area' is or how to define or select these 'typical areas'. Finally, the 'typical' in the past (i.e. 'typical' based on previous census data or other sources of data), does not ensure that the area will have remained 'typical' at the time of the study. It must be noted that the results from the "typical area" can only be generalized to the "typical area" and not to the population as a whole (i.e. the results of a small area study cannot be used to generalize to the whole population of a small area unless the small area was selected at random).

Appendix B

I DRAFT LIST OF QUESTIONS FOR RURAL SURVEY

1.   How long have you been living in this house (apartment)?

2a.   Have you always lived here?

 b.   If no, was your previous residence in ...

                    ... this town or city
                    ... another town or city
                    ... the country
                    ... a country outside of Canada?

3.   Do you own or rent this dwelling?

4a.   Is it your primary or secondary residence?

 b.   If secondary, what period of time do you and your family spend at
       this location ...

                    ... weekends
                    ... less than 1 month
                    ... several months
                    ... three to six months, or
                    ... more than 6 months?

 c.   If secondary, what season and time of year are you usually here?

5.   Approximately how many homes are in this community?

6a.   How far is your nearest neighbour?

 b.   How far is it to the nearest town?

7.   What is the language most often spoken in your home?

8.   What is the highest level of schooling you have obtained ...

                    ... elementary
                    ... high school
                    ... commercial or technical school
                    ... university, or
                    ... trade or skill training?

9.   Are you working at the present time, unemployed, a student, retired or what?

10a.   If employed, what kind of work do you do?

  b.   In what kind of business or industry is that?

11.   Are you the main wage earner in this household?

12a.   If no, what kind of work does the main wage earner do?

  b.   In what kind of business or industry is that?

13.   What is the total yearly income (before texes) of the main wage earner?

14.   What is the total income for all household members?

15a.   How many telephones do you have?

  b.   How many lines are there?

16.   What type of set(s) do you have ...

          ... standard
          ... colour
          ... premium
          ... push button dial?

17.   Is your telephone residential, business or both?
IF RESIDENTIAL, GO TO 23.

18.   If business or both, what type of business are you engaged in?

19.   Is the business run from this household or is it at some other location?

20.   Do you own the business or do you manage it for someone else?

21a.　Is your current telephone service adequate for your business needs?

　b.　If no, what changes or improvements do you feel are necessary?

22.　Do you have this telephone becuase it is necessary for business, necessary for your household or both?

23.　Do you have a single party line, 2-party, 3-party or multi-party line?

24a.　If other than single party-line, why do you not have a private line? Is it because ...

> ... you don't need it or want it
> ... it is too expensive
> ... it is not available from the telephone company?

　b.　Have you ever had a private line in another residence?

　c.　How much would you pay ...

a) for single party line　　b) for 2 party line　　c) 4 party line

...nothing more	...nothing more	...nothing more
...$1 more/month	...$1 more/month	...$1 more/month
...$2 more	...$2 more	...$2 more
...$5 more	...$5 more	...$5 more
...$10 more	...$10 more	...$10 more

25.　How satisfied are you with the telephone service in your area? For example with ...

> ... time taken for repairs
> ... quality of transmission
> ... size of free call zone
> ... anything else?

26.　If unsatisfied with items, how much more would you be willing to pay to obtain better service?

> ... nothing more
> ... $1 more/month
> ... $2 more
> ... $5 more
> ... $10 more

(THESE QUESTIONS WILL BE EXPANDED AT A LATER DATE)

27a.   Do you think the telephone company <u>could</u> provide better service?

b.   If yes, what improvement or additional service is needed?

28a.   Do you have any other means of communication such as CB radio, short-wave, or an intercom?

b.   If yes, what specifically do you use them for?

29a.   How many black and white, and colour sets do you have?

b.   If none, why do you not own one?

                    ... too expensive
                    ... do not watch TV
                    ... no signal available?

30a.   Is cable TV available here?

b.   If yes, are you on cable and how many channels does it provide?

31.   For how long each day is the television turned on in your home?

32.   How many hours do you watch TV per day? What about the others in your household?

33.   What are the channels that are available here 'off-air' and what is the quality of their reception?

34.   Do these channels provide you with satisfactory TV viewing? (in terms of content)

35.   How much would you be willing to pay for a cable to bring 1 extra channel into your home? How much for 3 extra channels, 5 extra channels?

<u>Additional questions may be added for inclusion in final questionnaire.</u>

Appendix B

Questionnaire items for Household Survey
(to include a business if located in the household)

II Draft Questions for Omnibus Survey

The Omnibus Survey includes questions on income, family size, language, and geographic location for each household.

1. Number and type of TV sets.

2. Is cable available here?

3. Do you subscribe?

Why?

a. Quality of picture
b. Number of channels (U.S.; Canada)

Why note?

a. Don't wat TV much
b. Cost
c. Already have good reception

4. What do you pay for cable?   If it were less expensive would you want it?

5. If it went up would you pay ...

...$2/month more
...$5/month more
...$10/month more

Appendix C

COST   ESTIMATE

APPENDIX C

Cost Estimate
for
Rural Communications Survey
(Household and business samples)

I. Specifications:

A. National Design.

(a) Household survey

Approximately 100 Enumeration Areas will be selected
from within 50 Area Aggregates (similar to Census Tracts).
A total listing of addresses within E.A.s will be made and
a sample drawn so as to yield 600 interviews.

Data will be collected in the form of personal inter-
views not to exceed 3/4 hour in length. A pre-test of 100
respondents will be conducted in Ontario and Quebec. 75-
Ontario, 25-Quebec.

Data will be coded, keypunched and will not exceed 3
cards per case. An edited data tape will be provided along
with an S.P.S.S. code-book and frequency distributions by
variable.

(b) Business survey

Listings of businesses will be obtained and linked to the
household sample areas. Names and addresses will be verified and
augmented if necessary prior to the survey.

Data collection will be undertaken simultaneously with the
household survey with 400 owners or managers of businesses.

B. Regional Design.

(a) Household survey

Approximately 40 Enumeration Areas (E.A.s) from within 20
Area Aggregates will be selected from each of 5 regions in Canada:
Atlantic, Quebec, Ontario, Prairies, British Columbia. E.A.s will

be listed and a sample drawn so as to yield 400 interviews from each region, a total of 2,000 interviews.

Data collection and processing are as described previously.

(b) Business survey

Sample selection and data collection procedures will be undertaken as described in the national survey of rural businesses. Approximately 300 interviews are expected from each of the 5 regions, a total of 1,500 interviews.

II. Costs

A. __National Design__   600 household interviews
400 business interviews

Sample Design	$ 6,000.00
*Sample Listing and Selection	21,395.00
Data Collection	62,665.00
Data Processing	5,600.00
**Administration and Project Management	25,000.00
Total Costs, Survey Research Centre	120,660.00
York University Overhead	23,798.00
TOTAL BUDGET	$ 144,458.00

B. __Regional Design__   2,000 household interviews
1,500 business interviews

Sample Design	$ 6,000.00
*Sample Listing and Selection	43,325.00
Data Collection	162,970.00
Data Processing	16,940.00
**Administration and Project Management	65.000.00
Total Costs, Survey Research Centre	294,235.00
York University Overhead	58,081.00
TOTAL BUDGET	$ 352,316.00

*Cost of business lists are not included. (approximately $3,000.-$5,000).

**Full-time staff salaries for project's duration.

COPELAND, M.D.G.
The demand for telecommunications
services in rural areas

DATE DUE
DATE DE RETOUR

9 AUG AOUT 1984			