CINTEL

CANADIAN INTERNATIONAL TELECOMMUNICATIONS DEMAND MODEL

F I N A L R E P O R T

Submitted to the Department of Communications, Ottawa
by the International Institute of Quantitative Economics

April 1973
I.I.Q.E.

International Institute of Quantitative Economics
1650, Lincoln Avenue, Suite 201
Montreal 108, Quebec
April, 1973

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

A. INTRODUCTION

A.1. OUTLINE OF REPORT AND HIGHLIGHTS

It is the purpose of this report to present the results of the study on the demand for Canadian international telecommunications, as obtained by using the Canadian International Telecommunications Demand Model (CINTEL) which is described later. For clarity the report has been organised in the following manner.

Part A consists of the highlights of the report, and a brief explanation of the basic concepts and assumptions relevant to the analysis, followed by a more extended summary of the most important results. In part B, the detailed theoretical considerations underlying the model are presented. The complete and detailed results of the econometric estimations, as well as the conclusions which can be drawn from this study, and some suggestions as to how the present results can be extended further, are given in part C. The method of gathering the data, as well as the data sources and the actual raw data used are given in an Appendix.

The following conclusions emanating from the study of Demand for International Telecommunications are considered to be of particular significance with respect to Canadian users:

TELEPHONE - international telephone demand is most strongly influenced by: price of telephone service, quality of telephone service, foreign trade; Canadian tourism overseas; and language commonality;

- a decrease in telephone price may lead to increased revenue (but this is less certain than in the case of telex);

- the demand for telephone traffic reacts positively to a higher quality of service;

- trade and Canadian tourists overseas are both important factors, but the latter appears to have a stronger influence on demand for telephone services.

TELEGRAPH - international telegraph demand is affected most strongly by telegraph prices, telex prices, foreign trade, and Canadian tourism overseas;

- a decrease in telegraph price will result in an increased revenue; this effect is less strong than for telex, but much stronger than for telephone;

- telex is an important competitor of telegraph; thus an increase in telex prices will result in greater demand for telegraph services;

- Canadian tourists overseas have a greater effect on telegraph demand than does the volume of foreign trade.

TELEX

- the most important factors influencing international telex demand are: price of telex, price of telegraph, and foreign trade;

- a decrease in telex price can lead to significant increases in revenue from increased telex demand;

- telegraph competes with telex; thus a price increase in telegraph results in increased demand for telex;

- foreign trade has a much greater impact on telex demand than on demand for other telecommunications services.

A.2. SUMMARY OF MODEL

The most important considerations to be borne in mind regarding the model are the following:

1. The incoming and outgoing flows of telecommunications services are treated separately. The principal reason for this

decision arises from the fact that the demand for the incoming services (originating in foreign countries) reflects the needs of foreign users, whereas the demand for the outgoing services (originating in Canada) depends on the tastes of Canadian users.

2. The telecommunications services are further separated into the three basic categories, telephone, telegraph and telex, since each of these modes of telecommunication has its own unique set of characteristics.

3. Although the telecommunications demands of the two main types of users, business and households are likely to be different, they are lumped together in the analysis owing to the unavailabilily of specific data relating to each type.

4. From basic economic considerations it is possible to identify certain key economic factors on which the telecommunication flows are assumed to depend. The factors determining demand are found to be the following: prices of telephone, telex, telegraph; quality of telephone service; foreign trade; tourism; per capita income; overlapping of working hours; commonality of language.

5. For the purposes of numerical estimation of the separate influences of each of these factors on telecommunications

demand, the following type of simple relationship is utilised[1]

$$\left[\begin{array}{l}\text{Telephone traffic flow in}\\ \text{minutes from Canada to}\\ \text{country X in a given year}\end{array}\right] = a + b.\left[\begin{array}{l}\text{Flow of Canadian tourists}\\ \text{from Canada to country X}\\ \text{in a given year}\end{array}\right] + c.\left[\begin{array}{l}\text{Dollar volume of total trade}\\ \text{(exports + imports) between}\\ \text{Canada and country X in a}\\ \text{given year}\end{array}\right] + \text{other factors}$$

Here the numerical weights a, b, c, etc. determine the relative influence of each of the associated factors, on the flow of telephone traffic.

Using the data for the above variables which are available in the years 1969, 1970 and 1971 for a group of 40 important countries, econometric techniques are utilized to determine the importance of each of the factors influencing demand. This includes the estimation of the numerical weights (coefficients) a, b, c, etc.

Although we have analyzed inflows and outflows for each type of service, the results for incoming traffic demand are much weaker than for outgoing flows. This is not surprising since as stated earlier incoming traffic manifests demand patterns of users in a heterogenous group of 40 countries, whereas outgoing traffic deals with Canadian users' demand,

---

[1] *In the actual econometric estimation, the logarithmic form was used for some of the variables, but this change does not affect the main arguments of this section.*

clearly a much more homogenous grouping. In the next section the results for outgoing demand will be emphasized for the above reason, and also because these are the results which are of particular interest to Canadian telecommunications authorities.

It should be noted that the determining factors of greatest interest for policy purposes are the prices of each service, and quality of telephone service. For this reason, the contents of the next section will deal mainly with the rolesthe above factors play, while the effects of other factors will be mentioned more briefly, and only in those instances where particularly significant relationships are suggested by the results.

A.3. SUMMARY OF RESULTS

A.3.1. Telephone Demand: Outgoing

On the basis of standard statistical criteria the results are very good; over 85% of the variation in outgoing Canadian telephone traffic among the 40 countries considered is accounted for by the effect of variations in the determining factors outlined earlier. Very strong and significant effects are due specifically to the following elements: price of

telephone calls, trade between Canada and a given country, Canadian tourists in a given country, language commonality, and quality of telephone service.

The volume of telephone traffic is found to vary inversely with the price of a phone call; i.e. once the influence of all the other factors is taken into account, the demand increases as the price decreases. Specifically, it is found that a 1 percent decrease in price is likely to result in about a 1.4 percent increase in volume. It is necessary to qualify the latter with a statement of degree of confidence in the statistical results: one can say with a probability of 72.6% that for a 1 percent decrease in the price, increase in volume will be greater than 1 percent.

The importance of this for policy analysis is the following: once the effects of other factors are accounted for, a price increase will reduce revenue and a price decrease will increase revenue.

The other factor of policy interest is the quality of service. Because an accurate quantitative measurement of the quality of service is extremely difficult to obtain, a quantitative first approximation is used in this study. Therefore it is not possible to present numerical results such as the "percent change" effects derived in the case of price. However, the results clearly lead to the conclusion that the volume of traffic increases as the quality of service improves.

The reservations concerning the confidence in the price effect results, and the numerical interpretation of the quality of service effects, in both cases may be attributable to shortcomings in the available data. More precise information would very likely result in much better knowledge of the economic relationships between prices and quality of service on the one hand, and demand for the telecommunications services on the other.

The results clearly show that the quantity demanded increases as per capita income of Canadian users increase, but because information is available only for a very short time-period, it is impossible to obtain numerical results in which much confidence could be placed.

Both foreign trade and number of Canadian tourists in a given country are important factors, but it may be noteworthy that the latter appears to be a much stronger factor: in approximate terms, whereas a 1 percent increase in trade volume results in just over 1/4 of a percent increase in telephone traffic, a 1 percent increase in Canadian tourism abroad results in 1/2 of a percent increase in telephone traffic.

Finally, it is of interest to note that the above results agree in general terms with those obtained by comparable studies of international telecommunications traffic for the U.S., and for a group of foreign countries.

A clear-cut relationship could not be established between the demand for telephone services out of Canada and the prices of the other two modes of telecommunications out of Canada.

A.3.2. Telegraph Demand: Outgoing

Econometric analysis of telegraph demand yields results which are as good as those for telephone; about 85% of the variation is accounted for by the influence of the following factors: prices of telegraph, telex, and telephone, foreign trade, Canadian tourism in foreign countries, and income. Only the most important of these are detailed below.

Telegraph traffic is clearly more responsive to its own price than telephone, as the results suggest that a 1 percent telegraph price decrease is likely to lead to about a 1.8 percent increase in the quantity demanded of telegraph traffic. This means that a price cut will lead to an increase in quantity demanded which is sufficient to increase revenue. This result can be stated with a high degree of confidence, i.e. 95%.

The results suggest that telex is a significant competitor of telegraph; a higher telex price leads to higher demand for telegraph service. It is note-worthy that the number

of Canadian tourists in a foreign country significantly influences the demand for telegraph services to that country, whereas this factor has little discernible effect on the demand for telex services, as shown in the next section.

A.3.3. Telex Demand: Outgoing

The results of the demand analysis for outgoing telex traffic are the best among the three services. Almost 90% of the variation in demand is statistically explained by the determining factors considered, in this case prices of telex, telegraph, and telex; foreign trade, and per capita income in Canada.

The effect of the price of telex - exclusive of installation charges - on the quantity demanded of telex traffic is extremely strong: a 1 percent decrease in price is likely to result in about a 4 percent increase in quantity demanded. These results point to the conclusion that a price-cut can lead to a significant increase in revenue. It might be added that this conclusion on revenue increases can be stated with much greater confidence that in the case of either telephone and telegraph (the degree of confidence is almost one, 99.9999%).

The price of telegraph services is found to influence telex demand in a competitive manner, i.e. higher telegraph prices lead to more demand for telex, suggesting that the two are strong substitutes among which

users make their choice on the basis of relative prices. This result is an agreement with the previous finding in the telegraph analysis, that telex is a competitor of telegraph.

Foreign trade is clearly the most important non-price influence upon telex demand: the higher the level of trade with a country, the higher is the demand for telex services. This is not surprising, but it is useful to note the following numerical result: a 1 percent increase in trade volume is likely to result in slightly less than 1 percent increase in telex demand. This would imply that there may be some economies of scale in telex use, associated with trade. In general the effect of foreign trade on telex is much stronger than its effect on telegraph and the combined effect of trade and tourism on telex demand is greater than the effect of trade on telegraph demand.

A.3.4. Telephone Demand: Incoming

The econometric results for incoming flows of telephone services are relatively weak compared to the results for outgoing traffic. Although the results explain over 80% of the variation in the demand for incoming flows, it is difficult to distinguish the separate contributions of the different variables. The most important explanatory variables are flow of trade, working hours commonality and language commonality.

A.3.5. Telegraph Demand: Incoming

The results explain over 70% of the variation in the incoming Canadian telegraph traffic. The most important explanatory variables are the flow of trade, the flow of foreign tourists entering Canada and the price of telegraph services originating abroad.

The flow of incoming telegraph traffic is found to vary inversely with the price of telegraph services; a result which was expected. The results show that a 1% decrease in price is likely to produce a 1.3% increase in the flow of traffic, which would clearly result in an increase in revenue from this type of service.

A.3.6. Telex Demand: Incoming

For incoming flows of telex traffic the results are almost as good as for outgoing flows of the same service. The results explain over 80% of the variation in the incoming flow of the

service. The most important explanatory variables are the flow of trade, the level of income and the price of telex.

The results imply that a 1% decrease in the price is likely create a 1.7% increase in the volume of traffic, and consequently an increase in the revenue from this type of service would result.

B. THE THEORETICAL DEMAND MODEL

B.1. INTRODUCTION

The theoretical basis of the demand model used for econometric estimations is presented in this section. Before we discuss the model, it is important to clarify four introductory points:

a) we shall separate inflow and outflow demand, because the latter depends on the economic behavior of Canadian users of these services (see (c) below), whereas the former manifests the economic behaviour of a more heterogeneous group of users, those in all countries outside of Canada;

b) we shall further separate the services into the three groups, telephone, telegraph, telex, in view of the different characteristics of these telecommunications modes;

c) the analysis of economic behavior will start at a very dissagregated level of individual economic units, households and business firms (where the latter category includes government) although the final form will not be so detailed owing to

data availability constraints. This procedure of disaggregated, micro-level analysis built-up to a macro level will be presented in detail in Sections B.2. only for telephone services, while for telegraph and telex the final forms will be explained more briefly with the implicit understanding that similar detailed analyses also underlie these forms;

d) we shall begin at an abstract level unconstrained by data availability, and proceed step by step through aggregation while making necessary assumptions, towards a form applicable to available data. This will be done in order to indicate clearly at what points lack of data cause loss of potential economic knowledge on the one hand, and where possible errors arise in the final quantitative estimates as a result of econometric mis-specification on the other.

B.2. TELEPHONE SERVICE

B.2.1. Outflows of Telephone Services

B.2.1.a Household Demand

The demand for telephone calls by a Canadian household is said to be a function of the absolute prices of all goods and services, the level of income, and tastes.

Let us begin by assuming that a telephone call to each country is a differentiated commodity, i.e. a telephone call to Singapore is a different commodity from a telephone call to Ireland. This means for example, that a particular household α, with given tastes and income, facing given prices for all goods in the market, will have a demand response to a change in the Canadian price for a call to Singapore that is different from the demand response to an equivalent change in the price of a call to Ireland. Similarly, the responses to other determining factors will be different.

Furthermore, we add a time-dimension in which we allow for changes in demand over time in response to changes in the explanatory variables of price, income and tastes.

Finally, we assume that by the Leontief aggregation theorem (3) all the prices but the ones for the three related telecommunications services, can be added together in an aggregate price index[1]. Then we have:

$$(1) \quad TFOC^{\alpha}_{j}(t) = D^{\alpha}_{1jt}\,(P^{0}_{1j}(t),\ P^{0}_{2j}(t),\ P^{0}_{3j}(t),\ \bar{P}(t),\ I^{\alpha}(t); U^{\alpha}(t))$$

$\alpha = 1,\ldots H$ (households) $\quad j = 1,\ldots J$ (countries)

$t = 1,\ldots T$ (time)

D^{α}_{1jt} = Form of the demand function by household α for telephone service to country j in year t;

---

[1] The Leontief aggregation theorem states that a twice differentiable function of n variables $f(x_1, x_2, x_3, \ldots x_n)$ can be written as $f(x_1, x_2, h(x_3, x_4, \ldots x_n))$ if and only if $\partial(\frac{hi}{hj})/\partial x_k = 0$ for $i,j,k = 3, \ldots, n$, where $h_m = \frac{\partial h}{\partial X_m}$.

$TFOC_j^{\alpha}(t)$ = Quantity demanded of outgoing telephone services by family α to country j in year t;

$P_{1j}^{0}(t)$ = Absolute price of telephone services to country j in year t;

$P_{2j}^{0}(t)$ = Absolute price of telegraph services to country j in year t;

$P_{3j}^{0}(t)$ = Absolute price of telex services to country j in year t;

$\bar{P}(t)$ = Aggregate price index in Canada in year t;

$I^{\alpha}(t)$ = Income of household α in year t; and

$U^{\alpha}(t)$ = "Tastes" of household α in year t.

If the above function is summed for all Canadian households, we obtain the following equation:

$$(2)\quad TFOC_j^{H}(t) = D_{1jt}^{H}\left(P_{1j}^{0}(t), P_{2j}^{0}(t), P_{3j}^{0}(t), \bar{P}(t), I(t), U(t)\right)$$

Where $TFOC_J^{H}(t) = \sum_{\alpha=1}^{H} TFOC_j^{\alpha}(t)$;

D_{1jt}^{H} = Form of the aggregate demand function of all the households for telephone services to country j in year t ;

$I(t) = \sum_{\alpha=1}^{H} I^{\alpha}(t)$; and

$U(t)$ = Total taste parameter .

Here we have made the assumption that the total level of income is the right income variable rather than its distribution across families. When this equation is used for different time periods, the above hypothesis is a sound one if there has not been a major income redistribution. The latter assumption is certainly valid for a short period of time. For longer periods of time it would be necessary to have more information on both the pattern of income distribution, and any possible changes in tastes.

B.2.1.b Business Demand

The second source of demand for telephone services is the business sector. Both the demand for telecommunications of the tourist industry as well as the government sector are included in this category.

We assume that the demand for telephone services by business is a derived demand, and as such it is a function of the different price and level of activity variables. Among the latter variables we will have Exports, Imports, International Flows of Investment, International Tourist Flows and Level of Canadian Income.

The final equation will be given by

$$(3)\quad TFOC_j^B(t) = D_{1jt}^B\,(P_{1j}^0(t), P_{2j}^0(t), P_{3j}^0(t), \bar{F}(t), IMP_j(t), EXP_j(t),$$

$$CINV_j(t), CTOUR_j(t), I(t)\ )$$

where the new variables included are:

$TFOC_j^B(t)$ = Quantity demanded of outgoing telephone services by business to country j in year t;

D_{jt}^B = Form of the demand function by business for telephone services to country j in year t;

IMP_j = Canadian imports from country j in year t;

EXP_j = Canadian exports to country j in year t;

$CINV_j(t)$ = Canadian investment in country j in year t;

$CTOUR_j(t)$ = Canadian tourist flow to country j in year t; and

$I(t)$ = Income of Canada in year t.

B.2.1.c. Total Demand and Alternative uses of Data

If equations (2) and (3) are added, we finally obtain:

$$(4)\quad TFOC_j(t) = D_{1jt}\,(P_{1j}^0(t), P_{2j}^0(t), P_{3j}^0(t), \bar{P}(t), I(t), IMP_j(t), EXP_j(t), CINV_j(t), CTOUR_j(t), U(t))$$

In the estimation of equation (4), after the specification of the function D_{1jt} there are two alternative approaches available:

(1) the use of time series: in this case we assume that the function D_{ljt} is the same for every t. Furthermore, we assume that the flow data comes from a demand equation, then with time series information on the flow of traffic, the prices of the different telecommunications services, the aggregate price deflator, income data, variables related to business activity and other variables related to changes in taste, we can estimate demand functions for flow of telephone services from Canada to country j. Clearly, we will have a different demand equation for flows from Canada to France from Canada to England, etc. The specific problem of identification of the demand equation is discussed in section B.5. below.

(2) the use of cross sections: in this case we assume that the function D_{ljt} is the same for every j. Thus 'ceteris paribus' we assume that the effect of a change in the price of a call to London on the flow of telephone traffic to London is the same as the effect of a change in the price of a call to France on the corresponding flow of traffic to France. Therefore, we are assuming that calls from Canada to France, to England, to West Germany etc. are explained by the same equation (i.e. these observations can be attributed to the same population, in the econometric sense). This is a very strong assumption indeed but the only way to test it is to have sufficient time series data to make the estimations indicated *(1)* above, and then to run tests for equality of the equations (see references *(1)*, *(2)*). In our econometric estimations we will try to capture such differences in the equations by introducing explicitely, variables such as working hours commonality, language commonality, stock of immigrants etc.

B.2.2. Inflows of Telephone Services

Now let us consider the model for incoming calls. As before, households and business will be separated.

B.2.2.a. Household Demand

Following the analysis of section B.2, the demand for telephone services of a household β, from country j to Canada is given by:

$$(5) \quad TFIC_j^{\beta}(t) = d_{1jt}^{\beta}(P_{1j}^{I}(t), P_{2j}^{I}(t), P_{3j}^{I}(t), \bar{P}_j(t), I_j^{\beta}(t), U_j^{\beta}(t))$$

$\beta = 1, \ldots\ldots\ldots\ldots, H^j$ (households in country j)

$j = 1, \ldots\ldots\ldots\ldots, J$ (countries)

$t = 1, \ldots\ldots\ldots\ldots, T$ (time)

d_{1jt}^{β} = Form of the demand function of household β of country j for telephone services to Canada in year t;

$TFIC_j^{\beta}(t)$ = Quantity demanded of telephone services by household β to Canada in year t;

$P_{1j}^{I}(t)$ = Absolute price of telephone services to Canada from country j in year t;

$P_{2j}^{I}(t)$ = Absolute price of telegraph services to Canada from country j in year t;

$P^I_{3j}(t)$ = Absolute price of telex services to Canada from country j in year t;

$\bar{P}_j(t)$ = Aggregate price index in country j in year t;

$I^\beta_j(t)$ = Income of household β of country j in year t; and

$U^\beta_j(t)$ = "Taste " of household β of country j in year t.

If we add this function for all households in country j, we obtain the following equation:

$$(6)\quad TFIC^H_j(t) = d^H_{1jt}\,(P^I_{1j}(t), P^I_{2j}(t), P^I_{3j}(t), \bar{P}_j(t), I_j(t), U_j(t))$$

where $$TFIC^H_j(t) = \sum_{\beta=1}^{H^j} TFIC^\beta_j(t)$$

d^H_{1jt} = Form of the aggregate demand function of all the households in country j for telephone services to Canada in year t;

$$I_j(t) = \sum_{\beta=1}^{H^j} I_j(t)$$

$U_j(t)$ = Total "taste" parameter in country j in year t.

B.2.2.b. Business Demand

For the business sector we will have the following demand equation:

$$(7)\quad TFIC_j^B = d_{1jt}^B \left(P_{1j}^I, P_{2j}^I, P_{3j}^I, \bar{P}_j(t), IMP_j(t), EXP_j(t), FINV_j(t), FTOUR_j(t), I_j(t) \right)$$

where the new variables included are:

$TFIC_j^B(t)$ = Quantity demanded of incoming telephone services by business from country j to Canada in year t;

d_{1jt}^B = Form of the demand function of business for telephone services from country j to Canada in year t; and

$FINV_j(t)$ = Foreign investment of country j in Canada in year t.

B.2.2.c. Total Demand and Alternative Sources of Data

Now adding equations (5) and (7) we obtain:

$$(8)\quad TFIC_j(t) = d_{1jt} \left(P_{1j}^I(t), P_{2j}^I(t), P_{3j}^I(t), \bar{P}_j(t), IMP_j(t), EXP_j(t), FINV_j(t), FTOUR_j(t), I_j(t), U_j(t)\right)$$

Here again, after the specification of function d_{ijt} there are two alternative approaches available:

(1) the use of time series. In this case we assume that the function d_{ijt} is the same for every t. If the time series for the different variables appearing in (8) were available we could estimate demand equations for flows of telephone services from country j to Canada. Clearly, we will have a different demand equation for flows from France to Canada, from West Germany to Canada, etc.;

(2) the use of cross sections. In this case we assume that the function d_{ijt} is the same for every j. This assumption is much stronger than the corresponding one for outgoing calls, because in the previous case we assumed that the functional form of the demand equation was the same for flows of services originating in Canada independent of the country of destination of the service, while here we are assuming that the functional form of the demand equation is the same for flows of telephone services coming into canada independent of the country of origin of the service. Thus, the assumption used for incoming calls is stronger because here the basic unit of observation is heteregoneous, referred to the different foreign countries, whereas in the previous case all the units of observation were with respect to Canada. In our estimations we will allow for some differences in the functional form of the equation for the different countries where the calls originate, by introducing variables such as working hours commonality, language commonality, etc.

B.3. TELEGRAPH SERVICES

B.3.1. Outflows of Telegraph Services

As in the case of telephone, there are two categories of users, households and business, and again the determinants are different for each of these.

In the case of households the factors affecting demand for telegraph services are the same as for telephone demand, except that commonality variables are less likely to be relevant. This hypothesis could be tested with the existing data. Similarly, business demand is also of the same form as for telephone, with the quality and commonality factors dropped.

Therefore the demand equation for outflows of telegraph services will be given by:

$$(9) \quad TGOC_j(t) = D_{2jt}\ (P^O_{1j}(t),\ P^O_{2j}(t),\ P^O_{3j}(t), \bar{P}(t), I(t), IMP_j(t),$$

$$EXP_j(t),\ CINV_j(t),\ CTOUR_j(t),\ U(t))$$

where $TGOC_j(t)$ = flow of telegraph services from Canada to country j in year t;

D_{2jt} = form of the demand function for telegraph services from Canada to country j in year t.

As in section B.2.2. for the estimation of equation

(9) we have in principle two sources of data: time series and cross-section.

B.3.2. Inflows of Telegraph Services

Using the arguments of section B.3.1. the demand for incoming telegraph services will be given by:

$$(10)\quad TGIC_j(j) = d_{2jt}(P^I_{1j}(t), P^I_{2j}(t), P^I_{3j}(t), \bar{P}_j(t)\ IMP_j(t), EXP_j(t),$$

$$FINV_j(t), FTOUR_j(t), I_j(t), U_j(t))$$

where $TGIC_j(t)$ = flow of telegraph services from country j to Canada in year t;

d_{2jt} = form of the demand function for telegraph services from country j to Canada in year t.

B.4. TELEX SERVICES

B.4.1. Outflows of Telex Services

In the case of telex traffic, for all practical purposes there are no residential users, and hence the demand for this service will arise mainly from businesses.

As in the telegraph case commonality variables should be relatively unimportant here. Therefore the demand for outgoing flows of telex services will be given by:

$$(11)\quad TXOC_j(t) = D_{3jt}(P^O_{1j}(t), P^O_{2j}(t), P^O_{3j}(t), \bar{P}(t), I(t), IMP_j(t), EXP_j(t), CINV_j(t), CTOUR_j(t), U(t))$$

where $TXOC_j(t)$ = Flow of telex services from Canada to country j in year t;

D_{3jt} = Form of the demand function for telex services from Canada to country j in year t.

B.4.2. Inflows of Telex Services

For incoming flows of telex services we will have the following relation:

$$(12)\quad TXIC_j(t) = d_{3jt}(P^I_{1j}(t), P^I_{2j}(t), P^I_{3j}(t), \bar{P}_j(t), IMP_j(t), EXP_j(t), FINV(t), I_j(t), U_j(t))$$

where $TXIC_j(t)$ = Flow of telex services from country j to Canada in year t;

d_{3jt} = Form of the demand function for telex services from country j to Canada in year t.

B.5. SOME ECONOMETRIC PROBLEMS IN THE ESTIMATION OF THE DEMAND EQUATIONS

In the previous sections, the different demand equations of the model were formulated. In the present section we will study in detail some methodological problems that arise in the estimation of these equations.

Given the available information we will use cross-section data and also data pooled from cross-section and time series; the latter point is discussed in greater detail in part C. The first problem that arises is that of the identification of the demand equations. Generally in a competitive market, the combination of price and quantity data that are observed arise from the interaction of demand and supply functions. But the market for international (and domestic) flow of telecommunications is clearly a controlled market in which the regulated firm can charge for their service, a negotiated price which is not directly related to the quantity presently sold. In this kind of market, at the ruling price one observes either the quantity demanded or the capacity of production, whichever is the smallest. As an example, let us start with the demand for outgoing telephone services. In this case graphically, we have the following

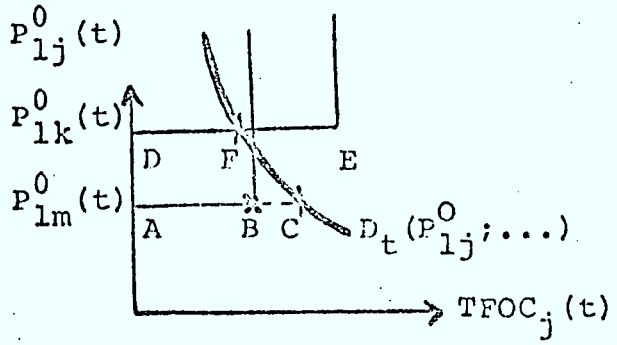

FIGURE 1. The Identification Problem

Here D_i is the downward sloping demand function for outgoing telephone services which we have assumed to be the same for calls from Canada to any country j. The dots after the semi-colon indicate that all the rest of the explanatory variables which appears in equation (4) of section B.2. are assumed to be constant. AB is the production capacity for telephone calls to country m, and DE is the production capacity for telephone calls to country k.

In figure 1, for telephone calls from Canada to country k at the price $P^o_{1k}(t)$ fixed by the regulatory authority, the quantity demanded is lower than the capacity at that price and therefore we observe a point such as F in the demand equation. However, for calls from Canada to country m at the fixed price $P^o_{1m}(t)$, the quantity demanded is higher than the capacity of the telephone network and therefore we observe a point such as B which is <u>not</u> on the demand curve. This type of situation is associated with queuing, transmission or call set-up delays, and similar features of unsatisfied demand at the ruling price. If this characterization of the model for telephone services is correct, then there are two alternative approaches which can be applied to countries such as m. The first choice is to exclude from the sample, all countries of the type m in which there is unsatisfied demand. This procedure is particularly useful when there are enough countries of type k to make the estimated results reliable.

The second approach is to introduce some shifting variable such that the unsatisfied demand (BC in the diagram) is a function of the former variable. This can be done by introducing a variable for quality of service, the basic assumption being that the better the quality of the service, the smaller the excess demand. If our model is correct, and if the quality of service variable is measured such that it decreases with improving quality, the coefficient of the former variable in the regressions should be negative. The better the quality of service the nearer would be the observed flow to the quantity demanded[1].

For the case of telegraph, capacity limitations may not apply, but the service can be quite heterogeneous especially with respect to delivery time. The price that one would like to have is for a homogeneous service and clearly, this is not the case in a cross-section. The only procedure that can be adopted in this case is to consider separately countries with homogeneous service and/or to include again some variable for quality of service.

In the case of telex, one should expect fairly homogeneous service with no capacity limitations at the ruling prices, and therefore there would be more countries of the type k in our demand equation.

After this discussion of the model to be utilized and the assumptions made in its formulation, we proceed to a discussion of the data gathered for this study.

---

[1] This effect could also be captured by grouping the countries according to quality of service and using a dummy variable that will take different values for the different categories. If the value assigned to the dummy variable decreases with the quality of service we should obtain a negative coefficient for this variable as stated above.

REFERENCES

(1) CHOW, G.C., "Tests of equality between sets of coefficients in two linear regressions", Econometrica, Vol. 28 (1960), pp. 591-605.

(2) FISHER, F.M. "Tests of equality between sets of coefficients in two linear regressions: an expository note", Econometrica, Vol. 38 (1970), pp. 361-366.

(3) LEONTIEF, W.W., "Composite commodities and the problem of index numbers", Econometrica, Vol. 4 (1936), pp. 39-59.

C. THE STATISTICAL RESULTS

C.1. GENERAL CONSIDERATIONS

In this section we will discuss in detail the results that were obtained when we estimated the different demand equations for telecommunication services.

Before going into the details of the estimations let us examine some general considerations.

1.- The flow of traffic data refers to the fiscal year, i.e. April 1st of a given year to March 31st of the following year. It was decided that it would not be worthwhile to undertake the additional work of having the explanatory variables referred to the fiscal year also, since the smooth characteristics of most of the series indicated that such a procedure would not affect the results greatly. Therefore, in our model in which all the rest of the variables refers to the calendar year, the telecommunications traffic flows appear with a three month lead.

2.- As stated in section B, it is assumed that the demand equations for telecommunications services are the same for the same type of mode of outgoing services to different countries (e.g. demand for telephone services to France, to Italy, to Greece), and across countries for incoming service. To make this crucial assumption more realistic we introduce explicitly, variables that can account for differences in the demand functions. Thus, except for the variables introduced above the demand functions have been assumed to be the same. This means that we allow for parametric differences in these functions. The types of variables that will be introduced to allow for parametric differences in the functions:

language commonality, working hours commonality and stock of immigrants from different countries etc. Another variable which can lead to either a parametric shift in the demand functions or represent a measure of unsatisfied demand for telephone services, is telephone density in the country that it is receiving the communication.

3.- The theory presented so far only identifies a list of the variables to be included in the demand equations and in most cases also predicts the sign of the response of the dependent (or telecommunications flow) variables to a change in an explanatory variable. However, the theory does not indicate what explicit form the demand equations should take. From the postulate of simplicity in inductive inference, it is possible to arrive at two alternative specifications of the demand functions such that they are either linear in the variables themselves or linear in the logarithms of the variables. Working with functions linear in the logarithms of the variables has the advantage that the magnitudes of the variables are considerably reduced and in this way the assumption of equal error variance for each observation (homoscedasticity) is more plausible. Furthermore, in the sample with which we are working, the logarithmic transformation has the additional advantage of reducing the collinearity among the regressors and therefore of making the estimation of the corresponding coefficients more reliable.

4.- In the sample used for the estimation, even after the logarithmic transformation there is a high collinearity among some

of the explanatory variables. This collinearity is most severe in the case of imports and exports of commodities as well as between immigrant stock and the flow of canadian tourists. Therefore, it is impossible to estimate accurately the individual contribution made by each of these variables to the quantity demanded of telecommunications services.

This result implies among other things, that we cannot separate the contributions of imports and exports. The only course of action available with the given sample, is to go back to the basic theory and consider only a subset of the most important regressors. With these considerations in mind it is clear that the flow of trade variable should be in our model. One can decide also mainly on theoretical grounds, and after considering the results of other studies in which the samples permitted the use of more variables, to introduce the flow of tourists as another regressor.

Therefore, due to the multicollinearity problem it is necessary to leave out or lump together some of the collinear regressors. Let us illustrate the consequences of this procedure, in terms of the interpretation of the coefficients to be estimated, by considering the model

$$(13) \quad \text{Log } Y_t = \beta_1 + \beta_2 \text{ Log } X_{2t} + \beta_3 \text{ Log } X_{3t} + \beta_4 \text{ Log } X_{4t} + \beta_5 \text{ Log } X_{5t} + \epsilon_t$$

We assume that in (13) all the assumptions of the classical multiple regression model are fullfilled (2),(5). Therefore using the method of ordinary least squares (OLSQ) we obtain the best linear unbiased estimates (BLUE). If the X's are not perfectly collinear then OLSQ is still BLUE but now we cannot estimate the coefficients accurately. The random errors of the estimated coefficients will be too big in comparison to the estimated coefficients.

(1) Consider the example:

$$\text{Log } X_{3t} \approx K \text{ Log } X_{2t}$$

This is comparable to the case of flow of tourist and stock of immigrant in our sample when we found a very high degree of collinearity between the logarithms of both variables. If this is the case the coefficient in (13) can not be estimated accurately.

In particular the estimates of β_2 and β_3 will have substantial standard errors.

What we can do in this case is to rewrite (13) as:

$$\text{Log } Y_t = \beta_1 + \beta'_2 \text{ Log } X_{2t} + \beta_4 \text{ Log } X_{4t} + \beta_5 \text{ Log } X_{5t} + \varepsilon_t$$

where $\beta'_2 = \beta_2 + K\beta_3$

Here we have used "a priori" judgment to retain the tourist flow as the variable Log X_{2t}, and therefore its coefficient now includes the coefficient of the left out variable (Log X_{3t}) times the coefficient k defined in (1) above.

(2) In the case of imports and exports, these two variables are too collinear, to allow the estimation of their individual coefficients accurately. Therefore it is considered necessary to return to the theoretical formulation, in order to restate the demand functions in term of total trade flows. This is so,

- because there is no strong "a priori" justification to expect that the impact of imports on flows of telecommunication should be different from the impact of exports.

Therefore if X_{4t} denotes the imports and X_{5t} the exports, the complete reformulated model is:

$$\text{Log } Y_t = \beta_1 + (\beta_2 + K\beta_3) \text{ Log } X_{2t} + \beta'_4 \text{ Log } (X_{4t} + X_{5t}) + \tilde{\varepsilon}_t$$

C.2. OUTFLOWS OF TELEPHONE SERVICES

We will commence by presenting the explicit form of the demand equation fitted to the data, and then proceed to analyse this function in detail. Following the terminology of Section B, the demand for outgoing flows of telephone services is given by:

$$\begin{aligned}\text{Log } TFOC_j(t) = {} & \beta_{11} + \beta_{12} \text{ Log } P^o_{1j}(t) + \beta_{13} \text{ Log } P^o_{2j}(t) + \beta_{14} \text{ Log } P^o_{3j}(t) \\ & + \beta_{15} \text{ Log } \overline{P}(t) + \beta_{16} \text{ Log } IMEX_j(t) + \beta_{17} \text{ Log } CTOUR_j(t) \\ & + \beta_{18} \text{ Log } I(t) + \beta_{19} \text{ Log } TD_j(t) + \beta_{110} WHC_j \\ & + \beta_{111} LC_j + \beta_{112} \text{ Log } QS_j(t) + \varepsilon_{1j}(t)\end{aligned}$$

Where:

$TFOC_j(t)$ = quantity demanded of telephone services from Canada to country j in year t, in thousands of minutes;

$P^o_{1j}(t)$ = absolute price of telephone services from Canada to country j in year t, in dollars per thousand minutes;

$P^o_{2j}(t)$ = absolute price of telegraph services from Canada to country j in year t, in dollars per thousand words;

$P^o_{3j}(t)$ = absolute price of telex services from Canada to country j in year t, in dollars per thousand minutes;

$\overline{P}(t)$ = implicit price deflator of gross domestic product at market price in Canada in year t, index 1969 = 1.0;

$IMEX_j(t)$ = total flow of trade between Canada and country j in year t, in millions of current dollars;

$CTOUR_j(t)$ = total number of Canadian tourists entering country j in year t, as measured at the frontiers, in thousands of persons;

$I(t)$ = gross domestic product at market price of Canada in year t, in millions of current dollars;

$TD_j(t)$ = telephone density in country j in year t, in telephones per one hundred inhabitants;

WHC_j = working hours commonality index between Canada and country j, index from 1 to 10;

LC_j = language commonality index between Canada and country j, index from 1 to 4;

QS_j = quality of service index between Canada and country j, index from 3 to 9;

$\varepsilon_{1j}(t)$ = random error of the regression;

$\beta_{11}, \beta_{12}, \ldots, \beta_{112}$ = unknown parameters to be estimated.

We will present first, the estimation of equation (1) for 1969, 1970 and 1971. Then the pooling of the data for the three years, and some further studies of the results will be discussed.

Before analysing the results of table 1 in some detail, let us stop to comment on one point. The variables Log $\overline{P}(t)$ and Log I(t) both of which refer to Canada are constant for a given year, and therefore their constribution to Log TFOC is mixed with the constant in equations 1.1, 1.2, 1.3, 1.5, 1.6, 1.7, 1.9, 1.10, 1.11.

In equations 1.1 to 1.3, there are some important points to note.

1. The coefficients of the trade and tourist variables are highly significant because the associated t statistic is greater than 3 in each case, and they are very stable also in these three equations.
2. Although the coefficient of the price of telephone variable has the expected negative sign implying that the telephone traffic decreases with increasing price, its t value is never above 2. The coefficient o

Table 1(a): Demand for outgoing flows of telephone services. Dependent variable

Log $TFOC_j(t)$ (explanatory variables in current dollars)

Explanatory Variables

Equation number	Constant	Log $P^o_{1j}(t)$	Log $P^o_{2j}(t)$	Log $P^o_{3j}(t)$	Log $\bar{P}(t)$	Log $IMEX_j(t)$	Log $GROUP_j(t)$	Log $I(t)$	Log $TD_j(t)$	WHC_j	LC_j	Log $OS_j(t)$	$\bar{R}^2$	F	$\hat{\sigma}_\epsilon^2$	N	Year
1.1	2.406 (.177)	-1.060 (-.783)	-2.243 (-2.804)	2.241 (1.221)	-	.337 (3.698)	.485 (4.248)	-	.433 (3.022)	.097 (1.575)	-	-	.825	25.37	.499	37	1969
1.2	12.124 (.869)	-1.894 (-1.383)	-1.480 (-1.836)	1.362 (.766)	-	.332 (3.396)	.465 (4.110)	-	.422 (2.702)	.173 (2.635)	-	-	.820	24.56	.520	37	1970
1.3	20.026 (1.483)	-1.986 (-1.604)	-1.183 (-1.553)	.417 (.243)	-	.325 (3.653)	.448 (4.131)	-	.222 (1.221)	.092 (1.292)	-	-	.831	23.51	.383	33	1971
1.4	-571.089 (-.879)	-1.666 (-2.296)	-1.635 (-3.783	1.449 (1.510)	-108.470 (-.853)	.322 (6.377)	.474 (7.813)	51.605 (.896)	.376 (4.539)	.129 (3.664)	-	-	.846	65.76	.424	107	1969 1970 1971
1.5	5.322 (.411)	-.717 (-.554)	-.615 (-.559)	.458 (.236)	-	.318 (3.661)	.491 (4.530)	-	.389 (2.825)	.042 (.661)	.227 (2.047)	-	.843	25.16	.450	37	1969
1.6	16.282 (1.231)	-1.484 (-1.142)	.258 (.237)	-.715 (-.373)	-	.332 (3.516)	.448 (4.209)	-	.363 (2.438)	.111 (1.652)	.247 (2.212)	-	.842	24.99	.459	37	1970
1.7	25.030 (1.922)	-1.654 (-1.397)	.219 (.217)	-1.451 (-.772)	-	.334 (3.957)	.421 (4.010)	-	.147 (.834)	.029 (.397)	.196 (1.979)	-	.848	23.46	.343	33	1971
1.8	-542.138 (-.890)	-1.305 (-1.899)	-.065 (-.112)	-.392 (-.383)	-103.392 (-.866)	.317 (6.691)	.464 (8.142)	49.352 (.913)	.325 (4.119)	.072 (2.000)	.220 (3.773)	-	.864	68.68	.373	107	1969 1970 1971
1.9	4.713 (.371)	-.706 (-.555)	-.297 (-.271)	.503 (.264)	-	.275 (3.053)	.525 (4.823)	-	.289 (1.907)	.036 (.578)	.198 (1.796)	-.822 (-1.455)	.849	23.49	.432	37	1969
1.10	16.987 (1.348)	-1.512 (-1.221)	.581 (.553)	-.724 (-.397)	-	.293 (3.263)	.475 (4.645)	-	.194 (1.173)	.100 (1.546)	.202 (1.858)	-1.090 (-1.967)	.856	24.92	.416	37	1970
1.11	22.904 (1.815)	-1.926 (-1.671)	.440 (.448)	-.843 (-.457)	-	.281 (3.232)	.471 (4.528)	-	.039 (.217)	.032 (.453)	.157 (1.603)	-.906 (-1.683)	.859	22.76	.319	37	1971
1.12	-17.247 (-1.592)	-1.398 (-2.135)	.249 (.444)	-.183 (-.189)	-	.269 (5.709)	.502 (9.049)	2.713 (3.243)	.199 (2.353)	.066 (1.918)	.183 (3.218)	-.968 (-3.281)	.877	76.78	.338	107	1969 1970 1971

Note: Values in brackets are the computed t- values of the coefficients

$\bar{R}^2$ = Multiple determination coefficient corrected by degrees of freedom

N = Number of observations in the regression

F = Computed F ratio

$\hat{\sigma}_\epsilon^2$ = Estimated variance of the errors

the price of telegraph variable is negative also, implying that telegraph is a gross complement of telephone instead of a gross substitute. Although the coefficient of the price of telex variable is positive as anticipated (i.e. telex services are a gross substitute of telephone services), its t-value is low.

3. The coefficients of the telephone density and working hours commonality variables have the expected sign but overall, the t-values are not too high.

4. The estimated error variances ($\hat{\sigma}^2_\varepsilon$) are very similar in these three equations and the hypothesis of equality of the random error variances across years is accepted.

5. The comments in 1. and 4. above suggest that a test for the null hypothesis of equality of the regression equations for the different years should be carried out. Using a Chow test *(1)*, the null hypothesis of equality in the regression equations through time is indeed accepted. Therefore, we can pool the data over all three years and run the regression which yields equation 1.4.

In this equation, most of the variables are highly significant with the exception of the price deflator and income variables. However, the estimated income elasticity is extremely high (52.3). On examining the data one realizes that the trouble arises due to the high collinearity between the price deflator and the income variable since each of them take only three different values in the sample and these three pairs of values lie along a straight line when one of the variables is plotted against the other[1].

---

[1] Indeed the simple correlation between these two variables is .997.

In equations 1.5, 1.6, 1.7, 1.8, LC has been added as a regressor. The coefficient of language commonality in these regressions has the expected sign, but the coefficients of the price variables are very unstable in comparison with corresponding results from equations 1.1 to 1.4

In equations 1.9 to 1.12 the quality of service variables has been added as one of the regressors and although its coefficient has the right sign the latter is significant only in the last regression.

From this set of equations 1.12 is the most acceptable approximation as the demand equation because it is the best in terms of t-values and $\bar{R}^2$. The only problem is the behavior of the coefficients of the price variables and the high collinearity between the price and the income variables. To eliminate the last problem, we will restrict our demand equation (3) of section B.2.1.b. further by imposing the constraint that it should be homogeneous of degree zero in the money variables P_1^o, P_2^o, P_3^o, $\bar{P}$, IMEX and I. With this added restriction the demand equation can be written as:

$$\text{Log TFOC}_j(t) = \beta_{11}+\beta_{12}\ \text{Log}\frac{P^o_{1j}(t)}{\bar{P}(t)} + \beta_{13}\ \text{Log}\frac{P^o_{2j}(t)}{\bar{P}(t)} + \beta_{14}\ \text{Log}\frac{P^o_{3j}(t)}{\bar{P}(t)}$$

$$+\beta_{16}\ \text{Log}\frac{\text{IMEX}_j(t)}{\bar{P}(t)} + \beta_{17}\ \text{Log CTOUR}_j(t)$$

$$+\beta_{18}\ \text{Log}\frac{I(t)}{\bar{P}(t)} + \beta_{19}\ \text{Log TD}_j(t) + \beta_{110}\ \text{WHC}_j$$

$$+\beta_{111}\ \text{LC}_j + \beta_{112}\ \text{Log QS}_j(t) + \varepsilon_{1j}(t)$$

Now equations 1.9 to 1.12 are re-estimated subject to the above constraints. The results appear in equations 1.13 to 1.15 respectively of Table 1(b). When comparing corresponding pairs of the above equations the only coefficient that changes is the constant which is now an estimator of $\beta_{11}+\beta_{18}\ \text{Log}\frac{I(t)}{\bar{P}(t)}$ instead of $\beta_{11}+\beta_{15}\ \text{Log}\ \bar{P}(t)$ $+\beta_{18}\ \text{Log}\ I(t)$ as in the previous regressions. The deflated equation corresponding to 1.12 appears under 1.16 in table 1(b) where the coefficient of the income variable although still somewhat high, is much lower in the latter equation than in the former one. We

Table 1(b): Demand for outgoing flows of telephone services

Dependent variable Log $TFOC_j(t)$ (explanatory variables deflated)

Explanatory Variables

Equation Number	Constant	Log $\frac{P_{1j}^{\circ}(t)}{\bar{P}(t)}$	Log $\frac{P_{2j}^{\circ}(t)}{\bar{P}(t)}$	Log $\frac{P_{3j}^{\circ}(t)}{\bar{P}(t)}$	Log $\frac{IMEX_j(t)}{\bar{P}(t)}$	Log $CTOUR_j(t)$	Log $\frac{I(t)}{\bar{P}(t)}$	Log $TD_j(t)$	WHC_j	LC_j	Log $QS_j(t)$	$\bar{R}^2$	F	$\hat{\sigma}_\varepsilon^2$	N	Year
1.13	4.713 (.371)	-.706 (-.555	-.297 (-.271)	.503 (.264)	.275 (3.053)	.525 (4.823)	---	.289 (1.907)	.036 (.578)	.198 (1.796)	-.822 (-1.455)	.849	23.49	.432	37	1969
1.14	16.936 (1.350)	-1.512 -1.222	.581 (.553)	-.724 (-.397)	.293 (3.263)	.475 (4.644)	---	.194 (1.173)	.100 (1.546)	.202 (1.858)	-1.090 (-1.967)	.856	24.92	.416	37	1970
1.15	22.757 (1.819)	-1.926 (-1.671)	.440 (.448)	-.843 (-.457)	.281 (3.232)	.471 (4.527)	---	.039 (.218)	.032 (.453)	.157 (1.603)	-.906 (-1.683)	.859	22.77	.319	33	1971
1.16	-31.986 (-1.620)	-1.391 (-2.127)	.252 (.450)	-.168 (-.173)	.269 (5.714)	.503 (9.077)	4.004 (2.664)	.200 (2.366)	.066 (1.932)	.183 (3.220)	-.970 (-3.291)	.877	76.91	.337	107	1969 1970 1971

should still be cautious in interpreting this coefficient because the real income variable does not vary a great deal over the three year period under study and therefore it is fairly collinear with the constant of the regression. This is related to the comments of section A where it was pointed out that the only way to get meaningful income elasticities was to work with longer time series.

In the following discussions, equation (1.16) will be taken as the best approximation to the demand equation for outgoing telephone services.

Let us now summarize the main characteristics of the results, with special reference to equation 1.16

1. Excluding the constant term, the price of telegraph and the price of telex variables, the coefficients of equation 1.16, are significantly different from zero at a 5% level with the exception of the coefficient of WHC which is significant at a 6% level.

2. For the price variables, only the own price elasticity is significantly different from zero. The coefficients of the other two prices have a sign different from the expected one. most of the time,

a result that is also found in a corresponding study for telecommunications flows into and out of the United States (lumped together) made by A. Lago *(3)* . The own price elasticity is -1.391 but not statistically different from -1. The point estimate of this elasticity indicates that a cut in the international price of telephone services would increase revenues from these services.

3. The pattern of signs for the coefficients of the other two price variables in equation 1.16, i.e. positive for the coefficient of the price of telegraph variable and negative for that of the price of telex variable, has been reported also by G. Yatrakis *(6)*, using a substantially different model, in a study in which the basic observations were total flows between two points.

4. The trade and tourist variables (and the variables collinear with them) are the two most important variables explaining the international demand for outgoing telephone services .

5. The inclusion of quality variables (Log QS and Log TD) improves the results in terms of $\bar{R}^2$ and makes the coefficient of the price of telephone variable more significant.

C.3. INFLOWS OF TELEPHONE SERVICES

Before presenting the results that were obtained for this type of equation we will make a few comments on the information available.

The direct information on prices for the different incoming telecommunications flows was unavailable, and therefore, we were forced to build this price data using either raw data obtained from the different countries or the corresponding Canadian prices where the former data was unavailable, as described in Appendix I. The difficulty here was that in the former case this raw data was given in terms of domestic currencies of the corresponding countries and therefore to make them compatible with our model it was necessary to convert them to a uniform currency. This was a major problem, because from the international statistics available, usually it is not possible to deduce the effective foreign exchange rate applicable to the flow of communications, while the situation is further complicated due to the use of gold francs in international payments of this nature. An additional problem was that to get the price paid by customers, data on the internal taxes to the price of telecommunication services was also required, and such information was not always available. The above discussion applies also to the prices of the other services.

The second point that should be made is that the national income data for 1971 was available only for a small subset of countries (mainly O.E.C.D. member countries) and therefore the sample for 1971 was greatly reduced by this constraint. For countries where the 1971 income was unavailable it was decided to extrapolate the income for 1971 using the 1970 figure and the appropriate average rate of growth of the previous ten years (see Appendix I). This procedure was followed because for incoming calls, due to the lack of data, we had already forced the same demand function to apply to all the different countries. Given these circumstances most of the variability in the income variable would arise from cross-country comparison, and therefore it was considered adequate to work with an estimate of the income in 1971 for the different countries involved. To implement the above approximation, the rate of growth of total income for the previous ten years was assumed to be the growth rate for 1970-71.

Following the terminology of Section B, the demand for incoming flows of telephone services is given by:

$$\begin{aligned}\text{Log } TFIC_j(t) = {} & \beta_{21} + \beta_{22} \text{ Log } P^I_{1j}(t) + \beta_{23} \text{ Log } P^I_{2j}(t) \\ & + \beta_{24} \text{ Log } P^I_{3j}(t) + \beta_{25} \text{ Log } IMEX_j(t) \\ & + \beta_{26} \text{ Log } FTOUR_j(t) + \beta_{27} \text{ Log } I_j(t) \\ & + \beta_{28} \text{ Log } TD_j(t) + \beta_{29} WHC_j(t) + \beta_{210} LC_j \\ & + \beta_{211} \text{ Log } QS_j(t) + \varepsilon_{2j}(t)\end{aligned}$$

Where the new variables are:

$TFIC_j(t)$= quantity demanded of telephone services from country j to Canada in year t, in thousands of minutes;

$P^I_{1j}(t)$ = absolute price of telephone services from country j to Canada in year t, in dollars per thousand minutes;

$P^I_{2j}(t)$ = absolute price of telegraph services from country j to Canada in year t, in dollars per thousand words;

$P^I_{3j}(t)$ = absolute price of telex services from country j to Canada in year t, in dollars per thousand minutes;

$FTOUR_j(t)$ = total number of foreign tourist entering Canada in year t, as measured at the frontiers, in thousand of persons;

$\varepsilon_{2j}(t)$ = random error of the regression for country j in year t;

$\beta_{21}, \ldots \beta_{212}$ = parameters to be estimated.

When this last equation was estimated, the results were found to be very unreliable. This was due firstly to the strong assumption of the same demand equations across countries that was made, and also to the strong collinearity in the sample between Log FTOUR, Log I and Log LMEX.[1] The results obtained appear in table 2.

---

[1] The sample correlation coefficient between any pair of these variables was always higher than .70

The equations 2.1 to 2.3 of table 2(a) give very poor results. The own price elasticity is always positive and the price elasticities of telegraph and telex have a negative sign contrary to 'a priori' expectations. Although the quality variables have the expected signs, the absolute values of their t-values are always below two. Another discouraging feature of these results is the low and insignificant coefficient for the income variable. However, this effect is due in part to the high collinearity between the income and the trade variables.

As stated at the beginning, in addition to the general problem of the quality of the price data, we have in the case of incoming flows the problem of intrinsic heterogeneity in the demand relations which has been effectively ignored (e.g. we are assuming that the price, income etc. response of the respective telecommunication services is the same for flows from Singapore to Canada, as it is for flows from France to Canada, etc.).

To allow for more homogeneity in the demand functions for incoming flows of telecommunications, we return to the basic demand equations of section B and express these in terms of per capita variables for each of the foreign countries. The results obtained after implementing the above procedure

appear in table 2(b).

In this table we have the same pattern of signs for the coefficients of the price variables as in table 2(a). Once again the income variable is not an important factor in the demand equation. This can be due in part to the fact that large differences in income distribution across countries render the comparison of dollars of income per head not very meaningful. This is not the case with international trade (from which the importance of the trade variable arises), where there is an effective "telecommunications content" of imports and exports.

Clearly, the correction for "size" of the country as described above has improved the results quite substantially. Although $\bar{R}^2$'s of tables 2(a) and 2(b) are not directly comparable because the dependent variable is different. the F test yields a much better result in the latter case. Due to the collinearity between the trade and the tourist flow variables mentioned earlier, it is a little difficult to identify the separate contributions of each of these variables, while the situation is worsened by the presence of other regressors which also add to the effects of this collinearity. This is clear when we compare equations 2.4 and 2.6 where the only difference is the exclusion of the tourist flow variable in the second equation. In the latter case the only significant coefficient that is substantially affected is the coefficient of the trade variable which now includes the contribution of the omitted tourist flow variable as well.

Table 2(a): Demand for incoming flow of telephone services

Dependent variable Log $TFIC_j(t)$

Explanatory Variables

Equation number	Constant	Log $P^I_{1j}(t)$	Log $P^I_{2j}(t)$	Log $P^I_{3j}(t)$	Log $TMEX_j(t)$	Log $FTOUR_j(t)$	Log $I_j(t)$	Log $TD_j(t)$	WHC_j	LC_j	Log QS_j	$\bar{R}^2$	F	$\hat{\sigma}^2_\epsilon$	N	Year
2.1	4.666 (.414)	.827 (.740)	-1.455 (-1.247)	-.643 (-.460)	.370 (1.509)	.256 (1.743)	.176 (.794)	.498 (2.502)	.155 (1.890)	.290 (1.748)	-.894 (-1.039)	.610	15.56	1.575	94	1969 1970 1971
2.2	8.501 (.769)	1.023 (.915)	-1.801 (-1.556)	-1.103 (-.797)	.649 (5.852)	-	-	.588 (3.040)	.135 (1.784)	.242 (1.661)	-.204 (-.319)	.604	18.73	1.600	94	1969 1970 1971
2.3	7.356 (.651)	.967 (.858)	-1.720 (-1.469)	-1.004 (-.716)	.540 (2.375)	-	.122 (.549)	.570 (2.896)	.153 (1.848)	.287 (1.710)	-.500 (-.596)	.600	16.55	1.613	94	1969 1970 1971

Table 2(b): Demand for incoming flow of telephone services

Dependent variable Log $\frac{TFIC_j(t)}{POP_j(t)}$

Explanatory variables

Equation number	Constant	Log $P^I_{1j}(t)$	Log $P^I_{2j}(t)$	Log $P^I_{3j}(t)$	Log $\frac{IMEX(t)}{POP_j(t)}$	Log $\frac{FTOUR(t)}{POP_j(t)}$	Log $\frac{I_j(t)}{POP_j(t)}$	Log $TD_j(t)$	WHC_j	LC_j	Log QS_j	$\bar{R}^2$	F	$\hat{\sigma}^2_\epsilon$	N	Year
2.4	12.054 (1.303)	.580 (.642)	-.871 (-.939)	-1.490 (-1.303)	.339 (1.575)	.427 (4.280)	.021 (.070)	.376 (1.300)	.165 (2.258)	.260 (1.957)	-1.322 (-1.905)	.830	45.06	1.021	91	1969 1970 1971
2.5	11.619 (1.203	.883 (.902)	-.888 (-.891)	-2.003 (-1.628)	.754 (3.697)	-	-	.445 (1.883)	.201 (2.542)	.323 (2.375)	-.649 (-.925)	.796	45.06	1.225	91	1969 1970 1971
2.6	11.765 (1.155)	.889 (.895)	-.897 (-.878)	-2.013 (-1.606)	.757 (3.576)	-	-.016 (-.048)	.456 (1.434)	.202 (2.526)	.321 (2.204)	-.638 (-.857)	.794	39.57	1.240	91	1969 1970 1971

C.4. OUTFLOWS OF TELEGRAPH SERVICES

The general form of the demand for outgoing flows of telegraph services is given by:

$$\text{Log } TGOC_j(t) = \beta_{31} + \beta_{32} \text{ Log } P^o_{1j}(t) + \beta_{33} \text{ Log } P^o_{2j}(t)$$

$$+\beta_{34} \text{ Log } P^o_{3j}(t) + \beta_{35} \text{ Log } \bar{P}(t) + \beta_{36} \text{ Log } IMEX_j(t)$$

$$+\beta_{37} \text{ Log } CTOUR_j(t) + \beta_{38} \text{ Log } I(t) + \varepsilon_{3j}(t)$$

As before, the above function is assumed to be homogeneous of degree zero in P^o_1, P^o_2, P^o_3, $\bar{P}$, IMEX and I. With this additional restriction the equation can be rewritten as:

$$\text{Log } TGOC_j(t) = \beta_{31} + \beta_{32} \text{ Log } \frac{P^o_{1j}(t)}{\bar{P}(t)} + \beta_{33} \text{ Log } \frac{P^o_{2j}(t)}{\bar{P}(t)} + \beta_{34} \text{ Log } \frac{P^o_{3j}(t)}{\bar{P}(t)}$$

$$+\beta_{36} \text{ Log } \frac{IMEX_j(t)}{\bar{P}(t)} + \beta_{37} \text{ Log } CTOUR_j(t) + \beta_{38} \text{ Log } \frac{I(t)}{\bar{P}(t)}$$

$$+\varepsilon_{3j}(t)$$

The results that were obtained when this equation was estimated appear in table 3 .

Here again, the variables flow of trade and flow of tourists have a substantial explanatory power, and furthermore the coefficients are very stable from regression to regression. It is important to note that in this set of equations, the real income variable is not significant, according to the standard t-test. This can be due to two factors, the first of which is the small variability in Log $\frac{I(t)}{\overline{P}(t)}$ that was already commented upon in the last section. The second point is related to the possibility that a service like telegraph could be demanded mainly by business and in that case the quantity demanded would be very closely related to Log $\frac{IMEX}{\overline{P}}$. The other important point to note is that the coefficients of the price variables are now highly significant for the price of telegraph and the price of telex. The coefficient of the telephone price does not have the expected sign, but it is not significant.

In equation (3.5.) the real income variable is left out and, as expected, there are only marginal changes in the values of the coefficients of all the other explanatory variables.

Table 3: Demand for outgoing flow of telegraph services

Dependent variable Log $TGOC_j(t)$ (explanatory variables deflated)

Explanatory Variables

Equation number	Constant	Log $\frac{P^{o}_{1j}(t)}{P(t)}$	Log $\frac{P^{o}_{2j}(t)}{\bar{P}(t)}$	Log $\frac{P^{o}_{3j}(t)}{\bar{P}(t)}$	Log $\frac{IMEX_j(t)}{\bar{P}(t)}$	Log $CTOUR_j(t)$	Log $\frac{I(t)}{\bar{P}(t)}$	$\bar{R}^2$	F	$\hat{\sigma}^2_\varepsilon$	N	Year
3.1	-4.194 (-.781)	-.266 (-.311)	-1.745 (-3.482)	2.341 (2.690)	.512 (9.085)	.224 (3.207)	-	.855	43.65	.203	37	1969
3.2	-.232 (-.040)	-.893 (-.965)	-1.991 (-3.619)	2.656 (2.708)	.449 (6.791)	.279 (3.662)	-	.817	33.24	.251	37	1970
3.3	-4.340 (-.663)	-.623 (-.623)	-1.581 (-2.932)	2.811 (2.628)	.470 (6.654)	.267 (3.280)	-	.814	29.09	.266	33	1971
3.4	-7.299 (-.504)	-.627 (-1.234)	-1.846 (-6.050)	2.596 (4.889)	.476 (13.564)	.257 (6.196)	.407 (.345)	.843	96.23	.216	107	1969 1970 1971
3.5	-2.419 (-.778)	-.637 (-1.261)	-1.850 (-6.098)	2.575 (4.902)	.476 (13.661)	.256 (6.219)	-	.844	116.47	.215	107	1969 1970 1971

C.5. INFLOWS OF TELEGRAPH SERVICES

In tables 4(a) and 4(b) we present the results for incoming flows of telegraph traffic, whereas in section C.2. the second set of equations apply to the demand model in which per capita values of the relevant variables are used to compensate for the size effect in foreign countries. In these two sets of equations as expected "a priori", the price of telegraph variable has a negative sign always. Furthermore, as in the equation for outflows of telegraph traffic, the trade variable is the most important contributor to the demand for this kind of service. The income variable in this regression not only has a sign contrary to "a priori" expectations, but also its associated t-value is greater than two in absolute value. In going from table 4(a) to table 4(b), the results of the latter set of equation are better in terms of $\overline{R}^2$, although once again the coefficient of income has a sign contrary to the expected one. The important point to note in both tables is the sign and t-statistic of the price of telegraph variable. In all the cases, this variable has the anticipated sign and furthermore in most of the equations its associated t-statistic is greater than two in absolute value.

Table 4(a): Demand for Incoming Flow of Telegraph Services

Dependent Variable Log $TGIC_j(t)$

Explanatory Variable

Equation number	Constant	Log $P^I_{1j}(t)$	Log $P^I_{2j}(t)$	Log $P^I_{2j}(t)$	Log $IMEX_j(t)$	Log $FTOUR_j(t)$	Log $I_j(t)$	$\bar{R}^2$	F	$\hat{\sigma}^2_\epsilon$	N	Year
4.1	.117 (.021)	1.121 (1.497)	-1.311 (-2.424)	.191 (.235)	.877 (6.833)	.123 (1.202)	-.201 (-2.263)	.558	20.63	.832	94	1969 1970 1971
4.2	2.326 (.416)	.603 (.827)	-1.751 (-3.391)	.589 (.725)	.633 (7.048)	.120 (1.150)	-	.538	22.67	.871	94	1969 1970 1971
4.3	4.193 (.783)	.652 (.894)	-1.862 (-3.664)	.376 (.475)	.789 (9.077)	-	-	.536	27.90	.874	94	1969 1970 1971

Table 4 (b): Demand for Incoming Flow of Telegraph Services

Dependent variable Log $\frac{TGIC_j(t)}{POP_j(t)}$

Explanatory Variables

Equation number	Constant	Log $P^I_{1j}(t)$	Log $P^I_{2j}(t)$	Log $P^I_{3j}(t)$	Log $\frac{IMEX_j(t)}{POP_j(t)}$	Log $\frac{TOUR_j(t)}{POP_j(t)}$	Log $\frac{I_j(t)}{POP_j(t)}$	$\bar{R}^2$	F	δ^2_ϵ	N·	Year
4.4	4.315 .544	.701 (.862)	-.752 (-1.301)	-.166 (-.174)	.875 (7.286)	.304 (3.457)	-.420 (-2.414)	.749	45.97	.881	91	1969 1970 1971
4.5	-5.646 (-.811)	.773 (.926)	-1.276 (-2.317)	1.001 (1.183)	.775 (6.688)	.313 (3.465)	-	.735	51.10	.931	91	1969 1970 1971
4.6	-4.019 (-.545)	1.038 (1.174)	-1.575 (-2.727)	.638 (.716)	1.044 (11.437)	-	-	.701	53.96	1.050	91	1969 1970 1971

C.6. OUTFLOWS OF TELEX SERVICES

The general form of the demand for outgoing flows of telex services is given by:

$$\text{Log } TXOC_j(t) = \beta_{51} + \beta_{52} \text{ Log } P^o_{1j}(t) + \beta_{53} \text{ Log } P^o_{2j}(t)$$

$$+ \beta_{54} \text{ Log } P^o_{3j}(t) + \beta_{55} \text{ Log } \overline{P}(t) + \beta_{56} \text{ Log } IMEX_j(t)$$

$$+ \beta_{57} \text{ Log } CTOUR_j(t) + \beta_{58} \text{ Log } I(t) + \varepsilon_{5j}(t)$$

In this equation we have included Log CTOUR in order to test how "robust" our specification is. It can be anticipated "a priori" that the estimate of β_{57} should not be statistically different from zero.

If the above equation is restricted to be homogeneous of degree zero in P^o_1, P^o_2, P^o_3, $\overline{P}$, IMEX and I, we obtain:

$$\text{Log } TXOC_j(t) = \beta_{51} + \beta_{52} \text{ Log } \frac{P^o_{1j}(t)}{\overline{P}(t)} + \beta_{53} \text{ Log } \frac{P^o_{2j}(t)}{\overline{P}(t)} + \beta_{54} \text{ Log } \frac{P^o_{3j}(t)}{\overline{P}(t)}$$

$$+ \beta_{56} \text{ Log } \frac{IMEX_j(t)}{\overline{P}(t)} + \beta_{57} \text{ Log } CTOUR_j(t) + \beta_{58} \frac{I(t)}{\overline{P}(t)} + \varepsilon_{5j}(t)$$

One of the most interesting features of Table 5 is the stable character of the coefficient of Log $\frac{IMEX}{\overline{P}}$. This is expected

Table 5: Demand for outgoing flow of telex services

Dependent variable Log $TXOC_j(t)$

Explanatory Variables

Equation number	Constant	Log $\frac{P^o_{1j}(t)}{\bar{P}(t)}$	Log $\frac{P^o_{2j}(t)}{\bar{P}(t)}$	Log $\frac{P^o_{3j}(t)}{\bar{P}(t)}$	Log $\frac{IMEX_j(t)}{\bar{P}(t)}$	Log $\frac{I(t)}{\bar{P}(t)}$	$\bar{R}^2$	F	$\hat{\sigma}^2_\varepsilon$	N	Year
5.1	28.330 (3.571)	-.256 (-.170)	1.129 (1.313)	-4.176 (-2.923)	.843 (9.426)	-	.801	37.38	.628	37	1969
5.2	38.041 (6.105)	-.723 (-.606)	.732 (1.044)	-4.666 (-3.976)	.855 (11.456)	-	.854	53.67	.418	37	1970
5.3	30.024 (4.662)	-.110 (-.099)	.864 (1.234)	-4.377 (-3.903)	.916 (12.199)	-	.889	65.08	.332	33	1971
5.4	10.850 (1.542)	-.412 (-.574)	.915 (2.150)	-4.393 (-6.264)	.865 (19.566)	1.906 (1.147)	.857	128.88	.433	107	1969 1970 1971
5.5	33.407 (18.788)	-.461 (-.642)	.901 (2.115)	-4.459 (-6.370)	.866 (19.548)	-	.857	160.28	.435	107	1969 1970 1971

because telex is mostly used by business and therefore its demand is more business oriented. Another business related variable, the investment of Canada in country j in year t should be included also as one of the regressors ($CINV_j(t)$). Unfortunately this information was available on a non-confidential basis for a very small group of countries only. Hence, it was not possible to use this variable in the estimations. However, it is reasonable to expect a high collinearity between Log $\frac{IMEX}{\overline{P}}$ and Log $\frac{CINV}{\overline{P}}$, and therefore the coefficient of the former variable should include most of the contribution from the latter, to the international demand for outgoing telex services.

The results of table 5 also show a very high (negative) own price elasticity for telex services. This results is substially higher than values reported in previous studies *(3), (6)*. The implication of this high elasticity is that there is room for a substantial increase in the revenue of the telex industry through the reduction of prices. Judging by the sign of the coefficient of Log $\frac{P_2^O}{\overline{P}}$, telegraph is a gross substitute of telex, as expected "a priori". The coefficient of telephone price has a sign different from the expected one, but it is not significant.

The coefficient of income is not significant also, confirming the earlier hypothesis that telex services are demanded mainly by businesses involved in international trade.

As expected the coefficient of Log CTOUR is not significant Hence, the final equation used here is equation 5.5.

C.7. INFLOWS OF TELEX SERVICES

In tables 6(a) and 6(b) we present the results for inflows of telex services, where as in sections C.2 and C.4, the latter table refers to the case where appropriate per capita variables have been used. As expected, the flow of tourists was not significant in the regression, a result which was also indicated in section C.5. for outgoing flows. An important point here is the high value and highly significant t-statistic of the own price elasticity of the demand for telex. This result indicates that major increases in revenue for the telex industry can be obtained through price cutting. The above conclusion was also reached in the case of outgoing telex services (see section C.5.).

Another noteworthy feature is that the price of telegraph variable has the "a priori" expected positive sign indicating that telegraph is a substitute for telex. The flow of trade variable is quite significant and it has a coefficient comparable to the one that was obtained for outflows of telex services. Finally, as before the income variable is not significant (see relevant comments is section C.2.).

Table 6(a): Demand for Incoming Flow of Telex Services
Dependent Variable Log $TXIC_j(t)$

Explanatory Variables

Equation number	Constant	Log $P^I_{1j}(t)$	Log $P^I_{2j}(t)$	Log $P^I_{3j}(t)$	Log $IMEX_j(t)$	Log $I_j(t)$	$\bar{R}^2$	F	$\hat{\sigma}^2_\epsilon$	N	Year
6.1	41.518 (8.632)	-2.191 (-3.233)	.997 (2.068)	-3.972 (-5.532)	.573 (5.744)	.307 (3.822)	.777	65.95	.682	94	1969 1970 1971
6.2	38.204 (7.521)	-1.398 (-2.018)	1.667 (3.455)	-4.588 (-6.106)	.856 (11.890)	-	.743	68.33	.786	94	1969 1970 1971

Table 6(b): Demand for incoming flow of telex services

Dependent Variable $\frac{TXIC_j(t)}{POP_j(t)}$

Explanatory Variables

Equation number	Constant	Log $P^I_{1j}(t)$	Log $P^I_{2j}(t)$	Log $P^I_{3j}(t)$	Log $\frac{IMEX_j(t)}{POP_j(t)}$	Log $\frac{I_j(t)}{POP_j(t)}$	$\bar{R}^2$	F	$\hat{\sigma}^2_\epsilon$	N	Year
6.3	12.815 (2.356)	-.808 (-1.450	.207 (.525)	-1.721 (-2.641)	.716 (11.307)	.757 (6.329)	.873	125.59	.417	91	1969 1970 1971
6.4	30.684 (5.472)	-.951 (-1.417)	1.167 (2.658)	-3.808 (-5.615)	.883 (12.718	-	.816	101.07	.606	91	1969 1970 1971

C.8. POTENTIAL AREAS FOR EXTENSION OF THE STUDY

We can separate into three main categories the areas in which additional and/or more accurate information can increase the reliability of the present results.

1) Better price data for telecommunication services.

Since the price elasticities of telecommunications services are crucial parameters for policy decisions, it is very important to obtain a more accurate estimate of these values. The same type of information will improve the accuracy of the estimates of cross elasticities between the various telecommunications modes.

2) Breakdown of traffic flow between Business and Households.

As explained at lenght in section B, for each telecommunications mode, e.g. telephone, the specification for demand will vary in accordance with the type of user (business and households). In the present study both categories of user have been treated together, which may have introduced into the estimations some errors of aggregation whose consequences could not be determined. Therefore additional information would be helpful here, since it would allow us to estimate a better aggregate demand for telecommunications services.

3) Better quality of service data.

A more accurate measurement of the quality of service is helpful from two points of view. Firstly, it allows a better estimation of the demand equation, because by introducing

a quality variable it is possible to compensate for some types of heterogeneity in the flow of traffic data. Secondly, the quality of service (like price) is an important policy variable, and therefore it is vital to measure accurately its impact on the flow of telecommunications.

4) Longer time series.

For evaluation of investment plans, it is of fundamental importance to be able to project future traffic flows. In the long run the most important variables explaining the volume of traffic are the so called "level of activity variables", among which the level of income is an important one. However, the only way to estimate long term income elasticities more accurately is by having longer time series, at least for those countries having the highest telecommunication flows (England, France, W. Germany etc.).

REFERENCES

(1) See references (1) and (2) of Part B.

(2) JOHNSTON, J., Econometric Methods, second ed. (Mc Graw-Hill, New York, 1972), chap. 5.

(3) LAGO, A.M. "Demand forecasting models of international telecommunications and their policy implications", Journal of Industrial Economics, Vol. 19 (1970), pp. 6-21.

(4) MALINVAUD, E., Statistical Methods of Econometrics, second edition, (North Holland, Amsterdam, 1970).

(5) THEIL, H., Principles of Econometrics, (Wiley & Sons, New York, 1971).

(6) YATRAKIS, P.G., "Determinants of the demand for international telecommunications", Telecommunications Journal, Vol. 39 (1972), pp. 732-745.

A P P E N D I X I

DATA BASE

I.1. GENERAL INFORMATION

The different sources consulted and the methods employed for gathering the raw data used in the present study are described in this section. In general, information relating directly to Canada was obtained from the DOC or from Statistics Canada publications (with the important exception of CTOUR - the Canadian Tourist Flow to other countries), while data for foreign countries were obtained from various other sources including several United Nations publications, and in some cases directly through the agencies of the foreign governments themselves.

I.2. LIST OF COUNTRIES

Information on the telecommunication flows between Canada and 186 foreign countries was provided originally by the DOC for the years 1969/70, 1970/71 and 1971/72 (see sections I.3.1(a) - (c)), but in some cases this data was not complete. Hence, from the above list, a group of 67 countries was identified for each of which complete information on the flows of telephone, telegraph and telex traffic into and out of Canada was available. The final sample of 40 countries on which this investigation is based, was arrived at on the basis of a combination of the following criteria:

(i) annual flows either way of (a) telephone traffic should exceed 10,000 minutes, or (b) telegraph traffic should exceed 30,000 words, or (c) telex traffic should exceed 5,000 minutes;

(ii) relative availability of other data, particularly with regard to information on tourist flows for which the breakdown in terms of countries was not very extensive (see section I.3.2.(a), (b);

(iii) importance of traditional links between Canada and certain nations, e.g. Commonwealth countries, France, etc.

The subset of 40 countries for which the data base was constructed for the years 1969, 1970 and 1971 is listed below. Most of the data required during the investigation was available for the first two years, but the complete sets of figures for 1971 could be obtained for a smaller number of countries only, as discussed in more detail in section I.3.

1. Argentina
2. Australia
3. Austria
4. Barbados
5. Belgium
6. Bermuda
7. Brazil
8. Chechoslovakia
9. Denmark
10. Egypt
11. Finland
12. France
13. Germany, East
14. Germany, West
15. Greece
16. Hong Kong
17. Hungary
18. Iceland
19. India
20. Ireland
21. Israel
22. Italy
23. Jamaica
24. Japan
25. Morocco
26. Netherlands
27. New Zealand
28. Norway
29. Pakistan
30. Poland
31. Portugal
32. Roumania
33. South Africa
34. Spain
35. Sweden
36. Switzerland
37. Trinidad
38. United Kingdom
39. U.S.S.R.
40. Yugoslavia

I.3. VARIABLES AND DATA SOURCES

The data sources for all the dependent and independent variables considered in the econometric estimations are given below, where information concerning variables in the former category are listed first while the rest follow in alphabetical order. In each case the abbreviated version of the variable name used in the econometric equations is given in parentheses, and it is to be understood that each item of information is broken down in terms of country and year. Furthermore, the particular issues of periodical publications referred to in the text are those which contain information for the period of time covered by the investigation. Unless otherwise specified, the time period over which the flow quantities are measured is the calendar year, while the values for stock variables represent the mid-year figure.

I.3.1. Dependent Variables

I.3.1.a. Telephone Traffic Flows out of (TFOC), and into (TFIC) Canada

Each of these two flows were provided by the DOC, in terms of both numbers of calls and total minutes, for all the countries in the sample, for the years 1969/70, 1970/71 and 1971/72, where the time periods spanned extended from April 1st of the first year up to March 31st of the next.

I.3.1.b. Telegraph Traffic Flows out of (TGOC), and into (TGIC) Canada

The above two flows were also provided by the DOC, in

terms of messages and total words to all the countries over the same three time periods as for telephone traffic.

I.3.1.c. Telex Traffic Flows out of (TXOC), and into (TXIC) Canada

These flows were obtained from the DOC in terms of the numbers of calls as well as of minutes, to all the countries and over the same time periods as for telephone and telegraph traffic.

In a few cases (e.g. Sweden, Norway, etc), independent figures comparable to the values in categories a, b, and c above were included as supplementary information by the telecommunication authorities of the other countries, in their letters of reply to our request for detailed price data (see category i.below).

I.3.2. Independent Variables

I.3.2.a. Canadian Tourist Flows to Foreign Countries (CTOUR)

This data was obtained from references *(1)*, *(2)*, *(6)*, *(7)*, *(8)*, and from information requested directly through the Office of Tourism, Ottawa, and Canadian embassies in the relevant countries. Since a number of inconsistencies were discovered in the data from the various sources, arising chiefly from the widely differing measures (e.g. tourists crossing frontier, tourists registered at hotels, total hotel-nights, etc.) used by the different agencies, particular care was exercised to create a consistent and homogeneous set of data for this variable. The final measure chosen was the number of Canadian tourists crossing the frontiers of each foreign contry. In some cases only the number of tourists registered at hotels was available for 1971. However, for each of these countries k, it was noticed that the

ratio $\alpha_k = \frac{\text{no. of Canadian tourists crossing frontier of country k}}{\text{no. of Canadian tourists at hotels in country k}}$ was approximately the same for 1969 and 1970. Hence the Canadian tourist flow for 1971 was reconstructed assuming the relationship $CTOUR_k = \alpha_k$. (no of Canadian tourists at hotels in country k, in 1971).

I.3.2.b. Foreign Tourist Flows to Canada (FTOUR)

Information relating to this variable was obtained from references *(2)*, *(6)*, *(7)*, *(8)* and also from the Office of Tourism, Ottawa. Unlike in the case of CTOUR, no difficulties were encountered regarding the homogeneity of data for FTOUR, since the latter flows were measured in a consistent manner by Canadian agencies, in terms of foreign nationals arriving at the frontier.

I.3.2.c. Income (Per Capita - IPC; Total - I)

Both the per capita income and the gross national income at constant market prices in US dollars were available for 1970 from reference *(9)*. By using the corresponding growth rates for the appropriate year obtained from references *(10)* to *(12)*, the cross sectional data for the variables IPC and I were derived for the year 1969, and wherever possible for 1971 also. In the latter year, for countries where no appropriate figures were available, the total income was computed by assuming that the 1970-71 growth rate for GNP was equal to the corresponding average value over the previous ten years (i.e. 1960-1970), obtained from reference *(9)*. For the above countries, the per capita income for 1971 was derived from the formula

$IPC_{1971} = \frac{I_{1971}}{POP_{1971}}$ (see I.3.2.g. below)

I.3.2.d. Immigrants to Canada (Stock - IMMG; Flow over last n years - SIMn)

The stock of immigrants in Canada by country of birth up to mid-1961 was obtained from the 1961 Canadian Census in

reference *(1)*. IMMG for the years 1969, 1970 and 1971 were computed by adding to the 1961 census values, the annual flows of immigrants from mid-1961 up to the middle of the appropriate final year, as given in reference *(13)* (for the first and last years the semi-annual flow was used). The immigrant flow over the last n years was obtained by summing the annual flows over the preceding n years, as described above. In these computations for immigrant stock and flow, no discounting was done for deaths or re-emigration due to lack of accurate data.

I.3.2.e. Imports (IMP) and Exports (EXP); (also IMEX = IMP + EXP)

The dollar volume of Canadian imports and exports to each of the foreign countries of interest for the relevant years was available from references *(1)*, *(3)* and *(4)*.

I.3.2.f. Language Commonality Index (LC_j)

This index which varied from 0 to 4 was built up using the equation

where $LC_j = 2F_j + 4E_j$,

LC_j is the Language Commonality Index between Canada and country j,

F_j is the French speaking fraction of the population of country j,

E_j is the English speaking fraction of the population of country j, and

the weighting factors 2 and 4 represent the ratio of Francophones and Anglophones in Canada.

In the case of former British colonies such as India, a value $E_j = 0.5$ was assumed, based on the argument that the portion of

the population likely to use telecommunications services to Canada would be reasonably proficient in English. Clearly, for a given country LC would not change over the time period considered in this study.

I.3.2.g. Population (POP)

Population figures for 1969 and 1970 were obtained from the two most recent issues of reference *(9)*. Corresponding data for 1971 was available for most countries in reference *(11)*.

I.3.2.h. Prices of Outgoing Telecommunications Services (Telephone - P_1^O; Telegraph - P_2^O; Telex - P_3^O)

The above data was obtained from the DOC. Since the rate for a telephone call from Canada to a given country depended both on the time of day as well as the province of origin, the telephone prices provided in dollars per minute were based on a median value of the various applicable rates. Similar complications were avoided in the case of telegraph prices, where the values provided had been calculated as 60% of the rate in dollars per word for an ordinary telegram. No ambiguities existed with respect to telex prices since a single rate only was involved.

I.3.2.i. Prices of Incoming Telecommunications Services (Telephone - P_1^I; Telegraph - P_2^I; Telex - P_3^I)

The actual rate structure for all three types of telecommunications services in approximately a third of the countries in the sample were supplied directly by the telecommunications authorities of these countries. In the cases where the percentages of traffic flowing at each rate were supplied also, a true weighted value could be computed, e.g. for P_1^I the formula used was

$$P_{1j}^I = \frac{\sum_k P_{1jk}^I \cdot TF_{jk}}{100}$$

where P^I_{1j} is the true weighted mean price per minute for a telephone call from country j to Canada,

P^I_{1jk} is the k^{th} rate for a telephone call from country j to Canada,

and TF_{jk} is the percentage of total telephone traffic from country j to Canada which is charged at rate k.

A similar expression was used also to calculate P^I_2.

When the flow information was unavailable, a median figure for telephone price was computed assuming a 50-50 ratio between both person to person and station to station calls as well as calls made at the ordinary and reduced rates. This was found to be a reasonable estimate on the basis of advice from the DOC, and the detailed information provided by a few countries. The corresponding telegraph price was taken to be 60% of the rate per word in an ordinary telegram. No difficulty was encountered with regard to telex price since the rate was unique.

Where no information could be obtained from abroad, the Canadian prices for the appropriate years were assumed to apply in foreign countries as well. Since the corresponding Canadian and foreign prices were found to be different in cases where the latter information was available, the above assumption was not a very good one, but it was the best alternative under the given circumstances. All prices in foreign currencies were converted into Canadian dollar values using the appropriate exchange rates for the relevant years, from reference *(10)*.

I.3.2.j. Quality of Telephone Service (QS)

This variable was quantified in the following way. Two indices, each decreasing from 3 to 1 with improving quality of service provided respectively by:

(a) the international telephone circuits between Canada and each foreign country (QSI), and

(b) the local telephone circuits within each foreign country (QSL), were obtained from the DOC. The variable QS which was assumed to be a combination of QSI and QSL, was calculated for each country j using the expression

$$QS_j = 2.QSI_j + QSL_j$$

where QSI_j was assigned a weight twice that of QSL_j to account for the fact that a majority of the international calls would be directed to one or more principle cities in a given foreign country, involving little or no use of the local circuits. Thus the quality of service for telephone communications between Canada and a given country was represented by a single index varying from 3 to 9, where a lower value of the index represented a higher quality.

I.3.2.k. Telephone Density (TD)

The telephone density per 100 inhabitants in all countries as of January 1st for 1969, 1970 and 1971 was available from reference *(14)*. The mid-year figure for the years 1969 and 1970 was computed as the arithmetic mean of the values on January 1st of each year and the succeeding one. The 1971 figure was calculated by assuming that the growth rates for TD were identical over the two periods mid-1969 to mid-1970, and mid-1970 to mid-1971. This appeared to be a valid assumption for practically all the countries, on the basis of the TD data for previous years.

I.4.2.1. Working Hours Commonality Index (WHC)

An active period of ten hours, extending from 0700 to 1700 hours in each country was assumed. The Working Hours

Commonality Index varying from 0 to 10 was calculated on the basis of the hours of overlap between the active periods of Canada and each foreign country derived from reference *(15)* where a value zero was assigned when there was no overlap. As in the case of LC , the index WHC is time invariant also.

I.3.2.m. Other

Other supplementary information such as the number of telex stations in foreign countries, found to be useful in explaining anomalies which arose in the case of some countries, was obtained from references *(16)* and *(17)*.

I.4. RAW DATA

The raw data used in the present study can be found in the following printout of the CINTEL data bank. Since the variable names used to identify the same variable differ sometimes in the report and in the data list (i.e. in the actual computational work), a complete list of all the variables and their corresponding names is given below.

Variable	in Report	in Data List
Telephone traffic flow out of Canada	TFOC	TFOC
Telegraph traffic flow out of Canada	TGOC	TGOC
Telex traffic flow out of Canada	TXOC	TXOC
Telephone traffic flow into Canada	TFIC	TFIC
Telegraph traffic flow into Canada	TGIC	TGIC
Telex traffic flow into Canada	TXIC	TXIC
Canadian tourist flow to foreign countries	CTOUR	CTOUR
Foreign tourist flow to Canada	FTOUR	FTOUR
Income (total)	I	-
Income (per capita)	IPC or I/POP	I
Immigrant stock	IMMG	IMMG
Immigrant flow over last five years	SIM5	SIM5
Imports	IMP	IMP
Exports	EXP	EXP
Imports & Exports	IMEX	IMEX
Language commonality index	LC	LC

Variable	in Report	in Data List
Population	POP	POP
Price of outgoing telephone traffic	P_1^O	TFPC
Price of outgoing telegraph traffic	P_2^O	TGPC
Price of outgoing telex traffic	P_3^O	TXPC
Price of incoming telephone traffic	P_1^I	TFPF
Price of incoming telegraph traffic	P_2^I	TGPF
Price of incoming telex traffic	P_3^F	TXPF
Quality of telephone service	QS	QS
Telephone density	TD	TD
Working hours commonality index	WHC	WHC

CINTEL DATA LIST

COUNTRY	YEAR	TFOC	TFIC	TGOC	TGIC	TXOC	TXIC	TFPC	IMEX	TGPC	SIMS	TXPC	LC	TD
1	69	6.28	1.70	134.49	43.21	17.93	15.55	3500.00	70.96	260.00	1581.00	3000.00	0.	6.81
1	70	13.92	8.70	142.39	41.91	21.45	17.32	3500.00	68.11	260.00	1579.00	3000.00	0.	7.03
1	71	29.90	14.95	124.76	43.48	22.86	19.43	3500.00	56.37	260.00	-10.00	3000.00	0.	7.26
2	69	201.54	114.79	1409.31	1530.77	49.11	52.63	3500.00	259.54	190.00	14519.00	3000.00	4.	28.73
2	70	244.99	154.69	1476.71	1550.16	70.20	79.96	3500.00	343.90	190.00	14995.00	3000.00	4.	30.22
2	71	257.26	154.36	1421.24	1396.74	79.62	87.55	3500.00	308.31	190.00	-10.00	3000.00	4.	31.79
3	69	60.35	16.87	202.24	207.60	7.77	10.05	3220.00	47.94	190.00	4269.00	2500.00	0.	17.47
3	70	79.75	23.31	232.15	220.69	12.58	15.40	3220.00	54.47	190.00	3960.00	2500.00	0.	18.68
3	71	98.50	29.55	232.21	206.32	17.34	13.00	3220.00	51.73	190.00	-10.00	2500.00	0.	19.97
4	69	118.95	66.89	384.72	266.11	4.05	4.17	3500.00	9.03	140.00	42489.00	3000.00	4.	9.67
4	70	131.63	76.87	408.01	277.13	6.57	5.14	3500.00	12.52	140.00	51715.00	3000.00	4.	10.69
4	71	154.56	88.10	482.09	464.03	4.49	3.82	3500.00	13.96	140.00	-10.00	3000.00	4.	11.82
5	69	84.61	33.85	305.44	339.17	46.78	53.46	3220.00	177.17	170.00	4284.00	2500.00	1.	19.61
5	70	113.97	94.63	360.30	361.11	62.15	67.34	3220.00	241.45	170.00	4073.00	2500.00	1.	20.44
5	71	145.80	84.78	329.08	334.31	73.47	80.82	3220.00	239.67	170.00	-10.00	2500.00	1.	21.31
6	69	194.08	159.05	295.95	239.99	18.14	10.59	3500.00	11.59	140.00	496.00	2000.00	4.	51.43
6	70	231.84	208.56	332.06	275.01	20.76	15.79	3500.00	11.33	140.00	517.00	2000.00	4.	53.87
6	71	286.93	246.76	339.47	245.13	21.72	13.47	3500.00	13.59	140.00	-10.00	2000.00	4.	56.43
7	69	12.27	7.84	179.37	57.97	18.57	19.76	3500.00	92.37	260.00	1467.00	3000.00	0.	1.84
7	70	31.02	20.98	200.83	169.84	25.50	28.78	3500.00	136.70	260.00	1496.00	3000.00	0.	2.05
7	71	42.51	28.06	264.96	240.74	31.55	34.71	3500.00	144.31	260.00	-10.00	3000.00	0.	2.28
8	69	13.44	6.89	92.80	17.63	8.82	6.22	4000.00	33.82	220.00	16569.00	3000.00	0.	12.78
8	70	16.40	4.55	84.50	34.72	10.54	7.12	4000.00	34.36	220.00	17887.00	3000.00	0.	13.47
8	71	21.80	8.72	84.42	127.44	7.34	5.14	4000.00	36.86	220.00	-10.00	3000.00	0.	14.20
9	69	88.95	37.68	250.96	242.08	23.10	28.23	3220.00	47.40	170.00	4926.00	2500.00	0.	31.66
9	70	108.62	58.99	284.07	245.76	32.40	39.52	3220.00	51.52	170.00	4539.00	2500.00	0.	33.43
9	71	127.67	61.28	285.49	241.03	33.24	40.55	3220.00	57.56	170.00	-10.00	2500.00	0.	35.30
10	69	4.87	3.08	67.13	86.61	1.43	.29	5000.00	4.09	230.00	10468.00	4000.00	0.	1.14
10	70	4.19	1.98	81.54	80.26	.78	.93	5000.00	38.20	230.00	10088.00	4000.00	0.	1.15
10	71	4.56	2.51	88.32	82.22	.43	.37	5000.00	10.49	230.00	-10.00	4000.00	0.	1.15
11	69	26.41	10.53	107.65	139.74	16.04	15.53	3220.00	19.79	190.00	3748.00	2500.00	0.	22.31
11	70	42.27	18.51	122.26	161.08	25.12	25.20	3220.00	33.68	190.00	3858.00	2500.00	0.	24.17
11	71	58.00	24.36	131.91	160.08	25.20	25.55	3220.00	25.76	190.00	-10.00	2500.00	0.	26.19
12	69	337.53	231.59	1336.56	1740.65	76.32	120.83	3220.00	282.29	150.00	24988.00	2500.00	2.	15.51
12	70	446.42	354.01	1716.09	1930.02	118.12	165.93	3220.00	312.56	150.00	24550.00	2500.00	2.	16.62
12	71	555.48	361.06	1609.28	1878.77	167.91	251.87	3220.00	369.11	150.00	-10.00	2500.00	2.	17.81
13	69	505.88	207.23	1441.71	1112.12	186.87	240.62	3220.00	632.10	170.00	32915.00	2500.00	0.	19.50
13	70	681.28	315.28	1561.63	1019.35	233.81	311.23	3220.00	754.01	170.00	29171.00	2500.00	0.	21.39
13	71	804.90	346.11	1463.88	904.86	294.60	382.98	3220.00	748.84	170.00	-10.00	2500.00	0.	23.46
14	69	3.33	-2.00	-3.00	-4.00	.13	.11	3220.00	5.33	-9.00	-10.00	3000.00	0.	11.35
14	70	4.95	.69	-3.00	-4.00	.64	.11	3220.00	3.98	-9.00	-10.00	3000.00	0.	11.86
14	71	6.32	.93	-3.00	-4.00	.71	.75	3220.00	4.92	-9.00	-10.00	3000.00	0.	12.39
15	69	2598.87	1589.32	7636.15	5081.53	584.92	876.65	2500.00	1087.45	130.00	214766.00	2250.00	4.	24.11
15	70	3791.78	1931.60	7714.48	5861.71	810.50	1064.40	2500.00	2218.21	130.00	202049.00	2250.00	4.	25.82
15	71	4464.34	2500.03	7650.69	5721.66	1000.56	1500.85	2500.00	2193.24	130.00	-10.00	2250.00	4.	27.65

NOTES. DATA IS LISTED FROM COUNTRY NO. 1 TO NO. 40, AS SPECIFIED IN APPENDIX , UNITS ARE THOSE SPECIFIED IN THE REPORT.
MISSING DATA IS REPRESENTED BY A NEGATIVE VALUE.

CINTEL DATA LIST

COUNTRY	YEAR	TFOC	TFIC	TGOC	TGIC	TXOC	TXIC	TFPC	IMEX	TGPC	SIMS	TXPC	LC	TD
16	69	156.92	37.26	274.23	291.52	4.85	3.72	3220.00	14.60	200.00	39632.00	2500.00	0.	9.29
16	70	292.70	134.84	326.34	298.60	8.60	10.59	3220.00	28.96	200.00	40100.00	2500.00	0.	10.96
16	71	468.47	163.96	330.58	268.53	13.52	13.65	3220.00	17.06	200.00	-10.00	2500.00	0.	12.93
17	69	97.81	58.86	1099.39	941.53	18.55	10.34	3500.00	90.62	190.00	11928.00	3000.00	3.	11.59
17	70	131.08	79.93	1346.39	1073.25	29.97	20.13	3500.00	99.24	190.00	13002.00	3000.00	3.	13.60
17	71	173.09	103.85	1562.41	1134.04	33.60	20.16	3500.00	100.56	190.00	-10.00	3000.00	3.	15.95
18	69	22.99	4.55	105.67	.59	5.05	14.19	4000.00	12.07	220.00	6505.00	3000.00	0.	7.10
18	70	28.04	3.61	124.09	22.98	6.51	14.81	4000.00	16.08	220.00	6384.00	3000.00	0.	7.75
18	71	31.75	5.08	133.02	82.25	8.64	21.60	4000.00	11.86	220.00	-10.00	3000.00	0.	8.46
19	69	1.84	.91	10.95	14.32	.14	.24	3500.00	.42	180.00	127.00	2500.00	0.	33.12
19	70	2.66	.64	12.93	12.72	.23	.26	3500.00	.48	180.00	174.00	2500.00	0.	33.77
19	71	4.58	1.69	16.14	15.88	.17	.25	3500.00	.82	180.00	-10.00	2500.00	0.	34.43
20	69	7.69	5.08	1069.18	1021.83	5.50	5.04	4000.00	136.46	190.00	23936.00	4000.00	2.	.18
20	70	6.76	6.59	1295.23	1324.43	6.55	2.74	4000.00	169.66	190.00	27985.00	4000.00	2.	1.14
20	71	29.86	24.49	1565.90	1409.46	8.96	5.37	4000.00	195.41	190.00	-10.00	4000.00	2.	7.22
21	69	95.68	28.48	206.84	23.53	4.37	5.19	2500.00	25.05	130.00	10438.00	2500.00	4.	9.51
21	70	138.64	44.86	240.06	30.34	7.24	10.69	2500.00	27.51	130.00	10405.00	2500.00	4.	10.13
21	71	174.26	54.02	271.15	50.61	12.09	16.32	2500.00	26.64	130.00	-10.00	2500.00	4.	10.79
22	69	73.12	3.77	385.93	395.88	2.98	2.99	3500.00	32.04	210.00	4188.00	3000.00	1.	15.21
22	70	118.41	18.15	488.61	503.75	4.55	3.98	3500.00	28.91	210.00	4283.00	3000.00	1.	16.73
22	71	177.06	17.71	537.96	534.41	7.26	6.89	3500.00	36.07	210.00	-10.00	3000.00	1.	18.40
23	69	382.18	137.66	1500.54	1271.58	50.12	56.95	3220.00	274.79	180.00	124833.00	2500.00	0.	15.17
23	70	573.70	217.70	1652.37	1294.32	69.59	86.18	3220.00	328.93	180.00	105374.00	2500.00	0.	16.68
23	71	896.26	331.62	1636.54	1220.60	89.80	103.27	3220.00	367.52	180.00	-10.00	2500.00	0.	18.34
24	69	217.91	184.87	563.47	530.73	3.00	1.37	3500.00	86.46	140.00	-10.00	2500.00	4.	3.29
24	70	256.80	242.55	657.61	570.49	4.01	3.39	3500.00	73.61	140.00	-10.00	2500.00	4.	3.55
24	71	268.81	236.55	694.19	542.22	6.63	4.31	3500.00	68.61	140.00	-10.00	2500.00	4.	3.83
25	69	122.12	94.07	1319.31	1761.52	107.88	115.73	4000.00	1120.50	220.00	2956.00	3000.00	0.	21.26
25	70	154.85	132.40	1320.28	1734.77	162.37	171.98	4000.00	1374.79	220.00	3556.00	3000.00	0.	23.77
25	71	178.30	146.21	1420.93	1760.48	219.87	230.86	4000.00	1593.32	220.00	-10.00	3000.00	0.	26.58
26	69	3.65	3.13	53.76	61.10	.52	.72	5000.00	1.91	200.00	5329.00	3000.00	1.	1.04
26	70	5.52	.04	71.46	47.29	1.73	2.50	5000.00	5.77	200.00	4814.00	3000.00	1.	1.04
26	71	7.76	3.41	76.11	45.55	2.86	2.71	5000.00	5.64	200.00	-10.00	3000.00	1.	1.04
27	69	204.71	103.89	567.84	516.19	42.36	56.96	3220.00	263.64	160.00	15165.00	2500.00	1.	23.44
27	70	261.24	149.59	669.97	532.94	55.87	73.67	3220.00	356.11	160.00	14681.00	2500.00	1.	25.06
27	71	324.52	175.24	599.25	446.01	67.73	88.06	3220.00	311.16	160.00	-10.00	2500.00	1.	26.75
28	69	39.12	30.59	376.83	392.52	7.20	9.11	3500.00	78.16	190.00	4553.00	3000.00	4.	42.09
28	70	50.99	38.24	395.16	403.59	15.85	20.49	3500.00	85.75	190.00	4880.00	3000.00	4.	43.38
28	71	60.04	45.63	364.82	351.45	22.11	26.38	3500.00	75.77	190.00	-10.00	3000.00	4.	44.71
29	69	40.08	14.50	227.28	225.38	29.76	31.75	3220.00	148.54	160.00	2168.00	2500.00	0.	27.52
29	70	56.61	30.33	259.95	232.04	38.72	43.48	3220.00	225.37	160.00	2096.00	2500.00	0.	28.71
29	71	71.72	32.28	252.33	219.53	50.59	55.65	3220.00	239.58	160.00	-10.00	2500.00	0.	29.95
30	69	1.52	.17	288.03	326.85	.19	.17	5000.00	29.21	190.00	3351.00	4000.00	2.	.16
30	70	1.94	1.68	463.45	492.84	.74	.06	5000.00	65.76	190.00	3902.00	4000.00	2.	.17
30	71	2.63	1.32	396.28	537.10	.05	.03	5000.00	43.66	190.00	-10.00	4000.00	2.	.18

NOTES, DATA IS LISTED FROM COUNTRY NO. 1 TO NO. 60, AS SPECIFIED IN APPENDIX . UNITS ARE THOSE SPECIFIED IN THE REPORT.
MISSING DATA IS REPRESENTED BY A NEGATIVE VALUE.

/81

CINTEL DATA LIST

COUNTRY	YEAR	TFOC	TFIC	TGOC	TGIC	TXOC	TXIC	TFPC	IMEX	TGPC	SIMS	TXPC	LC	TD
31	69	11.26	-2.00	99.24	60.04	2.54	8.08	4000.00	18.96	220.00	10359.00	3000.00	0.	5.23
31	70	13.60	-2.00	111.46	84.63	3.20	8.07	4000.00	27.19	220.00	9285.00	3000.00	0.	5.52
31	71	21.70	-2.00	128.09	50.37	6.44	12.87	4000.00	33.30	220.00	-10.00	3000.00	0.	5.83
32	69	15.40	.06	140.29	170.21	2.32	2.84	3220.00	20.69	200.00	42432.00	2500.00	0.	7.07
32	70	25.80	.01	174.42	201.03	4.46	5.60	3220.00	24.57	200.00	44521.00	2500.00	0.	7.51
32	71	44.17	.44	182.44	205.34	8.96	11.19	3220.00	32.47	200.00	-10.00	2500.00	0.	7.98
33	69	4.18	2.46	43.15	.53	4.19	7.59	4250.00	8.36	230.00	2477.00	3000.00	0.	2.99
33	70	6.12	3.54	42.62	6.13	5.15	17.45	4250.00	8.59	230.00	2541.00	3000.00	0.	3.00
33	71	6.20	3.72	46.37	64.90	6.86	10.29	4250.00	19.82	230.00	-10.00	3000.00	0.	3.00
34	69	20.88	13.14	486.46	636.00	16.56	9.86	4000.00	124.44	180.00	5249.00	3000.00	2.	7.31
34	70	33.78	22.52	547.01	669.37	26.71	17.84	4000.00	149.71	180.00	5305.00	3000.00	2.	7.20
34	71	41.78	27.16	502.50	651.02	33.39	21.70	4000.00	120.75	180.00	-10.00	3000.00	2.	7.09
35	69	47.79	19.28	321.10	284.71	13.63	22.56	3220.00	84.62	220.00	7880.00	2500.00	0.	11.95
35	70	95.93	39.29	419.55	365.71	22.77	27.66	3220.00	98.97	220.00	7374.00	2500.00	0.	13.01
35	71	125.34	50.13	433.10	125.67	24.35	26.78	3220.00	104.29	220.00	-10.00	2500.00	0.	14.16
36	69	64.92	29.90	362.25	438.42	59.13	69.87	3220.00	125.78	160.00	1981.00	2500.00	0.	52.75
36	70	90.29	56.70	375.51	446.65	76.26	84.46	3220.00	153.62	160.00	2033.00	2500.00	0.	54.70
36	71	109.24	58.99	312.19	366.92	87.80	96.98	3220.00	158.10	160.00	-10.00	2500.00	0.	56.72
37	69	188.29	88.32	604.44	739.26	75.60	96.32	3220.00	118.16	170.00	9242.00	2500.00	1.	44.40
37	70	266.72	133.77	670.07	767.24	108.90	136.47	3220.00	118.13	170.00	9587.00	2500.00	1.	46.82
37	71	312.61	156.31	627.80	654.91	117.74	147.17	3220.00	124.42	170.00	-10.00	2500.00	1.	49.37
38	69	98.94	60.92	335.90	366.25	2.38	1.77	4000.00	37.23	140.00	-10.00	3000.00	4.	4.84
38	70	127.57	92.22	436.92	422.35	4.27	3.58	4000.00	28.76	140.00	-10.00	3000.00	4.	5.21
38	71	148.27	99.39	453.48	405.59	6.09	4.87	4000.00	28.43	140.00	-10.00	3000.00	4.	5.61
39	69	3.23	6.72	144.59	203.36	7.50	36.26	4000.00	21.37	190.00	3653.00	3000.00	0.	4.14
39	70	3.94	8.10	155.82	307.52	13.74	42.95	4000.00	110.63	190.00	3428.00	3000.00	0.	4.51
39	71	8.11	16.79	230.30	334.55	11.80	29.71	4000.00	138.77	190.00	-10.00	3000.00	0.	4.91
40	69	22.25	2.75	117.89	153.76	2.24	2.03	4000.00	13.65	210.00	26268.00	2500.00	0.	2.87
40	70	30.86	.83	145.57	195.85	4.93	4.46	4000.00	34.16	210.00	29901.00	2500.00	0.	4.04
40	71	44.72	3.58	157.44	187.83	6.05	5.45	4000.00	29.47	210.00	-10.00	2500.00	0.	5.69

NOTES. DATA IS LISTED FROM COUNTRY NO. 1 TO NO. 40, AS SPECIFIED IN APPENDIX . UNITS ARE THOSE SPECIFIED IN THE REPORT.
MISSING DATA IS REPRESENTED BY A NEGATIVE VALUE.

CINTEL DATA LIST

COUNTRY	YEAR	IMRG	I	POP	EXP	IMP	CTOUR	FTOUR	TFPF	TGPF	TXPF	QS	WHC
1	69	2.96	1123.00	23.98	62.32	8.64	2.78	3.00	3500.00	260.00	3000.00	5.00	8.
1	70	3.20	1160.00	23.98	59.13	8.98	2.71	3.20	3500.00	260.00	3000.00	5.00	8.
1	71	-14.00	-15.00	-16.00	49.12	7.25	3.34	-21.00	3500.00	260.00	3000.00	5.00	8.
2	69	23.50	2300.00	12.30	163.26	96.28	7.52	14.70	2870.00	150.00	3000.00	3.00	2.
2	70	26.13	2820.00	12.30	197.75	146.15	10.22	17.00	2900.00	150.00	3020.00	3.00	2.
2	71	-14.00	1183.20	12.30	182.64	125.67	12.51	16.58	2900.00	150.00	3020.00	3.00	2.
3	69	76.24	1880.00	7.37	9.07	38.88	69.00	3.56	3220.00	190.00	2500.00	4.00	3.
3	70	76.84	2010.00	7.37	8.85	45.61	98.00	3.91	3220.00	190.00	2500.00	4.00	3.
3	71	-14.00	2111.00	7.46	8.89	42.84	92.99	4.18	3220.00	190.00	2500.00	4.00	3.
4	69	3.95	564.00	.25	8.76	.27	39.61	2.64	2780.00	140.00	3000.00	3.00	8.
4	70	5.06	570.00	.26	10.97	1.55	31.62	2.90	2780.00	140.00	3000.00	3.00	8.
4	71	-14.00	-15.00	-16.00	11.50	2.45	-19.00	-21.00	2780.00	140.00	3000.00	3.00	8.
5	69	34.44	2600.00	9.65	116.23	60.94	28.50	6.03	3220.00	170.00	2500.00	3.00	4.
5	70	35.21	2720.00	9.65	189.94	51.50	28.71	6.97	3220.00	170.00	2500.00	3.00	4.
5	71	-14.00	2872.00	9.71	180.69	58.98	33.49	7.60	3220.00	170.00	2500.00	3.00	4.
6	69	.96	-15.00	.05	9.06	2.53	29.77	3.59	3500.00	140.00	2000.00	3.00	8.
6	70	1.04	3540.00	.05	11.14	.19	30.41	4.47	3500.00	140.00	2000.00	3.00	8.
6	71	-14.00	-15.00	-16.00	13.40	.19	29.52	-21.00	3500.00	140.00	2000.00	3.00	8.
7	69	2.46	398.00	92.28	50.25	42.13	1.94	3.69	3500.00	260.00	3000.00	5.00	7.
7	70	2.73	420.00	92.28	87.39	49.31	2.34	4.13	3500.00	260.00	3000.00	5.00	7.
7	71	-14.00	-15.00	-16.00	93.61	50.70	4.26	-21.00	3500.00	260.00	3000.00	5.00	7.
8	69	48.34	2130.00	14.42	3.77	30.05	5.72	2.38	4000.00	220.00	3000.00	6.00	3.
8	70	53.37	2230.00	14.42	6.87	27.49	7.17	1.41	4000.00	220.00	3000.00	6.00	3.
8	71	-14.00	2243.38	14.42	6.16	30.70	7.12	964.00	4000.00	220.00	3000.00	6.00	3.
9	69	37.58	3070.00	4.89	15.01	32.39	33.82	5.93	3220.00	170.00	2500.00	3.00	3.
9	70	38.23	3190.00	4.89	21.02	30.50	41.23	6.27	3220.00	170.00	2500.00	3.00	3.
9	71	-14.00	3212.33	4.89	22.86	34.70	41.91	6.68	3220.00	170.00	2500.00	3.00	3.
10	69	17.06	160.00	32.50	2.94	1.14	2.46	1.14	5000.00	230.00	4000.00	7.00	2.
10	70	18.33	210.00	32.50	37.78	.42	1.89	1.28	5000.00	230.00	4000.00	7.00	2.
10	71	-14.00	-15.00	-16.00	10.21	.27	3.17	-21.00	5000.00	230.00	4000.00	7.00	2.
11	69	33.85	2244.00	4.70	7.18	12.61	4.07	2.52	3220.00	190.00	2500.00	3.00	2.
11	70	34.62	2390.00	4.70	7.90	25.78	3.69	3.24	3220.00	190.00	2500.00	3.00	2.
11	71	-14.00	2459.00	4.68	11.65	14.12	4.14	3.54	3220.00	190.00	2500.00	3.00	2.
12	69	66.79	2955.00	50.33	128.58	153.71	140.00	32.53	3220.00	150.00	2500.00	4.00	4.
12	70	70.90	3100.00	50.33	154.20	158.36	180.00	36.91	3220.00	150.00	2500.00	4.00	4.
12	71	-14.00	3131.00	50.33	156.02	213.09	200.00	37.19	3220.00	150.00	2500.00	4.00	4.
13	69	237.56	2828.00	60.84	277.38	354.71	123.00	35.31	3220.00	170.00	2500.00	3.00	3.
13	70	241.76	2930.00	60.84	383.68	370.93	163.00	41.26	3220.00	170.00	2500.00	3.00	3.
13	71	-14.00	3085.00	61.31	319.43	429.40	151.65	45.81	3220.00	170.00	2500.00	3.00	3.
14	69	-14.00	2392.00	17.10	1.85	3.48	8.17	-21.00	3220.00	-23.00	3000.00	5.00	3.
14	70	-14.00	2490.00	17.10	.38	3.60	9.00	-21.00	3220.00	-23.00	3000.00	5.00	3.
14	71	-14.00	-15.00	-16.00	.75	4.17	-19.00	-21.00	3220.00	-23.00	3000.00	5.00	3.
15	69	1232.18	2232.00	55.53	1096.48	790.97	361.00	143.56	2480.00	100.00	2390.00	4.00	4.
15	70	1260.97	2290.00	55.53	1479.95	738.26	408.00	157.74	2670.00	100.00	1800.00	4.00	4.
15	71	-14.00	2315.00	55.90	1360.91	832.33	437.00	150.25	2670.00	100.00	1800.00	4.00	4.

NOTES: DATA IS LISTED FROM COUNTRY NO. 1 TO NO. 40, AS SPECIFIED IN APPENDIX. UNITS ARE THOSE SPECIFIED IN THE REPORT.
MISSING DATA IS REPRESENTED BY A NEGATIVE VALUE.

CINTEL DATA LIST

COUNTRY	YEAR	IMRG	I	POP	EXP	IMP	CTOUR	FTOUR	TFPF	TGPF	TXPF	US	WHC
16	69	88.02	1019.00	8.83	10.26	4.33	15.37	7.57	3220.00	200.00	2500.00	4.00	3.
16	70	95.13	1090.00	8.83	23.96	5.00	30.68	8.95	3220.00	200.00	2500.00	4.00	3.
16	71	-14.00	1097.63	8.83	11.01	6.05	40.90	8.55	3220.00	200.00	2500.00	4.00	3.
17	69	13.91	920.00	3.99	17.68	72.94	10.38	5.17	3500.00	190.00	3000.00	3.00	1.
17	70	16.16	970.00	3.99	20.75	78.49	21.92	5.94	3500.00	190.00	3000.00	3.00	1.
17	71	-14.00	994.25	3.99	20.37	80.19	12.52	7.28	3500.00	190.00	3000.00	3.00	1.
18	69	81.84	1528.00	10.29	2.88	9.18	11.89	2.52	4000.00	220.00	3000.00	7.00	3.
18	70	82.97	1600.00	10.29	6.89	9.19	13.77	3.04	4000.00	220.00	3000.00	7.00	3.
18	71	-14.00	1606.80	10.29	4.63	7.23	14.88	3.30	4000.00	220.00	3000.00	7.00	3.
19	69	2.23	2057.00	.20	.38	.03	.90	-21.00	3500.00	180.00	2500.00	4.00	5.
19	70	2.30	2170.00	.21	.42	.06	1.03	-21.00	3500.00	180.00	2500.00	4.00	5.
19	71	-14.00	-15.00	-16.00	.68	.14	1.28	-21.00	3500.00	180.00	2500.00	4.00	5.
20	69	27.20	108.00	526.04	95.55	40.90	4.83	6.01	4000.00	190.00	4000.00	5.00	0.
20	70	33.35	110.00	526.04	129.84	39.82	7.03	9.43	4000.00	190.00	4000.00	5.00	0.
20	71	-14.00	112.53	526.04	150.80	44.61	7.04	8.53	4000.00	190.00	4000.00	5.00	0.
21	69	43.01	1344.00	2.92	13.95	11.10	23.00	3.67	2500.00	130.00	2500.00	4.00	4.
21	70	44.64	1360.00	2.92	14.35	13.16	25.00	4.28	2500.00	130.00	2500.00	4.00	4.
21	71	-14.00	1404.00	2.97	12.84	13.80	27.00	4.07	2500.00	130.00	2500.00	4.00	4.
22	69	8.01	1833.00	2.82	16.97	15.07	15.80	6.01	3500.00	210.00	3000.00	3.00	2.
22	70	8.60	1960.00	2.82	14.45	14.47	17.92	6.25	3500.00	210.00	3000.00	3.00	2.
22	71	-14.00	2022.72	2.82	20.65	15.42	24.80	7.09	3500.00	210.00	3000.00	3.00	2.
23	69	436.55	1683.00	53.17	133.67	141.12	333.80	15.58	3220.00	180.00	2500.00	4.00	3.
23	70	447.23	1760.00	53.17	183.96	144.97	322.70	18.58	3220.00	180.00	2500.00	4.00	3.
23	71	-14.00	1800.00	54.08	210.05	157.47	330.10	18.66	3220.00	180.00	2500.00	4.00	3.
24	69	29.12	654.00	1.86	40.48	45.98	27.10	9.42	3500.00	140.00	2500.00	3.00	9.
24	70	37.27	670.00	1.86	46.54	27.07	25.10	11.42	3500.00	140.00	2500.00	3.00	9.
24	71	-14.00	680.72	1.86	40.06	28.55	28.10	11.82	3500.00	140.00	2500.00	3.00	9.
25	69	9.62	1749.00	102.32	624.79	495.70	16.55	18.52	4000.00	220.00	3000.00	3.00	2.
25	70	10.37	1920.00	102.32	793.08	581.72	42.44	22.01	4000.00	220.00	3000.00	3.00	2.
25	71	-14.00	1991.00	104.66	791.48	801.84	10.90	25.86	4000.00	220.00	3000.00	3.00	2.
26	69	9.14	227.00	15.05	1.46	.45	15.20	-21.00	5000.00	200.00	3000.00	6.00	4.
26	70	9.65	230.00	15.05	5.42	.34	17.09	-21.00	5000.00	200.00	3000.00	6.00	4.
26	71	-14.00	236.00	15.99	5.12	.52	20.71	-21.00	5000.00	200.00	3000.00	6.00	4.
27	69	154.77	2321.00	12.87	184.97	78.68	109.00	23.30	2800.00	160.00	2770.00	4.00	4.
27	70	157.18	2430.00	12.87	277.19	78.92	125.00	28.00	2100.00	170.00	2280.00	4.00	4.
27	71	-14.00	2510.00	13.19	234.78	76.38	125.40	29.09	2100.00	170.00	2280.00	4.00	4.
28	69	10.64	2596.00	2.78	36.98	41.18	3.98	5.09	3500.00	190.00	3000.00	3.00	3.
28	70	11.58	2700.00	2.78	42.69	43.06	4.96	6.19	3500.00	190.00	3000.00	3.00	3.
28	71	-14.00	2776.00	2.85	35.52	40.25	6.46	-21.00	3500.00	190.00	3000.00	3.00	3.
29	69	25.08	2785.00	3.85	103.64	44.89	5.22	4.89	2720.00	210.00	3000.00	3.00	3.
29	70	25.40	2860.00	3.85	176.23	49.13	4.59	5.38	3200.00	260.00	3600.00	3.00	3.
29	71	-14.00	2994.00	3.90	186.39	53.19	4.01	5.96	3200.00	260.00	3600.00	3.00	3.
30	69	6.55	98.00	126.74	22.14	7.06	2.31	1.09	5000.00	190.00	4000.00	7.00	0.
30	70	8.03	100.00	126.74	55.80	9.96	3.03	1.50	5000.00	190.00	4000.00	7.00	0.
30	71	-14.00	-15.00	-16.00	36.35	7.32	-19.00	-21.00	5000.00	190.00	4000.00	7.00	0.

NOTES. DATA IS LISTED FROM COUNTRY NO. 1 TO NO. 40, AS SPECIFIED IN APPENDIX , UNITS ARE THOSE SPECIFIED IN THE REPORT.
MISSING DATA IS REPRESENTED BY A NEGATIVE VALUE.

/84

CINTEL DATA LIST

COUNTRY	YEAR	IMMG	I	POP	EXP	IMP	CTOUR	FTOUR	TFPF	TGPF	TXPF	QS	WHC
31	69	189.44	1331.00	32.55	6.55	12.41	6.26	7.90	4000.00	220.00	3000.00	7.00	3.
31	70	191.00	1400.00	32.55	15.16	12.03	7.30	7.66	4000.00	220.00	3000.00	7.00	3.
31	71	-14.00	1414.00	32.55	18.04	15.26	7.65	9.21	4000.00	220.00	3000.00	7.00	3.
32	69	75.33	624.00	9.56	7.04	13.65	38.57	2.88	3220.00	200.00	2500.00	4.00	4.
32	70	83.92	660.00	9.56	10.61	13.97	47.38	3.91	3220.00	200.00	2500.00	4.00	4.
32	71	-14.00	665.94	9.56	13.71	18.75	-19.00	4.68	3220.00	200.00	2500.00	4.00	4.
33	69	30.87	883.00	20.01	1.22	7.14	-19.00	-21.00	4250.00	230.00	3000.00	9.00	2.
33	70	31.32	930.00	20.01	3.50	5.09	-19.00	-21.00	4250.00	230.00	3000.00	9.00	2.
33	71	-14.00	938.37	20.01	10.92	8.89	-19.00	392.00	4250.00	230.00	3000.00	9.00	2.
34	69	10.54	736.00	20.22	78.50	45.94	3.11	3.52	4000.00	180.00	3000.00	3.00	2.
34	70	11.36	760.00	20.22	104.00	45.70	4.26	3.96	4000.00	180.00	3000.00	3.00	2.
34	71	-14.00	782.80	20.22	66.16	54.59	5.98	-21.00	4000.00	180.00	3000.00	3.00	2.
35	69	13.90	969.00	32.95	55.91	28.71	104.82	3.89	3220.00	250.00	3020.00	4.00	4.
35	70	14.81	1020.00	32.95	64.51	34.46	123.87	4.51	3220.00	250.00	2570.00	4.00	4.
35	71	-14.00	1052.00	33.98	65.74	38.55	138.38	4.74	3220.00	250.00	2570.00	4.00	4.
36	69	21.71	3907.00	7.97	41.28	84.51	4.05	5.78	2730.00	200.00	3020.00	3.00	3.
36	70	22.03	4040.00	7.97	47.73	105.89	4.09	6.79	2100.00	200.00	2270.00	3.00	3.
36	71	-14.00	4004.00	8.11	45.18	112.93	4.14	6.31	2100.00	200.00	2270.00	3.00	3.
37	69	21.68	3211.00	6.23	34.24	83.93	91.00	7.57	3500.00	260.00	3020.00	3.00	3.
37	70	23.29	3320.00	6.23	37.30	80.83	134.00	8.93	3140.00	260.00	2230.00	3.00	3.
37	71	-14.00	3507.00	6.34	38.24	86.18	131.00	9.35	3140.00	260.00	2230.00	3.00	3.
38	69	16.25	890.00	1.04	19.49	17.74	10.94	6.05	2900.00	140.00	3000.00	3.00	8.
38	70	20.80	860.00	1.04	21.24	7.52	6.83	8.41	2900.00	140.00	3000.00	3.00	8.
38	71	-14.00	878.06	1.04	20.71	7.72	12.87	9.25	2900.00	140.00	3000.00	3.00	8.
39	69	192.40	1665.00	240.33	9.07	12.30	7.05	1.76	4000.00	190.00	3000.00	7.00	2.
39	70	192.94	1760.00	240.33	101.55	9.07	9.32	1.43	4000.00	190.00	3000.00	7.00	2.
39	71	-14.00	1781.12	240.33	126.12	12.65	-19.00	1.44	4000.00	190.00	3000.00	7.00	2.
40	69	81.73	621.00	20.35	8.02	5.63	16.00	2.25	4000.00	210.00	2500.00	0.00	3.
40	70	87.19	650.00	20.35	26.92	7.25	25.00	3.39	4000.00	210.00	2500.00	0.00	3.
40	71	-14.00	657.15	20.35	21.43	8.04	-19.00	4.11	4000.00	210.00	2500.00	0.00	3.

NOTES. DATA IS LISTED FROM COUNTRY NO. 1 TO NO. 40, AS SPECIFIED IN APPENDIX . UNITS ARE THOSE SPECIFIED IN THE REPORT.
MISSING DATA IS REPRESENTED BY A NEGATIVE VALUE.

REFERENCES

I. Statistics Canada Publications, Queen's Printer, Ottawa

(1) Canada Year Book (annual)

(2) Travel Between Canada and Other Countries (annual), cat. no. 66-201

(3) Imports by Countries (quarterly), cat. no. 65-006

(4) Exports by Countries (quarterly), cat. no. 65-003

(5) Canadian Statistical Review (monthly), cat. no. 11-003

II. Other Publications

(6) The Canadian Tourism Facts Book 1972, Office of Tourism, Dept. of Trade, Industry and Commerce, Ottawa

(7) International Tourism and Tourism Policy (annual), Organisation for Economic Co-operation and Development, Paris

(8) International Travel Statistics (annual), International Union of Official Travel Organizations, Geneva

(9) World Bank Atlas (annual), International Bank for Reconstruction and Development, Washington, D.C.

(10) International Financial Statistics (monthly), International Monetary Fund, Washington, D.C.

(11) Monthly Bulletin of Statistics (monthly), United Nations Statistical Office, New York

(12) Main Economic Indicators (monthly), Organization for Economic Cooperation and Development, Paris

(13) Quarterly Bulletin (quarterly), Department of Manpower and Immigration, Ottawa

(14) The World's Telephones (annual), American Telephone and Telegraph, New York

(15) The World Map, Dept. of Energy, Mines and Resources, Ottawa, 1967

(16) The Statesman's Year Book (annual), J. Paxton, Ed., Macmillan & Co., London

(17) Special Autonomous Working Party 5 Contribution No. 24 (GAS-5), International Telegraph and Telephone Consultative Committee, General Secretariat, I.T.U., 1971.