ECONOMIES OF SCALE

IN LOCAL GOVERNMENT

EXPENDITURES IN CANADA

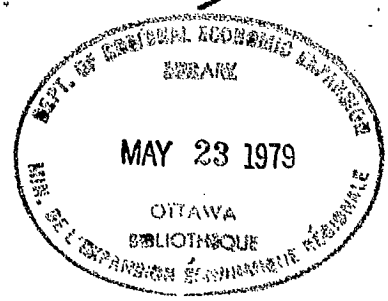
Regional Studies Section
Economic Analysis Branch

DEPARTMENT OF REGIONAL ECONOMIC EXPANSION

E C O N O M I E S O F S C A L E

I N L O C A L G O V E R N M E N T

E X P E N D I T U R E S I N C A N A D A



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SUMMARY OF CONCLUSIONS

On the basis of the study to date there appears to be no evidence suggesting that economies or diseconomies of scale are present in Canadian local government expenditure patterns. Moreover, all current evidence points toward the fact that the size of a community does not, other things being equal, influence the level of local government spending.

The study analyses the correlates of municipal expenditures in the 204 largest urban centres and 363 municipalities of Canada. It utilizes per capita expenditures information for seven functions: general government, fire protection, police protection. public works, sanitation and water works, recreation and community services; and the total per capita spending on these functions (total common functions).

The 22 independent variables used in an attempt to "explain" the spatial variations in the functional per capita expenditures fall into three broad groupings: socio economic variables, demographic and economic growth variables, municipal (controllable) variables.

A stepwise multiple regression was performed in order to examine the influence of these twenty-two independent variables, in turn, upon each of the dependent expenditure variables.

The statistical results are summarized in Appendix 2, tables 1 to 8. These indicate the cumulative percentage of the variation "explained" by the addition of significant variables, together with the appropriate constant, regression coefficients and their t-values. The results highlight the importance of the municipal or controllable variables, (for details see Appendix I) as opposed to the socio economic and demographic and economic growth variables, in "explaining" the seven functions.

The highest level of "explanation" (56.3%) was obtained for the Total Common Functions variable, followed by Recreation and Community Services (53.7%) and Police Protection (50.9%). For the remaining four functions the variations in per capita local government expenditure were below 50.0 per cent.

In order to eliminate, as far as possible, the effect of inter-provincial variations in expenditure the analysis was repeated for each of the five major economic regions of the country. Once again the simple correlation coefficients indicating the strength of the association between population size and per capita municipal expenditure on the common functions for each region were so slight, that the same results could have been expected to occur by chance. Similarly, for each of the six individual functions, population size exerted a negligible influence.

However, the proportion of the variation which was statistically "explained" by the 22 independent variables increased in the regional analysis. Only in the Atlantic and Ontario regions were lower levels achieved for the per capita expenditures on the common functions. Table 9 summarizes the variables which added more than 1% to the R^2 (these are approximately comparable to the variables which were significant at the 99% level of probability.)

The present study has obtained valuable insights into the determinants of the variations in the per capita expenditures of local governments; it has not, however, been able to consider the variation in the quantity and above all the quality of the municipal services provided for the same dollar expenditure. Therefore, although on the basis of the work to date there appears to be no evidence suggesting that economies or diseconomies of scale are present in local government expenditure patterns, greater knowledge of the quantity and quality of service is needed before this statement can be made conclusively.

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SECTION I

Introduction

A frequent discussion point in regional development studies has been the relative merits of achieving a faster rate of regional economic growth either through a policy of spreading expenditures around in the problem region or, alternatively, through a policy of concentration by adopting a growth centre strategy. The Department's implementation of a Special Area programme implies that the latter approach is currently favoured in Canada, yet little appears to be known about the real costs and benefits of such a programme to the municipalities concerned.

The investment of capital in the provision of such infrastructure as roads and schools might be expected to make a centre more attractive for new and existing industry, and increase the quality of services and opportunities for the residents. The effects of increased incomes and reduced unemployment levels might be expected to be transmitted through the multiplier process to other industries in the centre as well as in the surrounding region. If, however, the maintenance costs of that infrastructure or the costs of providing increased or improved municipal services represent an excessive burden for the local or provincial governments, then benefits may be lost if a growth centre is bankrupted in trying to handle the growth. Virtually nothing is known about the determinants of local government spending in Canada, so it is impossible to decide whether growth is desirable as far as the tax-paying

residents and municipal decision makers are concerned. Until more can be discovered about what factors determine the levels of per capita expenditures by municipal governments, it will possible to only partially evaluate a growth centre strategy.

It has often been claimed that there may be economies or diseconomies of scale in local government spending associated with increasing population size, or that certain regions or economic types of cities tend to behave differently. In order to start examining the determinants of local government spending and the evidence for scale economies, or regional and other effects upon the levels of per capita expenditures in Canada, a cross-sectional study was undertaken into the spatial variations in per capita local government expenditures on major functions in Canadian cities for 1968. This preliminary investigation into the so-called determinants of government spending was designed to review the relevant aspects of the existing literature, discover the data availability and limitations, and utilize an appropriate statistical technique, stepwise multiple regression, to analyse the data, as a prerequisite for a consideration of future research efforts.

The present study represents a preliminary report containing the results of the initial stages of this investigation. Section 2 summarizes and evaluates the relevant main features of some of the previous studies, while an attached bibliography lists a larger selection of the literature. Section 3 outlines the data which was available on per capita local governments

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expenditures on the major municipal functions, while Section 4 discusses the independent variables which could be utilized to try to "explain" the spatial variations in per capita functional spending. The sources of these variables are listed in detail in Appendix I. The results of the first Multiple Regression analyses are contained in Section 5, and in the tables of Appendix 2, while some brief suggestions for immediate or necessary future research requirements have been noted in Section 6.

SECTION 2

Brief Review of the Literature

The "optimum size" of cities has long represented the "holy grail" of urban research, but the key question of whether there is any increase or decrease in the per capita costs of providing municipal services in larger cities has yet to be resolved before any meaningful statements can be made about this ideal size. Despite many efforts in the past two decades, however, the existence of economies and diseconomies of scale in government services have yet to be effectively proved or disproved. Two approaches have been used to try to estimate the urban public service production function - the engineering approach or the statistical analysis of cross-section or time-series data. The engineering approach relies on technical information based on day-to-day operations or specially designed experiments. Although production functions estimated from technical information benefits from the fact that the range of applicability is known and the results of technical progress can readily be incorporated, its applicability is limited to a narrowly defined process and cannot take administrative costs and managerial efficiency into account. Of the other approach, very few of the statistical studies have used time-series data. Population size was not included as a variable in Morss, Fredland and Hymans (1967), Whitelaw (1969), or McMahon (1970) since there is an absence of reliable annual figures on

populations. Changes in the value of money and the aging of social infrastructure over time have also presented difficult problems. The bulk of the work has been concerned with "explaining" variations in the determinants of per capita expenditures of state, local or state/local governments.

Although the difficulties of analyzing the public sector have led one prominent authority to complain that

> "the problems are opaque, thorny, and a mare's nest, and the raw material is obscure, ineluctable, elusive and intractable",[1]

an increasing number of economists or political scientists have attempted to account for variations in government spending within the U.S.A. Almost with out exception these Determinants studies have applied multiple regression analysis to geographical data in an attempt to statistically examine the relationship of a number of independent variables which "explain" the variations in per capita municipal and state government expenditures at a single point in time. The main elements of this large literature, however, have already been outlined by Bird (1970) or Williams (1970), so the main emphasis here will be placed upon a brief discussion of the existing Canadian studies and upon the question of economies of scale.

Although the pioneering study of Solomon Fabricant (1952) confined its attention to the relationship between inter-state variations in per capita state-local aggregated expenditures and per capita incomes, population density and the urban percentage of the population, it soon became a popular practice of such

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[1] D. Netzer, in W. Hirsch (Ed.) (1964). Elements of Regional Accounts.

studies of state-local expenditures as Fisher (1961), Kurnow (1963), Fisher (1964), Sachs & Harris (1964), Bahl & Saunders (1966) to examine the evidence for economies of scale by introducing a population-size variable. A negative association between per capita expenditures and population size was regarded as evidence that economies of scale might exist. In many of these studies, however, population size failed to produce a statistically significant result. The examination of scale economies appears to have been started by Brazer (1959) in his study of the 462 larger U.S. cities with populations over 25,000 in 1951, and detailed examinations of the cities in Massachussetts, Ohio, and California, together with an analysis of the 40 largest cities and their overlying local governments in 1953. He found that there was evidence of a positive relationship between per capita expenditures and city size, but further analysis revealed that the between-groups variation is not significantly greater than that within-groups according to an F-test or analysis of variance. Rather than interpreting this relationship as indicating diseconomies of scale, Brazer noted that as population-size increases, more services become economically feasible or necessary, or that the population variable might be associated with other factors, such as income or population density, which, in turn, may account for the apparent association between expenditures and size. Brazer also noted that efficiency and quality of service contribute to variations in expenditure levels, "but we are a long way from being able to measure either. They have been neglected

only because it is not feasible to do otherwise."

The issue of possible economies of scale in the production of municipal services was raised by Hirsch (1959) in a study to see if local government fragmentation or balkanization in a metropolitan area led to inefficiencies and higher costs. His later work on the municipalities of the St. Louis Area (Hirsch, 1960 and 1964) led him to conclude that with the exception of water and sewage, urban transportation, planning, public health and hospitals, electricity supply and air pollution control, any economies of scale were small and did not apply for cities of over 250,000. These conclusions were corroborated by Shapiro (1963) and Schmandt and Stephens (1963), although they were challenged by Tiebout (1960) and Breton (1965) who felt that the quantity and quality of municipal services had not been adequately measured. In a later review of cost curve studies, (Hirsch 1968), he referred to studies by Kiesling (1966), and Hirsch (1960) for education, Schmandt and Stephens (1960) and Hirsch (1960) for police protection, and Hirsch (1965) for refuse collection, and noted that no evidence for scale economies were found. Secondary education by Riew (1966) produced a U-shaped cost curve with the trough at about 1,700 pupils. Will (1965) found that the major scale economies for fire protection were reached at 300,000 population although Hirsch (1959) discovered a U-shaped curve with the trough at about 11,000 for the same function. Isard and Coughlin (1957) found evidence of economies of scale for sewage plants.

There appear to have been very few studies, however, using Canadian data. Michas (1967) used combined provincial-municipal per capita current and capital expenditures in the Canadian provinces for 1951, 1956 and 1961. Initially Michas employed the three "classic" Fabricant factors and "explained" 78% of the variation among Canadian provinces compared to only 72% among U.S. states. Per capita incomes appeared to be the major factor "explaining" the variations, which Michas interpreted as reflecting the fiscal capacity of the constraint on financial resources.

Rivard (1967) followed up Brazer's work on U.S. cities by examining 91 Canadian cities with populations over 20,000 in 1961. He used 15 variables to account for inter-city variations in per capita spending on seven different expenditure functions: general government, protection to persons and property, public works, sanitation and waste removal, health, social welfare, recreation and community services, together with the total of these common functions. His variables succeeded in "explaining" 71.7% of the variation in per capita total expenditures, while for the individual functions it varied from 28.1% for public works to 71.9% for protection. Average incomes were again the most important "explanatory" variable, although a proxy variable for the age of the city, the percentage of dwellings built before 1945, was also quite prominent. Rivard also made use of two dummy variables, one indicating the region in which a city was located, while the other related to its relative location within a metropolitan area or whether the city in question was a central city,

suburb, or relatively isolated. Rivard concluded that population size did not contribute materially to differences in per capita expenditures when other explanatory variables are taken into account, except for protection and general government.

As part of a study of the impact of provincial spending and the determinants of its spatial patterns, Williams (1970) examined the inter-county variations in provincial expenditures among the 49 municipal counties of Ontario in 1965/66 fiscal Year. The 24 variables were related to the possible demand for expenditures which were broadly generalized as socio-economic needs, economic growth pressures, and political or vote-gaining considerations. The results of a multiple regression analysis suggested that poorer municipalities ask for more help or that legislation might be geared to the poorer, remote, less urbanised counties. Also, over 93% of the variations of total local government expenditures of the 977 municipalities aggregated to these 49 counties were "accounted for". Although the same socio-economic variables as in the analysis of provincial spending were important, for each variable there was an inverse relationship in each case to that for provincial expenditures, so that the rich municipalities spent more themselves yet received less in provincial spending. This study, however, included capital debt charges and did not examine the individual municipality or decision-making unit, and also did not examine the individual functions. Moreover, owing to the skewed population distribution which reduces the usefulness of the regression and correlation

coefficients and their significance tests, population size was not included as an explanatory variable.

A more recent unpublished study, Bodkin and Conklin (1971), examined total current expenditures on non-education programmes, together with the per capita expenditures on six functions: fire, police, total protection, water supply, sanitation and waste removal, and public works for a sample of the 70-90 larger municipalities in Ontario for 1961 and 1966. Although their results have not been corrected for degrees of freedom, 76.7% of the variations in the total current expenditures in 1961 were "accounted for" but the same nine variables only "explained" 45.3% in 1966. In 1961 the levels of explanation ranged from 12.5% for water supply, to 71.9% on protection, while for 1966 they varied from 16.2% for sanitation and waste removal to 55.8% for fire protection. They noted that

> "for both water supply and public works, per capita expenditures fall as population size increases. These expenditures fall at a decreasing rate, reaching a minimum at population sizes of 140,000 and 180,000 respectively. The 1961 data indicate this trend more clearly than do the 1966 data. For the other five expenditure categories, however, per capita expenditures rise as population size increases. They rise at a decreasing rate and, indeed, the rising trend may have stopped with the three or four largest municipalities in our sample."

They also hold the other variables constant and use figures for a range of population sizes as the values for their independent variable in order to confirm their observations. They observed that

> "we have uncovered very little evidence (aside from the categories of water supply and public works)

> of economies of scale in the production of municipal services, in the range of population sizes examined (10,000 to 300,000 persons.... Even if such economies of scale are, in fact, present, it seems extremely unlikely that, for the range of population sizes examined, they are substantial enough to offset the other factors making for the tendency of per capita municipal expenditures to rise with an increasing population."

They conclude that their results "do not suggest an overwhelming preponderance of economies of scale in the production of municipal goods... our calculations suggest that quite small municipalities, even those with populations in the range of 5,000 to 10,000 persons, can provide fire and police protection, sanitation and waste removal, conservation of health, recreation and community services as cheaply, or even more cheaply, than can the larger municipalities."

Writers, such as Bird (1970), Morss (1966) and Pryor (1967) have criticized the outpourings of American studies on the determinants of state and local government expenditure as being solely concerned with increasing the statistical "explanation" rather than with understanding the variations in expenditures. The studies were completely empirical with little real theoretical basis underlying the choice of variables so that this inductive approach has failed to develop plausible hypotheses. As a result the goal of understanding the observed spatial patterns of government expenditure has not been achieved. Even when the many interesting and relevant associations between different factors have been found, the research possibilities have been neglected.

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A preoccupation of some writers has been the influence of federal or state aid upon expenditures, and a lively debate on this subject ensued. The question of whether aid determines, or is determined by, the pattern of expenditure, however, has yet to be resolved. Many of the studies which have introduced aid as an independent variable into the regression equations have tended to be regressing the expenditures upon themselves. Also the influence of aid as an explanatory variable has often been exaggerated since the grants depend on the other factors, or upon matching local expenditures. Whether aid stimulates expenditures, or is simply substituted for them, has yet to be addquately answered.

In addition, Fisher and Fairbanks (1968) have pointed out a number of practical limitations of the multiple regression technique which has invariably been adopted in the determinants studies. Quite apart from the fact that the necessary data is frequently inaccurate or unavailable, correlation cannot be interpreted as causation, and it has been necessary to make assumptions about which is the dependent variable. Also, the influence of a third variable, which has not been identified or measured, may be dominant, so that the selected variable might merely be acting as a proxy or surrogate for this other variable. Arbitrary linear models have been adopted when the true relationship might, in fact, be a curvilinear one. The problem of multicollinearity, in which two of the variables are closely related to each other, means that the usual tests of significance might

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become unreliable. In particular, the multiple regression analyses have provided no information about the mechanics of the decision-making process, of how the independent variables actually influence the levels of government spending. Often the really important determinants simply cannot be quantified, and the writers observe that it is easier to measure external conditions, such as demographic or economic characteristics, than to quantify factors describing the government system or the decision-making process. Later writers, such as Harlow (1967), Sharkansky (1969) have attempted to examine state expenditures only, thus concentrating on the decision-making unit. One alternative, the use of principal components analysis also runs into the additional problem of how to interpret exactly what is contained in a component. Consequently the studies of Bahl (1969) and Pidot (1969) have thrown little light upon the problem.

Perhaps the most telling criticism of the determinants studies, though, has been their failure to even recognize that they have separated the influence of supply and demand factors. Rivard, however, does attempt to point out that such a distinction is necessary. Scale economies and variations in factor prices, together with variations in municipal output or in the quality of services which are provided, might be considered to be supply factors. The previous studies have concentrated almost entirely on the demand factors which are related to the social, economic and physical environments of the cities and which, in turn, might determine the needs, preferences, and abilities to pay of the city dwellers for municipal services.

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In Canada, Michas, Rivard, and Shoyama (1968) have all commented upon the apparent significance of local or provincial regional factors. Bird, in fact, suggests that "detailed study of the history of expenditure on particular functions in particular regions might, it appears, be more fruitful than further statistical overviews of the country as a whole." (Bird, 1970, p.45.) Bird, in his review, also notes that it might be worth testing specifically political variables as well as the influence of the fiscal and debt position of an area on the level and pattern of its expenditures. He also comments that a more careful study of the effects of intergovernmental fiscal transfers is urgently required in Canada.

Rivard's study, although providing valuable guidelines, has been limited to the cities over 20,000 population. It also neglects education spending which, although municipal responsibilities vary among the provinces, tends to account for at least one third of all local taxes whether paid direct to a school board or indirectly through a municipality. In addition, the level of municipal responsibilities for health or social welfare varies among the provinces, so Rivard's data incorporates this variable municipal portion. The provision of water, too, is also an important municipal function which is often handled by separate municipal sewer and water utilities, yet this function is also neglected. Fire protection, police protection and other protective services such as street lighting, weed control, etc., which might be expected to be determined by different variables, have been aggregated into a protection to persons and property category for

the purposes of his analysis. Finally, and perhaps more seriously, Rivard's use of a dummy variable for the region in which the city is located tends to give an exaggerated level of "explanation" of the variations since a large number of unknown variables are subsumed within this dummy variable. It is also difficult to determine the statistical significance of such a dummy variable. His use of another dummy variable for the distance from the core of a census metropolitan area also tends to appear to have "accounted for" the variations without effectively considering any of the variables which might make central cities different from their suburbs or from separate or geographically independent cities. Metropolitan areas are characterized by complex commuting patterns and the flight of the prosperous to the suburbs where they do not need to support the expensive services they consume, or which need to be provided for the older run-down city cores. In such a situation it might have been useful to consider metropolitan aggregates of municipal expenditures as well, even though the decision-making unit is no longer being analysed.

Bodkin and Conklin's study of the larger Ontario cities, which excludes Ottawa and Toronto Metropolitan areas, however, is specifically concerned with the evidence for scale economies. By concentrating upon a fairly limited number of variables, their levels of explanation have been lower than Rivard's, despite the fact that the inclusion of per capita provincial and federal grants appears to contain an element of self-correlation. The inclusion of socio-economic variables might have increased the

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coefficient of multiple determination, although their aim was to specifically consider the evidence supporting scale economies rather than blindly achieve the highest level of "explanation". It is perhaps significant that the lower levels of explanation in the 1966 cross-sectional study rather than in its 1961 equivalent, suggests that municipal expenditure determinants are becoming more complex in Canada, as in the U.S.A.

Quite apart from the severe practical difficulties of obtaining complete and reliable data on municipal expenditures on a uniform grouping of functions for all centres or census metropolitan areas or census major urban areas, the available independent variables are limited in an inter-censal year. It is apparent that, conceptually, it will be very difficult to distinguish between the supply and demand factors with any certainty. In particular, the quality of services provided cannot be equated with the per capita expenditures, and no study so far has effectively taken this important consideration into account. To examine the evidence for an engineering or technical type of supply factor like economies of scale, it would be necessary to hold constant all the other factors which might be expected to influence the municipal government's decision-making process which results in the variations in municipal per capita spending in any year. The random influence of individual politicians or bureaucrats might also need to be considered, too. This quite clearly is impossible, given the present limited state of knowledge about the governmental decision-making process and the

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factors which determine it. The best that can be anticipated from such a study is that the most obvious scale economies might be apparent, and that guidelines for further, more sophisticated, in-depth research studies might be found.

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SECTION 3

Dependent Variables Used in the Multiple Regression Model

Despite the conceptual problems which had been encountered in the previous studies, the selection of an adequate and scientific sample of cities for closer study into their behaviour over time must be preceded by preliminary study in which rather crude assumptions must be made and which is inevitably subject to the constraints of inadequate data. Anomalies might be selected for further research into the decision-making process and into the specific local conditions which create the extremely high or low expenditures in relation to comparable cities. Perhaps one more determinants study for Canadian cities can be justified as providing an indication of just how important such unknowns as the quality of services and other unmeasured variables would be. This information is essential before commencing any further work since if these unknown factors are minor, then little purpose would be served by devoting scarce research time to finding out more about them.

It was decided to start with as large a sample of Canadian urban areas as possible, so all 327 incorporated urban centres in Canada, which had populations exceeding 5,000 in 1966 were included. While the larger centres would be less subject than smaller ones to "random" variations, if a u-shaped cost curve exists, then inclusion of the smaller centres might enable the curve to be traced almost in its entirety. Also, in order

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to obtain statistically significant results, as many observations as possible were needed in some economic regions or provinces. Many of these cities, towns or villages, however, were merely part of a larger economic unit, the metropolitan area. There is an inevitable spillover of services associated with the complex intrametropolitan commuting patterns and the extension of services such as police protection, water supply, recreation, etc. beyond the boundaries of the central core city to its sub-urban municipalities. It was decided to initially examine the aggregated per capita expenditures of the Census Metropolitan Areas (C.M.A.) and the Census Major Urban Areas (C.M.U.A.), together with the 168 "geographically independent" urban centres with populations exceeding 5,000 persons. In the small number of cases where only part of a municipality had been considered to be part of a C.M.A. or C.M.U.A., the entire expenditures were included. In order to prepare the sample of 204 urban areas, therefore, it was necessary to include data for 463 municipalities. This procedure inevitably incorporated into the aggregates inefficiencies of "political Balkanisation" associated with a number of small local governments each unable to gain any advantages of scale-economies. The situation, too, is perhaps confused by the purchase of services by neighbouring municipalities, so there is a danger that double-counting may be incorporated. These limitations are unlikely to offset the advantages gained by using a closer approximation to true economic size of the urban areas since these also increase the population ranges that can be examined.

Data was collected for the 1968 calendar year, the

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latest for which complete information could be obtained. In the majority of provinces many of the municipalities did not estimate their populations, so it was necessary to use the more reliable 1966 Census. Only those boundary changes between the Census and 1968 which involved the annexation or amalgamation of entire municipalities could be taken into account. An inspection of the areas and populations involved in all boundary changes in the latter part of 1968, however, revealed that invariably few people were involved, and often only a small area was annexed. Since the municipal decision-makers might be expected to base decisions upon available data, the 1966 Census, the problem of calculating 1968 per capita expenditures using partially modified 1966 Census populations was not considered to be serious.

Although all the provinces tend to have adopted the DBS Manual of Municipal Accounting published in 1960 as a guide-line for the municipal accountants, functional definitions still tended to show variations. To ensure that uniform functional responsibilities could be examined, the published information was checked with the provincial departments of Municipal Affairs, and unpublished data was obtained. The financial statements of the two P.E.I. municipalities were used, while unpublished records for the Ontario municipalities were necessary to eliminate the allocation of capital expenditures to each function. The municipal financial accounts for Nova Scotia were studied in order to eliminate the practice of rounding-off to the nearest hundreds of dollars. Other gaps to be eliminated were related to the

water utilities of 3 of the Nova Scotia municipalities and the sewer and water utilities of St. John's, Newfoundland. Fire and police protection in St. John's, together with police in Corner Brook, were handled by the province and so had to be added to the municipal data. It was also necessary to obtain unpublished information on the separate costs of fire and police for Quebec, Manitoba and Saskatchewan. In addition, since water supply represents an important municipal function and in a number of cases also includes sewage disposal, these expenditures were aggregated with those of sanitation and waste removal. In order to eliminate the wide inter-provincial variation in municipal responsibilities, for health, social welfare, and education, it was necessary to consider total expenditures rather than the municipality's share only. As a result the provincial-municipal payments on welfare and education had to be obtained by adding the direct provincial transfer payments and grants to school boards. The work of Frazer (1971) demonstrating the existence of economies of scale in hospital spending meant that only a perfunctory analysis was necessary at the municipal level. Unpublished information on expenditures by individual hospitals, obtained from the records of the Department of National Health and Welfare and DBS have been utilized, but complete information on Welfare and on Education is not yet available. For these functions it has been necessary to make estimates since departmental records refer to welfare or school district areas which encompass several municipalities. The individual welfare cheque

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payments, which were coded by location in Newfoundland, were tabulated for two representative months, August and November, 1968, for long term and short term assistance, and for old age assistance, blind persons' allowances and disabled persons' allowances for November, 1968. The complete monthly payments for 1970 were then used to estimate the total 1968 welfare payments. Similarly, from the addresses in the detailed records of cash welfare payments in the New Brusnwick centres it was possible to estimate monthly social welfare and child welfare payments for 1968, and the application of the welfare district ratios of cash to voucher payments enabled these figures to be estimated. Unpublished material was collected in Toronto, while, whenever practicable, estimates were provided by the Welfare Departments in the other provinces. Complete information could not be obtained for the Newfoundland school districts, but data on provincial grants estimated to be applicable to the municipalities concerned can be supplied by the majority of the provincial departments of education.

In addition, so that data published in the 1961 Census could be used and an examination made of changes in patterns of spending over the 7 year period, data was also collected for a second cross-sectional study of per capita functional expenditures in 1961. In the absence of published provincial data, the financial statements of municipalities in P.E.I. and Manitoba were used, while additional information on fire and police expenditures was required for Ontario and Saskatchewan. It was

also necessary to utilize data for the 1960 calendar year for Quebec, but here no breakdown into fire and police was possible and the water utilities may include other public utilities. For each province, too, it was only feasible to obtain data on the municipalities own expenditures on health, welfare and education, rather than on total gross expenditures. The analysis of the 1961 data, however, was given a lower priority due to the fact that it referred to an outdated time period and that the populations involved in large numbers of annexations of parts of municipalities could not be determined. The initial analysis thus includes fairly reliable per capita expenditures on six functions, General Government, Fire Protection, Police Protection, Public Works, Sanitation and Water Works, and Recreation and Community Services, together with the total per capita spending on these Common Functions.

SECTION 4

Independent Variables Used in the Multiple Regression Analysis

Although any rigid classification is impossible, the variables used in an attempt to statistically "explain" the spatial variations in the functional per capita expenditures might be arranged into 3 broad groups, socio-economic variables, demographic and economic growth variables, and municipal or internal variables. In order to examine the evidence supporting the existence of economies or diseconomies of scale, it is first necessary to try to recreate the municipal decision making process on the basis of the end product, the variations in per capita expenditures in the municipalities. Only after enough is known about these other factors which may "determine" the level of government spending, can any meaningful suggestions be put forward concerning the influence of such a technical relationship as scale economies.

It seems reasonable to anticipate that the level of municipal spending will be influenced on the one hand by the needs or preferences of its residents, and on the other by the decision makers' perceptions of its ability to pay. The end product of the economic system, which may influence the political system, which, in turn might be hypothesised as influencing the levels of municipal expenditure. Since it is not possible here to quantify the operation of the political system, it is necessary to fall back on a number of socio-economic variables which might provide an indication of the local state of the economic system which might reflect the needs or preferences of the consumers of the

municipal services. Other things being equal, one might expect a politician to try to spend money in order to maximise the possibilities of being re-elected, so it seems reasonable to expect that there might be some limit to his freedom of action and that of the local government officials, although this still leaves much room for their individual preferences. A centre which is growing rapidly might be expected to need additional services, such as roads, sewers or water supply systems, particularly if new residents are attracted to the community, or if it is expected that its prosperity will, in the foreseeable future, lead to in-migration and growth. A high natural birth rate accompanied by immobility of labour might be expected to influence the decision makers' perceptions of future inadequate capacity of facilities, and the problem sectors.

Other things being equal, a rich community might be expected to spend more on such functions as fire and police, public works, sanitation and waterworks, while a poorer one might spend more on public health, and social welfare programmes. An older, more over-crowded community might be expected to need more fire and police protection due to the possibly greater fire risks and higher crime rates.

Perhaps a more direct influence upon a decision maker's level of priorities is the resources that are open to him. Given the almost insatiable demands for government services, it is likely that a local politician will spend money freely until the

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taxpayers begin to complain. It would follow, therefore, that a richer, expanding community has access to more property taxes than a low income, depressed community in which house prices are lower. If he is spending money raised elsewhere from provincial or federal taxpayers, he might be less subject to this constraint. On the other hand, there might be a limit to the level of dependence on another level of government before local freedom is lost. The only other real source of money is the capital market. A spendthrift policy with frequent recourse to borrowing not only increases the interest rates but also reduces the saleability of a municipality's debentures on the open market. Debt charges, which reflect the previous levels of municipal investments in social infrastructure, must take priority in the current municipal budget. Consequently a high level of municipal indebtedness might also limit a community's freedom of action to spend its scarce revenues on competing functions. Although it has yet to be effectively demonstrated for Canadian municipal government, it seems logical to expect that local decision makers consider each expenditure in relation to the previous level of spending on the same item or function. Such incrementalism, as it has been termed, is likely to be the characteristic, dominant feature, so that needs and preferences expressed in past expenditure decisions may still represent the most important determinant of the level of local expenditures on a particular function.

It is perhaps obvious that a variable such as property taxes might reflect a higher level of individual preferences for

services, as well as a higher level of revenues, with less expenditure restraints and a reduced dependence on other levels of government. Similarly, demographic and economic growth might also reflect needs as well as expected increased revenues. Income, for example, not only reflects both needs and ability to pay, but also affects the supply of services through the local price paid for labour and even goods and services. Consequently the mechanics of the actual decision making process cannot effectively be determined with any certainty.

The sources of 22 variables which could be obtained relatively easily have been documented in Appendix 2, but they will now be briefly discussed. The value and meaning of statistical significance tests are reduced in value if the data does not conform to a normal distribution, in a Gaussian distribution, or a "Bell-shaped curve". Whenever possible, therefore, percentages rather than absolute figures have been used to reduce such problems. Modified Population Size (X_1) should enable any obvious economies of scale to be apparent, although the skewed or non-normal distribution might need to be overcome later through log- or square-rooting transformations. Average incomes of Male Taxpayers (X_2) and % of Low Income Male Taxpayers (X_3) and % of High Income Taxpayers (X_4) would indicate the degrees of relative poverty and prosperity and hence the possible needs or preferences and ability to pay of the residents. Income taxes per capita (X_{16}) also incorporates the influence of disposable income and family size. Population Density (X_5) suggests the degree of overcrowding with its associated

problems which might increase the costs of the adequate provision of such services as sewers, water mains or roads. The Dependency Ratio (X_6) indicates the share of the population which is potentially unproductive, while Average Family Size (X_{22}) takes into account such features as the pressure on schools and child welfare programmes, future growth pressures, and hints at the level of real family resources. The age of a city (X_{19}) and (X_{20}) might suggest whether its infrastructure might be due for replacement or even has yet to be installed. The economic type of community and its occupational characteristics, measured by Relative Manufacturing Employment (X_7), Proportion in Managerial, Professional and Technical Occupations (X_8), or which are working as Manual or Semi-skilled Labour (X_9) might also change local attitudes to the desirable or acceptable levels of spending on different functions. White collar workers in non-industrial centres, for example, might expect more services, with less emphasis on treatment of industrial wastes. Similarly the owner-occupancy ratio (X_{21}) might mean that services to property such as fire or police might be preferred to other items. Variables reflecting Demographic Change (X_{10}), or Economic Change-Value of Retail Trade (X_{11}), Manufacturing Value Added (X_{12}) or a more direct indicator of current pressure on resources, Value of Building Permits relative to a rough index of Present Resources (X_{13}), might all reflect expenditure needs. Variables which might be considered more directly by the decision makers are related to the municipality's internal financial structure. These include Municipal Debt

per Capita (X_{14}), Property Taxes per Capita (X_{15}), Proportion of Capital Expenditures (X_{17}), and reliance on other governments (X_{18}).

There is still a danger, however, that these variables are subject to variations in definitions among the ten provinces. Taxable or total assessment, a closer indicator of the level of wealth in a community, is not uniform across the country, so property taxes are used instead. Capital expenditures, which here is only a residual item after the current expenditures have been removed, may include such items as the sinking fund contributions in one province but not in another. Similarly government contributions also includes payments from neighbouring municipalities for services that have been provided. Moreover, in Quebec the contributions are incomplete, while in New Brunswick the effect of the provincial equalization payments is noticeable.

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SECTION 5.

Results of the Multiple Regression Analysis

A stepwise multiple regression was performed in order to examine the influence of these 22 independent variables upon each of the dependent variables in turn. From the matrix of simple correlation coefficients there appeared to be little evidence of high inter-correlation among these independent variables, although, as might be expected, close relationships existed between X_2 and X_4 (Average Incomes and % with High Incomes), X_7 and X_9 (% employed in Manufacturing, and % in crafts, production process, and labouring occupations) and between X_{16} and X_{22} (Income Taxes per Capita and Average Size of Families).

In each of the 7 functions and the Total Common Functions, the simple relationships between population size and per capita expenditures were low. They ranged from a positive simple correlation of .31 for police protection which "explained" 10% of the variation, to a negative correlation coefficient of -.20 for the other protective service, fire protection, "accounting for" only 4% of its variation. Two other functions, Sanitation and Waterworks, and Hospitals, also had negative signs which might be interpreted as indicating slight support for the existence of economies of scale. The positive relationships for the remaining functions hinted, although again only slightly, that diseconomies of scale might be present. The variables which are

significant at the 99% level of probability, statistically "explain" 56.29% of the variation for the total common functions, 44.98% for fire protection, 50.94% for police protection, and 53.71% for recreation and community services. The levels of "explanation" for the remaining functions however, are much lower. Only 29.17% of the variation in general government can be "explained", and for public works it is 13.86%, sanitation and waterworks, 13.01%, and 16.40% for hospital spending. On the whole the results bear a close resemblance to those discovered in the study of the larger Ontario municipalities (Bodkin and Conklin 1971), even though the figures in the present study are subject to inter-provincial variations and the more variable influence of the smaller centers.

The results are summarized in Appendix 2 in Tables 1 - 8 and indicate the cumulative percentage of the variation "explained" by the addition of the significant variables, (the corrected coefficient of multiple determination expressed as a percentage), together with the appropriate constant, regression coefficients and their t-values which indicate the significance of the coefficients. These results highlight the importance of the municipal or internal variables, X_{14}, X_{15}, X_{17}, and X_{18}. In general, the property tax per capita, which acts as an approximate surrogate for the wealth of the community, including its industrial assessment, tends to emerge as being particularly significant - although if revenues balance expenditures and property taxes account for a large proportion of these revenues,

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then there may be an element of self-correlation included here. This variable entered in Step 1 for total common functions, police protection, and recreation, and in Step 4 and 3 of the other functions. This could either reflect the demands for higher levels of expenditure imposed by wealthier communities, or it could reflect the greater resources available to be spent by the financial decision-makers. Municipalities willing or able to borrow money through the issue of debentures are also able to spend at a higher per capita level, as suggested by a positive correlation coefficient between spending and municipal debt per capita. This variable entered in Step 1 for general government, Step 6 for total common functions, and Step 6, recreation. The importance, too, of the setting aside of money for capital purposes instead of spending on a specific function is suggested by the entry of the capital % of total expenditures (X_{17}) in Step 2 for recreation, Steps 3 for total common functions and sanitation and waterworks, Step 4 for police and Step 6 for general government. The dependence on grants, although perhaps less important than has been suggested in the U.S. literature, also appears to exert some influence on the decision making process. Contrary to the conclusions of a number of earlier studies, the three income variables do not dominate the "determinants". The low income variable entered in Step 5 for total common functions and Step 2 for public works, while the average income of male taxpayers appeared in Step 2 both for general

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government as well as for fire protection.

On the whole, municipal decision makers do not appear to pay much attention to the pressures of past or future demographic or economic growth. This may be due to the presence of unused capacity in the social infrastructure, a lack of sensitivity or awareness of the need for planning, or simply that these pressures would be felt in the capital items of expenditures.

In addition to the variables already mentioned, in the case of the total common functions, the level of spending also appears to be inversely related to the dependency ratio or the unproductive proportion of the population. The only other variables which were significant, - but together "explaining" less than 1% of the variation, - were the indicators of the occupational structure of the communities. Thus, the economic type of community also appears to play little part in influencing the level of municipal expenditures.

As inter-provincial variations in expenditures might have accounted for part of these variations, this factor was eliminated as far as possible by repeating the analyses for each of the 5 major economic regions of Canada. The separate analysis of the variations in municipal spending for each of the ten provinces would have involved using too small a sample, with too few observations to produce meaningful results. Newfoundland, PEI, Nova Scotia and New Brunswick were grouped

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into the Atlantic Region, while Manitoba, Saskatchewan and Alberta were combined as the Prairie Region.

Once again the simple correlation coefficients indicating the strength of the association between population size and the per capita municipal expenditures on the common functions were so slight for each region that the same results could have been expected to occur by chance. Positive relationships, indicating the possible existence of diseconomies of scale, were present for 4 regions, while an inverse relationship, with possible scale economies, occurred for B.C. only. None of these simple correlation coefficients were statistically significant at the 95% level of probability, however, and only for the Prairies did population size "account for" more than 10% of the variations in the per capita expenditures. Similarly, for each of the six individual functions, population size exerted a negligible influence. Any technical benefit of scale-economies has been subsumed and obliterated by the influence of the other determinants of local government expenditures.

In virtually all cases the proportion of the variation which was statistically "explained" by the 22 independent variables increased in the 5 regional analyses. Only in the Atlantic and Ontario Regions were lower levels achieved for the per capita expenditures on the common functions. Considering only the variables which each added more than 1% to the corrected R^2, approximately comparable to the variables which

were significant at the 99% level of probability, these results for each dependent variable and region are indicated in Table 9. On the whole the levels of "explanation" are higher for B.C., the Prairies, and perhaps for the Atlantic Region, where there are all a more limited number of observations. Ontario, and to a lesser extent, Quebec, are characterised by lower levels of "explanation" by these 22 independent variables.

The relative importance of each independent variable in the analysis of the seven per capita expenditures is again indicated by the stage or step when it enters the analysis. At each step the variable with the highest partial correlation coefficient is entered; this, in effect, holds constant the influence of the other existing variables. These results have been summarized for each dependent variable in Tables 10 - 16. These list the variables added at each step for each of the 5 regions together with the appropriate corrected R^2 figures. The R^2 has been corrected according to the formula $R^2 - \frac{(k-1)}{(n-k)} \cdot (1-R^2)$ where k is the number of independent variables, including the constant, and n is the number of observations. The principal use $\bar{R}^2$ is to determine whether the increase in R^2 has more than compensated for the loss of one degree of freedom occasioned by using the same sample size in estimating an additional regression coefficient. The smaller the sample size the greater will be the effect of a loss of one degree of freedom.

These tables indicate that while there is often little

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uniformity in the results, on the whole, the four municipal variables again tend to be prominent, although not as important as when all 204 observations were grouped together in the national analyses.

In the analysis of per capita expenditures on the common functions property taxes per capita entered in Step 1 for Ontario and B.C. and Step 2 for Quebec, while municipal debt per capita entered in Step 5 for Quebec and the Prairies. The type of city appeared to be more important in the Atlantic Region, while the age of the city "explained" some of the variations in Ontario, the Prairies and B.C. Average family size appeared to have some "explanatory" power in the Atlantic, owner-occupancy ratic in Quebec. The dependency ratio was particularly noticeable for the Atlantic and Quebec. Except for the Prairies, and to a lesser extent, Ontario, average incomes and income-distribution tended to be unimportant, while the growth indices tended to be minor, except in the Prairies and B.C. Population size failed to add 1% to the levels of explanation in all 5 regions.

The relatively minor importance of the growth variables, and the income variables, contrast with the continued importance of the municipal variables in the analyses of the individual functions. For the protective functions, fire (Y_3) and police(Y_4) the income tax paid per capita (X_{16}), the owner occupancy percentage (X_{21}) age of community (X_{19})(X_{20}) and type of community,

and on occasions, appear to have some value in some regions as "explanatory" variables. Population size, however, was entered in Steps 3 in the Atlantic Region and B.C., for fire protection, and also in Quebec for police protection. While the financial resources available to a municipality are important for public works (Y_5) and sanitation and waterworks (Y_6) in Ontario municipalities, the variables indicating economic growth enter the analysis at an early stage for public works in Quebec and B.C., and for Ontario, Prairies and B.C. for sanitation and waterworks. The type of community appears important in B.C. for public works, and in Quebec, B.C. for sanitation and waterworks. Population size appears to be important in understanding the level of expenditure on public works in Quebec, while population density is important in Ontario for public works, and in Quebec for sanitation and water. Except in the Prairies for public works, the age of the community seems to be of minor importance.

When attention is confined to the individual decision-making units instead of including the metropolitan aggregates (the CMAs and CMUAs) with the geographically independent municipalities, however, different patterns emerge. The analyses were repeated using data for 363 centres instead of the original 204 urban areas by including all incorporated municipalities with populations greater than 5000 people in 1966. This involved replacing X_2, X_3, and X_4, with comparable data from the 1961 Census,

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while variables X_{16} and X_{17} also had to be dropped due to lack of data. Serious gaps in data coverage also occurred if a municipality had been unincorporated in 1961 or its population was too small for data to have been published.

The level of "explanation" for the total common functions dropped to 16.00% while for each individual function the levels increased to 29.03% for general government, 46.41% for fire protection, 56.01% for police protection, 44.08% for public works, and 40.69% for sanitation and waterworks and 48.9% for recreation and community.

Population size continued to enter only at a late stage and failed to add even ½% to the level of "explanation", except for sanitation and waterworks, where it added 2.2%. The influence of the municipal variables disappeared almost entirely. In general, they were replaced by variables related to the relative location of the community within a metropolitan area. The age of the community, occupational type of municipality, owner-occupancy ratio, population growth, and levels or distributions of earnings all tend to reflect whether the municipality has a suburban or central location. In every function, except for public works, the dependency ratio continued to be prominent in "accounting for" variations; even here a new suburb would be expected to have a large number of young couples with families.

Seven percent of the variation in the total common functions could be "attributed" to the 1961-66 change in population, while a further 4% was "related to" the percent with low

earnings; another 2% was associated with the percent employed in manufacturing, while the percent of municipal revenues from government grants and the property taxes per capita each "explained" over 1% of the variation. The dependency ratio entered the regression model in Steps 1 for general government, and fire protection, Step 2 for police, and Step 3 for sanitation and waterworks. The percent of dwellings in 1961 built between 1920 and 1945, reflecting the age of the community, entered in Steps 1 for fire, police, public works, and sanitation, while the owner-occupancy ratio in 1966 entered the model in Steps 2 for fire, and sanitation, or Steps 3 for general government. Average earnings of males in 1961 also entered in Step 3 for public works, and Step 4 for fire.

Contrary to the U.S. experience, however, Incrementalism does not appear to dominate the process by which Canadian municipal budgetary decisions are made. In the U.S.A. incrementalism, in which budgetary decision-makers base their expenditures on the previous levels of expenditure, adding perhaps 5% or 10% to counteract the effects of inflation or for expansions of existing programmes, has been shown, for example in Sharkansky (1969), to dominate the state expenditure determinants. This stability in the Canadian municipal decision making process, at least over a 7 year period, is not readily apparent since it appears that the relative importance of the various factors affecting the levels of municipal expenditures may well have changed over the period 1961-1968. The additions of the appropriate 1961 per

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capita expenditures to the 5 models for Total Common Functions, General Government, Public Works, Sanitation and Waterworks, and Recreation and Community Services, added small amounts to the previously obtained levels of "explanation". Fire protection and police protection could not be evaluated since they were combined in 1960 for Quebec, although their influence was included in the total per capita expenditures. The corrected coefficients of multiple determination were again expressed as a percentage to indicate the amount of the variation which had been "explained" by the significant independent variables. The addition of a new variable in each case increased the amount "accounted for", and the new percentages were 61.44% for Total, Common Functions, 42.92% for General Government, 27.85% for Public Works, 13.33% for Sanitation and Waterworks, and 56.87% for Recreation and Community Services. The addition of the appropriate 1961 per capita figures increased the levels of "explanation" by 13.99% for Public Works, 13.75% for General Government, and 5.15% for the Total, Common Functions, but by only 0.32% for Sanitation and Waterworks, and 0.16% for Recreation. These results suggest that an analysis of the changes that have taken place over time in each municipality might enable the cause of each change to be pinpointed in a survey of the decision makers.

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SECTION 6

General Conclusions

In such an exploratory study it is perhaps inevitable that a broad general conclusion must be that the determinants of municipal spending in the 204 largest urban centres and in the 363 municipalities of Canada are extremely complex. Even by utilizing 22 independent variables, well over half of the variations in per capita local government expenditures were left "unexplained", except for two of the functional categories and for the total common functions. Moreover, in separate analyses for each of the 5 major economic regions of Canada, less than half of the variations for the total common functions could be "explained" for two of these regions, while one-third of the studies of the 6 functional categories for the 5 regions failed to "account for" even as little as half of the variations. Any Canadian studies, however, are handicapped by the general state of ignorance about the local government decision making process. There is an absence of any general theory about the relative importance of various social, economic and political factors and how they influence the level of local government spending.

On the whole, the variables internal to the decision making process, which would be readily available to the municipal decision-makers, appear to occupy positions of prominence. Past or expected economic or demographic growth appears to play little

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part in determining the levels of expenditure on various functions, and local governments apparently spend as much money as the municipality is able to raise from local taxation, the capital market, or from other governments. There is no conclusive evidence that the public sector attempts to remedy the social and economic deficiencies of the private economic system, nor that the type of community affects the attitudes towards the acceptable or desirable level of local government expenditure. The dramatic changes in the levels of "explanation" and the relative importance of the various independent variables with the inclusion of the large number of municipalities within the metropolitan or major urban areas, suggests that the relative location within the larger area is an important determinant of local government spending.

It must be repeated, however, that correlation cannot be regarded as causation, and it is always feasible that some variables may merely be acting as surrogates of other, unmeasured or unmeasurable, variables. In a situation involving choice or a decision, random or unique local factors may always be expected to complicate the spatial patterns. In any event, it is not impossible that the quantitative measures used to "predict" the expected levels of municipal expenditures may be more sensitive than the municipal decision makers' perceptions of the community's needs and resources.

Greater knowledge about the determinants of local

government expenditures is urgently needed if the needs and problems of such a large element of the public sector is to be understood and solved. All evidence, however, points towards the fact that, in its simplest form, the size of a community does not, other things being equal, influence the level of local government spending. There is no evidence suggesting that economies or diseconomies of scale are present in Canadian local government expenditure patterns. Although population size cannot necessarily be equated with the level of municipal output, there is a general insignificance of the population variable, both when the simple correlation coefficient is considered and when the influence of more important variables has been isolated using a stepwise multiple regression analysis. This evidence may be substantiated by reducing the influence of the extremely large relative size of such cities as Toronto and Montreal through a log.-transformation of the population data, while further studies might also be conducted for various size-groups of cities.

The out-dated nature of the 1961 Census and the occasional gaps in the data-coverage might be overcome by repeating the study for 1971 when Census data could be utilized. The most serious, and again unavoidable, deficiency, however, has been the inability to take into account the variations in the quality and quantity of municipal services provided for the money expended by each municipality. It has frequently been argued that a larger municipality is able to, or would need to, provide better municipal services for its inhabitants than a

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smaller one. Until this very important source of variation is taken into account, nothing conclusive can be stated concerning the presence or absence of economies or diseconomies of scale in local government spending. Unless quantity of the municipal services, and ultimately the quality of services, can be controlled, there is a very real danger that like is not being compared with like. Although the level of expenditures are valuable as a first approximation or an introduction to the problem, the influence of different quantities or qualities of services that are provided for the same dollar-expenditure must be taken into account if a satisfactory answer is to be reached concerning economies and diseconomies of scale.

While little progress has been made in the U.S.A. towards incorporating quantity and quality of services into an analysis of local government expenditures, it seems likely that the data coverage within the Canadian provinces would offer much scope for a more sophisticated and complete study. As a relatively large number of urban areas and municipalities have been incorporated into the present study, it might be more realistic to focus further attention initially upon only a sample of these Canadian urban areas. If the objective of any further study is to understand the mechanism by which the local government decision making process actually operates and how the various factors influence the decision makers, then it would be better to concentrate on the centres with small residuals from the multiple regression. It is in these centres that the 22 independent

variables appear to have "explained" more of the variations in the levels of spending. On the other hand, if additional factors or sources of variation are being sought, it might be more profitable to focus attention upon the urban areas which have large positive and negative residuals, or where the present factors have been inadequate in accounting for the level of local government expenditure. These data, which are summarized in the maps of Appendix III, might be utilized to select centres for additional study.

The functions where the Department of Regional Economic Expansion has been spending much money under its Special Areas programme, education, sanitation and waterworks, and highways or public works, may well be amenable to further analysis of the current or operating costs of these municipal services. Since it might be feasible for a local government or the provincial government to shift its expenditures into the other functions, or an expansion in these functions may be necessary if they are to keep pace with any economic or demographic growth in the centre, it would be necessary to consider all local government functions.

While much work has been conducted into possible scale economies in education, largely through the measurement of achievement levels, enough data could be collected, given time and research resources, to justify a study of each local government function in Canada. As a starting point, for example, data might be collected on the volume of water supplied by each municipality or the volume and type of sewage treated, together with the

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proportion of the municipality served, the age or capacity of the sanitation and waterworks plant, and any special problems related to the local physical or industrial environment. The level of expenditures on public works, for example, might be expected to be related to the road mileage, or the width or surfacing of the roads, as well as to the density or type of traffic; snow removal costs and other consequences of the climate might also influence the amount which needs to be spent on this function. Police per capita expenditures might be related to the mileage of roads to be policed, the value of property to be protected, and the crime rates, as well as the size of the police force and the sophistication of their equipment. Similarly, not only would fire losses vary according to the quality of protection which is provided, but might be related to the size of the full time force, the quality of its equipment, and the fire risks present in each community. General government expenditures might also be expected to be related to the number of administrators employed, the amounts paid to legislators, as well as the amount of property which has to be maintained. Recreation and community service expenditures per capita, too, might be related to the acreage of parks which are provided, the size of the library, and whether other services like swimming pools or rinks or community centres are also provided by the municipality rather than by other organizations. Welfare expenditures are likely to be related to the level of poverty in the urban area, while education costs might be related to

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the size of classes, the number of teachers, the age of the buildings, the area covered, as well as the range of specialties offered and other aspects of the quality of education.

In addition, since the labour content of local government expenditures is likely to be quite sizeable, data might also be collected on the number of municipal employees for each function, together with their payrolls. This should then permit some consideration of the influence of variations in factor prices, another source of variation in the supply of local government services, to be incorporated into the analysis.

Although the present study has obtained valuable insights into the determinants of local government variations in per capita expenditures in Canada, it is obvious that much still needs to be done. In particular, before any conclusive evidence can be produced to support or refute the existence of economies or diseconomies of scale, there must be some consideration of the variations in the quantity and quality of municipal services which are provided. At the moment, all that can be stated is that there is no evidence suggesting that the size of a community has any influence upon its level of per capita expenditures. The Department of Regional Economic Expansion's Special Areas programme of encouraging the development of growth centres in slow-growth regions may not appear to have immediate implications for the municipal finance of municipalities which are designated for this special assistance with the social infrastructure. The federal/provincial assistance has largely been

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for projects of a capital nature, but a municipality cannot finance its share of the costs, or if the operating costs are subsequently found to be too high, or that the municipality cannot later afford to provide the other services necessary for a successful growth centre, then the success of the Special Areas programme will be a short term feature only. Heavy municipal indebtedness, or high property taxation, or poor municipal services could, in the long run, be a great disincentive not only to industry and commerce but also for the potential residents of a growth centre.

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APPENDIX I

SOURCES OF INDEPENDENT VARIABLES

X_1: Population Size, 1966.
Census of Canada 1966. Volume 1 (1-7, Population, Incorporated Cities, Towns and Villages, DBS Catalogue No. 92-607. Modified to include 1966-68 boundary changes involving complete amalgamations or annexations of entire municipalities, including areas with no organized municipal governments.)

X_2: Average Incomes of Male Taxpayers, 1968.
Unpublished Tabulation for ADA, prepared by the Department of National Revenue.

X_3: Percentage of Male Taxpayers with Incomes Below $2,000, 1968.
Unpublished tabulation for ADA prepared by the Department of National Revenue.

X_4: Percentage of Male Taxpayers with Incomes over $10,000, 1968.
Unpublished tabulation for ADA prepared by the Department of National Revenue.

X_5: Population Density per Square Mile, 1966.
Modified from Census of Canada, 1966. Volume 1, (1-1) Introduction to Volume 1, DBS Catalogue No. 92-601.

X_6: Dependency Ratio, 1966 (% of Population Aged Over 65 and Under 20). Census of Canada, 1966. Volume 1, (1-10). Age Groups. DBS Catalogue No. 92-610.

X_7: Economic Type of Community, 1961. (% of Labour Force in Manufacturing Industries, 1961). Census of Canada, 1961. Vol. III, Part 2, Labour Force. DBS Catalogue No. 94-519, 94-520, 94-521, and 94-522.

X_8: Occupational Type of Community. (% of Labour Force in Managerial, Professional and Technical Occupations, 1961). Census of Canada, 1961. Vol. III, Part 1, Labour Force. DBS Catalogue Nos. 94-504, 94-505, 94-506, and 94-508.

X_9: Occupational Type of Community. (% of Labour Force as Labourers, Craftsmen and Production Process Workers, 1961). Census of Canada, 1961. Vol. III, Part 1, Labour Force. DBS Catalogue Nos. 94-504, 94-505, 94-506, 94-508.

X_{10}: Population-Change, 1961-1966. (1966 as a % of 1961). Based upon Census of Canada, 1966. Volume 1 (1-7) Population, Incorporated Cities, Towns and Villages, DBS Catalogue No. 92-607.

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X_{11}: Changes in Value of Retail Trade, 1961-1966.(1966 as a % of 1961). Census of Canada, 1961. Volume VI, Part 1, Retail Trade. Locations, Counties or Census Divisions and Incorporated Places of 1,000 population and over. DBS Catalogue No. 97-502.
Census of Canada, 1966. Volume VI (6-3) Retail Trade, Counties or Census Divisions, Cities and Towns. DBS Catalogue No. 97-603.

X_{12}: Changes in Value Added by Manufacturing, 1961-1968.(1968 as a % of 1961). DBS Daily Bulletin Supplement, Advance Statement No. 3. Summary Statistics of Manufacturing Industries, Selected Cities and Census Metropolitan Areas, 1961-1964. DBS Catalogue No. 31-209.
DBS 1968 Annual Census of Manufactures, Preliminary Bulletin. Manufacturing Industries - Geographical Distribution, Selected Municipalities and Census Metropolitan Areas. DBS Catalogue No. 31-209-P-2.
Unpublished Tabulations from the Manufacturing & Primary Industries Division, DBS.

X_{13}: Value of Building Permits as a % of Total Revenues, 1968.
DBS (Business Finance Division). Building Permits, Annual Summary, 1968. DBS Catalogue No. 64-203.
Total Revenues -
Newfoundland, Department of Municipal Affairs and Housing. 1968 Annual Report of Municipal Statistics, pp.35 & 37. (Total Revenues - Deficit).
Prince Edward Island, Annual Report of the Department of Municipal Affairs, 1969, p. 11 (Total - Taxes applied for Education).
Nova Scotia, Department of Municipal Affairs, Annual Report of Municipal Statistics for the year 1968, pp.30 & 37. (Total Revenue - Education Expenditures, pp. 32 & 39).
New Brunswick, Department of Municipal Affairs, 1968. Annual Report of Municipal Statistics, pp. 17, 78, 79. (Grand Total).
Quebec, Bureau de la Statistique de Québec. Finances Municipales pour l'année financière 1968-69, pp. 92-148. (total - Autres Sections, Vente d'Energie electrique, et autres revenus).
Ontario, Department of Municipal Affairs, 1968. Summary of Financial Reports of Municipalities, pp. 2-231. (Total Revenues - Local Contributions for Education).
Manitoba, Department of Urban Development and Municipal Affairs. 1968 Statistical Information respecting the Municipalities of the Province of Manitoba and the Metropolitan Corporation of Greater Winnipeg, pp. 21 & 23. (Total Revenues - Tax Imposition, Schools).

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Saskatchewan, Annual Report of the Department of Municipal Affairs of the Province of Saskatchewan for the Fiscal Year 1968-69, pp. 151 (Total - Education expenditures, p. 173).
Alberta, Annual Report of the Department of Municipal Affairs of the Province of Alberta for the year 1968, pp. 6, 68, 284, 316. (Grand Total Revenues - Education Expenditures, pp. 6, 69, 283, 317).
British Columbia, Department of Municipal Affairs, Municipal Statistics, Including Regional Districts, for the Year ended Dec. 31, 1968, pp. 85-91. (Total Revenues - School Taxation).

X_{14}: Municipal Debt per Capita, 1968.

Newfoundland, op. cit. pp. 17, 19 (Capital Fund - Debenture Debt, Other Long Term Debt).
Prince Edward Island: City of Charlottetown Financial Statements, December 31, 1968, p.4 (Capital Funds: Debentures Payable) and Commissioners of Sewers and Water Supply, Charlottetown Financial Statements, December 31, 1968, p. 2 (Long Term Liabilities). Annual Report of the Town of Summerside for the Fiscal Year ending December 31st, 1968, p. 16 (Capital Fund Liabilities - Debentures Payable), and p. 30 (Water Utility Capital Fund Liabilities - Outstanding Liabilities, and Sewer Utility Capital Fund Liabilities - Outstanding Debentures).
Nova Scotia, op. cit. pp. 27, 34 (General Section, Capital Fund Liabilities - Debenture Debt, Due to other Funds (term), and Other Term Debt) and p. 50 (Water Utilities, Capital Fund Liabilities - Term Debt) and unpublished information from Public Service Commission of Halifax, Caledonia Power and Water Board, and Dominion Utilities
New Brunswick, op. cit. pp. 9, 62, 63. (General Capital and Loan Fund Liabilities - Long Term Debt) and pp. 24, 90. (Water and Sewerage Utility Capital & Loan Fund Liabilities - Long Term Debt).
Québec, op. cit. pp. 9-59 (Passif du Fonds de Capital et d'Emprunts - Dette Obligataire, Section Generale, Aqueduc et Egouts).
Ontario, op. cit. pp. 6-230 (Capital Fund Liabilities - Net Long Term Liabilities, General Municipal Activities).
Ontario Department of Municipal Affairs, 1968, Summary of Financial Reports of Municipal Enterprises pp. 4-80 (Water Utilities Net Longterm Liabilities).
Manitoba, op. cit. pp. 15, 17. (Capital and Loan Fund Liabilities - Unmatured Debenture Debt).
Alberta, op. cit. pp. 11, 100, 296, 322 (General Capital and Loan Fund Liabilities, Debenture Debt, Other Long Term Liabilities).

British Columbia, op. cit. pp. 52-59 (General Capital and Loan Fund Liabilities - Total Debenture Debt, Other Long Term Debt), and pp. 101-109 (Waterworks Utility Capital & Loan Fund Liabilities - Debenture Debt - Short Term Capital Borrowing, Other Long Term Debt).

X_{15}: Property Taxes per Capita, 1968.

Newfoundland, op. cit. pp. 34, 36 (Real Property Tax).
P.E.I., op. cit. p. 11 (Real Property Assessments)- taxes applied for Education.
Nova Scotia, op. cit., pp. 7, 18 (Real Property Taxation Revenue) - Education Expenditures (pp. 37, 39).
New Brunswick, op. cit. pp. 17, 78, 79 (Local Warrant).
Québec, op. cit. pp. 92-148 (Section Génerale, Taxes Foncières Generales et Speciales).
Ontario, op. cit. pp. 2-231 (Realty Taxation - Residential and Farm, and Commercial & Industrial).
Manitoba, op. cit. pp. 20 & 22 (Tax Imposition - General).
Saskatchewan, op. cit. p. 103 (General Municipal) - Real Property, Business & Occupancy Taxation.
Alberta, op. cit. pp. 6, 67, 283, 315 (Amalgamated Tax Levy - Real Property) - Education Expenditures (pp. 6, 69, 283, 317).
British Columbia, op. cit. pp. 84-90 (Real Property Taxation - Municipal Purposes).

X_{16}: Income Taxes per Capita, 1968.

Unpublished Tabulation, Department of National Revenue.

X_{17}: Capital Expenditures as a % of Total Municipal Expenditures, 1968.

Capital Expenditures:
Newfoundland, op. cit. pp. 41, 49, and Water and Sewer Utility Current Expenditures, and Fire and Police Expenditures - Current Expenditures.
P.E.I. Charlottetown op. cit. pp. 3, and Rink Expenditures, and Sewer & Water Expenditures - Current Expenditures. Summerside, op. cit. pp. 19, 31 (Water) 32 (Sewer), 34 (Civic Stadium), and 35 (Swimming Pool) - Current Expenditures.
Nova Scotia, op. cit. pp. 33, 40, 52 (Water Utilities), 66,(Community & Recreation Centres) and unpublished data from Public Services Commission of Halifax, Caledonia Water & Power Co., Dominion Utilities - Current Expenditures.
New Brunswick, op. cit. pp. 20, 84, 85, & 32, 98 (Water & Sewer Utilities - Current Expenditures.
Québec, op. cit. pp. 92-149 (Total Depenses - Depenses, Autres Sections) - Current Expenditures.
Ontario, op. cit. pp. 4-228 (Total) + Enterprises op. cit. pp. 3-79 (Total, Water Utilities) - Current Expenditures.

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Manitoba, op. cit. pp. 25, 27, and pp. 29, 31 (Water and Sewer Utilities) - Current Expenditures.
Saskatchewan, op. cit. pp. 173 and 194 (Water Utility) - Current Expenditures.
Alberta, op. cit. pp. 6, 72, 284, 318, and pp. 16, 112, 302, 326 (Water Supply System) - Current Expenditures.
British Columbia, op. cit. pp. 93-99 and pp. 127-133 (W (Waterworks Utility) - Current Expenditures.

X_{18}: Government Contributions as a % of Total Revenues, 1968.
Contributions:
Newfoundland, op. cit. p. 35 (Provincial Government - Revenue Grant, Public Works, Other).
P.E.I., op. cit. p. 11 (Per Capita Grants, Other Grants).
Nova Scotia, op. cit. p. 41, 42 (Total Contributions, Grants & Subsidies).
New Brunswick, op. cit. pp. 17, 78, 79 (Provincial Grants, Other Government Grants).
Québec, op. cit. pp. 92-148 (General Section Subventions - Province, Federal, Section Aqueduc et Egouts, Subventions - Province).
Ontario, op. cit. pp. 2-231 (Total Contributions from Other Governments).
Manitoba, op. cit. pp. 21, 23. (Grants in Lieu of Taxes, Other Grants).
Saskatchewan, op. cit. p. 151 (Contributions).
Alberta, op. cit. pp. 6, 68, 284, 318 (Contributions, Grants and Subsidies).
British Columbia, op. cit. pp. 85-91 (Contributions, Grants and Subsidies).
Total Revenues: - As for X_{13}.

X_{19}: Age of City. % of Total Dwellings in 1961 Built Before 1920. Census of Canada, 1961. Volume 2, Part 2, Housing - Basic Dwelling Characteristics, DBS Catalogue No. 93-523.

X_{20}: Age of City. (% of Dwellings in 1961 Built between 1920 and 1945).

X_{21}: Owner-occupancy Ratio, 1966 (% of Dwellings in 1966 Occupied by Owners). Census of Canada, 1966. Volume II (3-2) Households and Families - Dwellings by Structural Type and Tenure. DBS Catalogue No. 93-602.

X_{22}: Average Family Size, 1966. (Average Number of Persons per Family, 1966). Census of Canada, 1966. Volume II (2-9) Households and Families - Families by Size. DBS Catalogue No. 93-609.

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APPENDIX II

RESULTS OF THE MULTIPLE REGRESSION ANALYSES

TABLE I

COEFFICIENTS OF MULTIPLE DETERMINATION

ASSOCIATED WITH THE MOST POWERFUL INDEPENDENT VARIABLES,

AS DETERMINED BY STEP-WISE REGRESSION

Dependent Variable: 1968 TOTAL PER CAPITA EXPENDITURES ON THE COMMON FUNCTIONS IN THE URBAN CENTRES WITH OVER 5,000 PEOPLE, IN CANADA

Step		Independent Variables Added	Cumulative % of Variation "Explained"
1.	X_{15}	Property Tax Per Capita, 1968	35.21
2.	X_6	Dependency Ratio, 1966	44.36
3.	X_{17}	Capital Expenditures as a % of Total Expenditures, 1968	50.50
4.	X_{18}	Government Contributions as a % of Total Revenues, 1968	53.01
5.	X_3	% of Male Taxpayers with Incomes under $2,000, 1968	54.79
6.	X_{14}	Municipal Debt per Capita, 1968	55.32
7.	X_8	% of Labour Force in Managerial, Professional and Technical Occupations, 1961	55.74
8.	X_9	% of Labour Force as Labourers, Craftsmen and Production Process Workers, 1961	56.29

$$Y_1 = \underset{(0.04)}{160.85} - \underset{(-2.18)}{0.55X_3} - \underset{(-4.49)}{2.20X_6} + \underset{(2.06)}{0.50X_8} + \underset{(1.87)}{0.25X_9}$$

$$+ \underset{(1.99)}{0.02X_{14}} + \underset{(7.04)}{0.51X_{15}} - \underset{(-3.73)}{0.55X_{17}} + \underset{(4.55)}{0.34X_{18}}.$$

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TABLE 2

COEFFICIENTS OF MULTIPLE DETERMINATION
ASSOCIATED WITH THE MOST POWERFUL INDEPENDENT VARIABLES,
AS DETERMINED BY STEP-WISE REGRESSION

Dependent Variable: 1968 PER CAPITA EXPENDITURES ON GENERAL GOVERNMENT, URBAN CENTRES WITH OVER 5,000 POPULATION, IN CANADA

Step		Independent Variables Added	Cumulative % of Variation "Explained"
1.	X_{14} -	Municipal Debt per Capita, 1968	13.02
2.	X_2 -	Average Income of Male Taxpayers, 1968	19.17
3.	X_8 -	% of Labour Force in Managerial, Professional & Technical Occupations, 1961	21.36
4.	X_{15} -	Property Tax per Capita, 1968	22.90
5.	X_{16} -	Income Taxes paid per Capita, 1968	25.63
6.	X_{17} -	Capital Expenditures as a % of Total Expenditures, 1968	27.46
7.	X_9 -	% of Labour Force as Labourers, Craftsmen & Technical Occupations, 1961	28.10
8.	X_{21} -	% of Dwellings Occupied by Owners, 1966	28.65
9.	X_5	Population Density per Square Mile, 1966	29.17

$$Y_2 = 2.96 + 0.0014X_2 - 0.0004X_5 + 0.14X_8 + 0.05X_9 + 0.0009X_{14}$$
$$(0.0001) \quad (3.10) \quad (-1.56) \quad (2.63) \quad (1.86) \quad (3.25)$$

$$+ 0.06X_{15} - 0.008X_{16} - 0.08X_{17} - 0.04X_{21}.$$
$$(3.06) \quad (-2.54) \quad (-2.45) \quad (-1.67)$$

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TABLE 3

COEFFICIENTS OF MULTIPLE DETERMINATION
ASSOCIATED WITH THE MOST POWERFUL INDEPENDENT VARIABLES[1]
AS DETERMINED BY STEP-WISE REGRESSION

Dependent Variable: 1968 TOTAL PER CAPITA EXPENDITURES ON FIRE PROTECTION IN THE URBAN CENTRES WITH OVER 5,000 PEOPLE, IN CANADA

Step		Independent Variables Added	Cumulative % of Variation "Explained"
1.	X_{22}	Average Family Size, 1966	19.63
2.	X_4	% of Male Taxpayers with Incomes over $10,000, 1968	27.66
3.	X_{18}	Government Contributions as a % of Total Revenues, 1968	30.66
4.	X_{15}	Property Tax per Capita, 1966	35.62
5.	X_5	Population Density per Square Mile, 1966	39.45
6.	X_{11}	Changes in Value of Retail Trade, 1961-1966	42.36
7.	X_{21}	% of Dwelling Occupied by Owners, 1966	44.03
8.	X_{19}	% of Dwellings Built Before 1920, 1961	44.98

$$Y_3 = \underset{(0.004)}{7.90} + \underset{(3.11)}{0.23X_4} + \underset{(3.57)}{0.0009X_5} - \underset{(-3.08)}{0.02X_{11}} + \underset{(4.94)}{0.08X_{15}} + \underset{(5.43)}{0.08X_{18}}$$

$$+ \underset{(2.09)}{0.03X_{19}} - \underset{(-2.66)}{0.06X_{21}}.$$

TABLE 4

COEFFICIENTS OF MULTIPLE DETERMINATION
ASSOCIATED WITH THE MOST POWERFUL INDEPENDENT VARIABLES,
AS DETERMINED BY STEP-WISE REGRESSION

Dependent Variable: 1968 TOTAL PER CAPITA EXPENDITURES ON POLICE PROTECTION IN THE URBAN CENTRES WITH OVER 5,000 PEOPLE, IN CANADA

Step		Independent Variables Added	Cumulative % of Variation "Explained"
1.	X_{15}	Property Taxes per Capita, 1968	32.74
2.	X_6	Dependency Ratio, 1966	40.33
3.	X_7	% of Labour Force Employed in Manufacturing, 1961	43.47
4.	X_{17}	Capital Expenditures as a % of Total Expenditures, 1968	46.00
5.	X_1	Population Size, 1966	48.17
6.	X_{13}	Building Permits as a % of Total Municipal Revenues, 1968	49.07
7.	X_{22}	Average Family Size, 1966	50.06
8.	X_2	Average Income of Male Taxpayers, 1968	50.94

$$Y_4 = \underset{(0.00008)}{15.54} + \underset{(3.14)}{0.00000X_1} + \underset{(2.12)}{0.0007X_2} - \underset{(-0.81)}{0.08X_6} + \underset{(3.82)}{0.05X_7}$$

$$+ \underset{(1.97)}{0.002X_{13}} + \underset{(5.25)}{0.07X_{15}}.$$

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TABLE 5

COEFFICIENTS OF MULTIPLE DETERMINATION
ASSOCIATED WITH THE MOST POWERFUL INDEPENDENT VARIABLES,
AS DETERMINED BY STEP-WISE REGRESSION

Dependent Variable: 1968 TOTAL PER CAPITA EXPENDITURES ON PUBLIC WORKS IN THE URBAN CENTRES WITH OVER 5,000 PEOPLE, IN CANADA

Step		Independent Variables Added	Cumulative % of Variation "Explained"
1.	X_{16}	Income Taxes paid per Capita, 1968	6.96
2.	X_3	% of Male Taxpayers with Incomes under $2,000, 1968	10.38
3.	X_{18}	Government Grants as a % of Municipal Revenues, 1968	13.86

$$Y_5 = \underset{(0.009)}{20.41} - \underset{(-3.96)}{0.44X_3} + \underset{(1.20)}{0.006X_{16}} + \underset{(3.02)}{0.10X_{18}}.$$

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TABLE 6

COEFFICIENTS OF MULTIPLE DETERMINATION
ASSOCIATED WITH THE MOST POWERFUL INDEPENDENT VARIABLES,
AS DETERMINED BY STEP-WISE REGRESSION

Dependent Variable: 1968 TOTAL PER CAPITA EXPENDITURES ON SANITATION AND WATERWORKS IN THE URBAN CENTRES WITH OVER 5,000 PEOPLE, IN CANADA

Step		Independent Variables Added	Cumulative % of Variation "Explained"
1.	X_{16}	Income Taxes paid per Capita, 1968	8.19
2.	X_8	% of Labour Force in Managerial, Professional and Technical Occupations, 1961	10.44
3.	X_{17}	Capital Expenditures as a % of Total Expenditures, 1968	12.24
4.	X_{15}	Property Tax per Capita, 1968	13.01

$$Y_6 = \underset{}{11.67} + \underset{(0.005)}{0.23X_8} + \underset{(2.17)}{0.05X_{15}} + \underset{(1.66)}{0.006X_{16}} - \underset{(1.21)}{0.14X_{17}}. \quad \underset{(-2.41)}{}$$

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TABLE 7

COEFFICIENTS OF MULTIPLE DETERMINATION
ASSOCIATED WITH THE MOST POWERFUL INDEPENDENT VARIABLES,
AS DETERMINED BY STEP-WISE REGRESSION

Dependent Variable: 1968 TOTAL PER CAPITA EXPENDITURES ON RECREATION & COMMUNITY SERVICES IN THE URBAN CENTRES WITH OVER 5,000 PEOPLE, IN CANADA

Step		Independent Variables Added	Cumulative % of Variation "Explained"
1.	X_{15} -	Property Tax Per Capita, 1968	40.47
2.	X_{17} -	Capital Expenditures as a % of Total Expenditures, 1968	44.82
3.	X_{19} -	% of Total Dwellings in 1961 Built Before 1920, 1961	47.06
4.	X_{22} -	Average Family Size, 1966	49.99
5.	X_{6} -	Dependency Ratio, 1966	50.76
6.	X_{5} -	Population Density, 1966	51.43
7.	X_{14} -	Municipal Debt per Capita, 1968	51.90
8.	X_{18} -	Government Grants as a % of Total Revenues, 1968	52.70
9.	X_{20} -	% of Dwellings Built Between 1920 and 1945, 1961	53.36
10.	X_{8} -	% of Labour Force in Managerial Professional & Technical Occupations, 1961	53.71

$$Y_7 = \underset{}{25.40} \underset{(0.01)}{- 0.0006X_5} \underset{(-2.31)}{- 0.28X_6} \underset{(-2.03)}{+ 0.09X_8} \underset{(1.57)}{+ 0.007X_{14}} \underset{(2.39)}{+ 0.14X_{15}} \underset{(7.37)}{}$$

$$\underset{}{} \underset{(-2.48)}{- 0.09X_{17}} \underset{(2.17)}{+ 0.04X_{18}} \underset{(-3.71)}{- 0.06X_{19}} \underset{(1.96)}{+ 0.04X_{20}}$$

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TABLE 8

COEFFICIENTS OF MULTIPLE DETERMINATION
ASSOCIATED WITH THE MOST POWERFUL INDEPENDENT VARIABLES,
AS DETERMINED BY STEP-WISE REGRESSION

Dependent Variable: 1968 TOTAL PER CAPITA EXPENDITURES ON HOSPITALS IN THE URBAN CENTRES WITH OVER 5,000 PEOPLE, IN CANADA

Step		Independent Variables Added	Cumulative % of Variation "Explained"
1.	X_{19}	% of Dwellings Built Before 1920, 1961	5.37
2.	X_9	% of Labour Force as Labourers, Craftsmen and Production Process Workers, 1961	11.55
3.	X_8	% of Labour Force in Managerial, Professional & Technical Occupations, 1961	12.10
4.	X_4	% of Male Taxpayers with Incomes over $10,000, 1968	13.17
5.	X_{16}	Income Taxes paid per Capita, 1968	15.26
6.	X_{18}	Government Contributions as a % of Total Revenues, 1968	16.40

$$Y_8 = \underset{}{199.43} - \underset{(0.004)}{10.62X_4} + \underset{(-3.06)}{4.76X_8} - \underset{(2.09)}{3.99X_9} + \underset{(-3.61)}{0.03X_{16}} - \underset{(2.92)}{1.19X_{18}} + \underset{(1.92)}{1.58X_{19}}$$

$$(2.96)$$

TABLE 9

Levels of "Explanation"
by Functional Category
and Major Economic Region
of Canada, 1968

Dependent Variable	Atlantic Region	Quebec	Ontario	Prairie Region	British Columbia	Total (204 Obs.)	Total (363 Obs.)
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Total Common Functions	49.0	76.8	40.4	79.7	86.1	56.3	16.0
General Government	42.3	43.0	39.3	33.2	92.6	29.2	29.0
Fire Protection	55.2	47.9	59.5	79.3	81.3	45.0	46.4
Police Protection	61.9	49.0	57.5	87.4	93.2	50.9	56.0
Public Works	80.1	40.7	20.8	50.4	87.2	13.9	44.1
Sanitation & Waterworks	63.0	30.1	27.5	82.1	77.9	13.0	40.7
Recreation & Community Services	73.7	53.6	45.2	55.1	84.7	53.7	48.9

Only Variables adding more than 1% to the Amount "Explained" are included.

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TABLE 10

Corrected Coefficients of Multiple Determination
Associated with the Independent Variables Adding 1%
As Determined by Stepwise Regression,
By Major Economic Regions of Canada

Dependent Variable: 1968 Total Per Capita Expenditures on the Common Functions

Independent Variable Added
(& Corrected Cumulative % of Variation 'Explained')

Step	Atlantic Region		Quebec		Ontario		Prairie Region		British Columbia	
		(%)		(%)		(%)		(%)		(%)
1.	X_6	(23.9)	X_6	(39.3)	X_{15}	(21.4)	X_2	(37.9)	X_{15}	(49.0)
2.	X_{22}	(36.0)	X_{15}	(59.5)	X_3	(30.7)	X_9	(52.1)	X_{16}	(57.2)
3.	X_8	(45.7)	X_{21}	(64.3)	X_{20}	(37.5)	X_7	(56.4)	X_{11}	(68.1)
4.	X_7	(49.0)	X_8	(67.6)	X_6	(38.7)	X_{13}	(61.1)	X_{19}	(80.8)
5.			X_{14}	(69.4)	X_{16}	(40.4)	X_{14}	(72.0)	X_{20}	(84.6)
6.			X_{17}	(71.6)			X_{19}	(75.5)	X_{22}	(86.1)
7.			X_{18}	(74.2)			X_3	(77.8)		
8.			X_4	(75.3)			X_{11}	(79.7)		
9.			X_2	(76.8)						

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TABLE 11

Corrected Coefficients of Multiple Determination
Associated with the Independent Variables Adding 1%
As Determined by Stepwise Regression,
By Major Economic Regions of Canada

Dependent Variable: 1968 Per Capita Expenditures on General Government, Urban Areas with over 5,000 population in Canada

Independent Variable Added
(& Corrected Cumulative % of Variation 'Explained')

Step	Atlantic Region		Quebec		Ontario		Prairie Region		British Columbia	
		(%)		(%)		(%)		(%)		(%)
1.	X_6	(26.1)	X_{15}	(23.8)	X_2	(18.9)	X_{15}	(2.8)	X_7	(28.7)
2.	X_{20}	(31.7)	X_6	(28.7)	X_{15}	(23.2)	X_5	(8.3)	X_{17}	(55.8)
3.	X_3	(34.8)	X_{22}	(30.0)	X_6	(28.5)	X_{18}	(15.1)	X_{14}	(63.1)
4.	X_2	(40.6)	X_{14}	(31.5)	X_8	(30.9)	X_6	(21.9)	X_{10}	(79.3)
5.	X_9	(42.3)	X_2	(34.8)	X_4	(35.5)	X_{14}	(25.6)	X_8	(83.7)
6.			X_{17}	(37.5)	X_7	(38.3)	X_2	(33.2)	X_{19}	(85.9)
7.			X_{18}	(41.5)	X_{20}	(39.3)			X_3	(89.5)
8.			X_4	(43.0)					X_{13}	(92.6)

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TABLE 12

Corrected Coefficients of Multiple Determination
Associated with the Independent Variables Adding 1%
As Determined by Stepwise Regression
By Major Economic Regions of Canada

Dependent Variable: 1968 Per Capita Expenditures on Fire Protection, Urban Areas in Canada with over 5,000 Population

Independent Variable Added
(& Corrected Cumulative % of Variation 'Explained')

Step	Atlantic Region		Quebec		Ontario		Prairie Region		British Columbia	
		(%)		(%)		(%)		(%)		(%)
1.	X_{16}	(30.4)	X_{21}	(28.9)	X_{15}	(19.9)	X_4	(49.6)	X_{19}	(35.6)
2.	X_{21}	(41.4)	X_6	(36.2)	X_4	(27.1)	X_{13}	(64.2)	X_{12}	(51.3)
3.	X_1	(45.8)	X_9	(39.3)	X_{16}	(37.0)	X_7	(73.2)	X_1	(60.1)
4.	X_{22}	(48.9)	X_{14}	(41.0)	X_{13}	(39.8)	X_{21}	(79.3)	X_{22}	(66.3)
5.	X_{19}	(50.5)	X_{10}	(46.4)	X_{12}	(43.4)				
6.	X_{18}	(52.0)	X_3	(47.9)	X_3	(45.7)				
7.	X_9	(55.2)			X_{21}	(47.7)				
8.					X_{19}	(49.6)				
9.					X_5	(50.6)				
10.					X_{22}	(51.9)				
11.					X_9	(54.2)				
12.					X_6	(57.8)				
13.					X_{10}	(59.5)				

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TABLE 13

Corrected Coefficients of Multiple Determination
Associated with the Independent Variables Adding 1%
As Determined by Stepwise Regression
By Major Economic Regions of Canada

Dependent Variable: 1968 Per Capita Expenditures on Police Protection, Urban Areas in Canada with over 5,000 Population

Independent Variables Added
(& Corrected Cumulative % of Variation 'Explained')

Step	Atlantic Region		Quebec		Ontario		Prairie Region		British Columbia	
		(%)		(%)		(%)		(%)		(%)
1.	X_8	(38.2)	X_{16}	(31.1)	X_{18}	(28.2)	X_4	(61.7)	X_{15}	(57.0)
2.	X_{21}	(48.7)	X_3	(41.4)	X_3	(36.6)	X_{12}	(71.4)	X_5	(67.4)
3.	X_{20}	(56.8)	X_1	(45.9)	X_{14}	(43.0)	X_{15}	(75.1)	X_{18}	(83.9)
4.	X_6	(61.9)	X_{18}	(49.0)	X_{17}	(47.0)	X_9	(76.9)	X_{14}	(88.0)
5.					X_{21}	(50.7)	X_1	(81.3)		
6.					X_{19}	(53.5)	X_{18}	(93.9)		
7.					X_{20}	(56.1)	X_{20}	(85.3)		
8.					X_1	(57.5)	X_2	(87.4)		

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TABLE 14

Corrected Coefficients of Multiple Determination
Associated with the Independent Variables Adding 1%
As Determined by Stepwise Regression
By Major Economic Regions of Canada

Dependent Variable: 1968 Per Capita Expenditures on Public Works, Urban Areas in Canada with over 5,000 Population

Step	Independent Variable Added (& Corrected Cumulative % of Variation 'Explained')									
	Atlantic Region	(%)	Quebec	(%)	Ontario	(%)	Prairie Region	(%)	British Columbia	(%)
1.	X_{21}	(7.4)	X_{11}	(9.5)	X_{15}	(4.3)	X_{19}	(27.7)	X_{11}	(21.1)
2.	X_{20}	(24.8)	X_{1}	(15.0)	X_{5}	(6.8)	X_{20}	(37.4)	X_{20}	(48.2)
3.	X_{2}	(34.8)	X_{6}	(27.9)	X_{16}	(9.0)	X_{12}	(41.8)	X_{8}	(63.2)
4.	X_{1}	(43.4)	X_{15}	(32.9)	X_{3}	(13.9)	X_{13}	(44.6)	X_{15}	(71.6)
5.	X_{17}	(55.1)	X_{22}	(35.9)	X_{22}	(15.9)	X_{6}	(46.6)	X_{13}	(77.9)
6.	X_{4}	(59.4)	X_{17}	(37.7)	X_{21}	(20.8)	X_{3}	(50.4)	X_{16}	(81.0)
7.	X_{7}	(61.9)	X_{14}	(39.4)					X_{19}	(82.9)
8.	X_{18}	(63.7)	X_{16}	(40.7)					X_{14}	(87.2)
9.	X_{22}	(69.8)								
10.	X_{12}	(77.1)								
11.	X_{14}	(80.1)								

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TABLE 15

Corrected Coefficients of Multiple Determination
Associated with the Independent Variables Adding 1%
As Determined by Stepwise Regression,
By Major Economic Regions of Canada

Dependent Variables: 1968 Per Capita Expenditures on Sanitation and Waterworks, Urban Areas in Canada with over 5,000 Population

Independent Variable Added
(& Corrected Cumulative % of Variation 'Explained')

Step	Atlantic Region		Quebec		Ontario		Prairie Region		British Columbia	
				(%)		(%)		(%)		(%)
1.	X_{13}	(9.7)	X_8	(21.1)	X_{15}	(15.7)	X_6	(20.4)	X_{11}	(21.5)
2.	X_{10}	(25.9)	X_{22}	(28.4)	X_{11}	(20.2)	X_{11}	(26.4)	X_{12}	(28.1)
3.	X_5	(29.2)	X_5	(30.1)	X_{12}	(24.2)	X_{21}	(33.6)	X_8	(34.8)
4.	X_{22}	(31.8)			X_3	(26.3)	X_9	(34.9)	X_{21}	(57.9)
5.	X_6	(47.0)			X_5	(27.5)	X_5	(36.4)	X_{19}	(62.6)
6.	X_1	(58.9)					X_{16}	(42.9)	X_9	(66.9)
7.	X_{14}	(62.7)					X_8	(50.8)	X_{14}	(69.2)
8.	X_{19}	(63.0)					X_{14}	(53.4)		
9.							X_{19}	(59.4)		
10.							X_{10}	(70.8)		
11.							X_{12}	(75.9)		
12.							X_2	(82.1)		

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TABLE 16

Corrected Coefficients of Multiple Determination
Associated with the Independent Variables Adding 1%
As Determined by Stepwise Regression
By Major Economic Regions of Canada

Dependent Variables: 1968 Per Capita Expenditures on Recreation and Community Services, Urban Areas in Canada with over 5,000 Population

Independent Variable Added
(& Corrected Cumulative % of Variation 'Explained')

Step	Atlantic Region		Quebec		Ontario		Prairie Region		British Columbia	
		(%)		(%)		(%)		(%)		(%)
1.	X_6	(48.3)	X_{15}	(41.7)	X_2	(26.3)	X_9	(22.9)	X_{15}	(30.5)
2.	X_{22}	(57.8)	X_{21}	(51.9)	X_{14}	(36.2)	X_{14}	(33.4)	X_{19}	(39.6)
3.	X_9	(68.3)	X_6	(53.6)	X_{15}	(39.1)	X_{21}	(43.0)	X_{14}	(49.0)
4.	X_3	(69.7)			X_7	(40.3)	X_3	(51.5)	X_1	(58.0)
5.	X_{19}	(71.5)			X_{21}	(42.2)	X_{11}	(52.9)	X_8	(69.7)
6.	X_{15}	(72.8)			X_{12}	(44.0)	X_1	(55.1)	X_7	(76.2)
7.	X_5	(73.7)			X_4	(45.2)			X_5	(79.9)
8.									X_6	(81.6)
9.									X_{11}	(84.7)

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TABLE 17

CORRECTED COEFFICIENTS OF MULTIPLE DETERMINATION ASSOCIATED WITH THE INDEPENDENT VARIABLES ADDING 1% AS DETERMINED BY STEPWISE REGRESSION, 363 INCORPORATED MUNICIPALITIES IN CANADA WITH OVER 5,000 POPULATION FOR VARIOUS DEPENDENT VARIABLES, 1968

Independent Variable Added
(and Corrected Cumulative % of Variation 'Explained')

Step	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
1.	X_{10} (7.1)	X_6 (14.1)	X_6 (34.7)	X_{20} (47.8)	X_{20} (25.9)	X_{20} (16.7)	X_{15} (44.2)
2.	X_2* (11.0)	X_8 (19.9)	X_{21} (41.4)	X_6 (53.0)	X_{19} (40.9)	X_{21} (26.4)	X_{20} (45.7)
3.	X_7 (13.6)	X_{21} (23.6)	X_{20} (43.7)	X_{21} (54.9)	X_2* (42.8)	X_6 (30.7)	X_{23} (46.8)
4.	X_{18} (15.4)	X_{12} (25.4)	X_2* (46.4)	X_{19} (56.0)	X_3* (44.1)	X_{22} (34.4)	X_6 (47.9)
5.	X_{14} (16.0)	X_5 (26.6)				X_{12} (36.8)	X_{18} (48.9)
6.		X_3* (27.6)				X_1 (38.7)	
7.		X_9 (29.0)				X_5 (39.8)	
8.						X_{11} (40.7)	

Y_1: Total per Capita Expenditures on the Common Functions.
Y_2: General Government Expenditures per Capita.
Y_3: Fire Protection Expenditures per Capita.
Y_4: Police Protection Expenditures per Capita.
Y_5: Public Works Expenditures per Capita.
Y_6: Sanitation and Waterworks Expenditures per Capita.
Y_7: Recreation and Community Services Expenditures per Capita.

X_2* - Average Earnings of Male Wage-earners, 1961 Census.

X_3* - Percentage of Male Wage-earners earning under $2,000, 1961 Census.

19 Independent Variables used. (1968 Income Tax data replaced with 1961 Census data.)