MACRO-ECONOMIC INFLUENCES ON URBAN EMPLOYMENT PATTERNS

MACRO-ECONOMIC INFLUENCES ON URBAN EMPLOYMENT PATTERNS - AN INPUT-OUTPUT ANALYSIS

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ABSTRACT

The purpose of this study is to explore the influence on urban employment patterns of changes in demand for commodities by foreign and domestic consumers. Foreign induced changes in commodity demand are reflected in this study by assumed changes in exports of selected commodity groups, ranging from relatively unprocessed groups such as grain, to sophisticated groups such as electrical products and chemicals. The domestic sources of commodity demand change considered in this study are various components of current expenditure by the federal government - on health, education and defence programs, as well as on total government expenditure. The influence of these sources of final demand change is traced to the employed populations of Montreal and Toronto metropolitan areas, and the component districts of these urban areas. An important concern is with whether or not some shocks tend to alleviate or accentuate existing unemployment rate disparities between the central city and fringe of Montreal and Toronto.

A national input-output system, together with an appended employment allocation matrix is utilized to estimate the urban employment impacts. The area impacts differ because, on the one hand, employment in some industries is affected more than in others, depending on the particular source of final demand change assumed, and on the other hand,

the proportion of an area's employed population affiliated with a given industry tends to differ from that of other areas.

Before implementing the model the latter proposition, concerning inter-area differences in industrial affiliation pattern of the employed, is supported by theoretical reasoning and empirical analysis. Theoretically, different industries have different locational preferences in an urban area, as a result of factors related to technology, cost of production, and market access. Combined with the theoretical assumption concerning minimization of cost and/or distance of travel to work, area differences in the proportion of workers affiliated with a given industry is implied. This hypothesis is not rejected by analysis of variance experiments based on the pattern of male and female employed populations residing in districts of Montreal and Toronto. Adjusted census statistics on the employed population are used in these experiments, the adjustment being required in order to make the urban portion of the model consistent with the 1961 input-output system.

Implementation of the model reveals that the metropolitan areas of Montreal and Toronto are influenced to similar degrees by the assumed changes in various components of final demand, but that certain sub-metro areas were affected more than others. There is a tendency for suburban and wealthier areas to be affected more than central and less affluent

districts though there are important exceptions. Some components of final demand change tend to accentuate existing intra-urban unemployment disparities.

It is finally shown how the area impact disaggregated by sub-population can be used to identify structural factors responsible for inter-area differences in the total impact. The disaggregated impacts also reveal qualitative, or distributional aspects of the aggregate impacts and thus may be of interest to urban planners. It is possible, for example, to check if female or male employees, affiliated with a lower paying industry group, and resident in a relatively poor district of the city, is influenced more than average by a particular type of final demand change.

The limitations and possible extensions are finally reviewed. One limitation involves the assumption that given the industry, sub-populations of the employed are discharged at similar rates when there is a fall in product demand. The theory treating labour as a quasi-fixed factor implies that the lower grades of labour would be discharged at higher rates than the higher grades. Any bias due to the omission of this effect would reinforce the results related to intra-urban unemployment rate disparities, however. Future research suggested by this study include incorporation of the discriminatory discharge effect into the

model and further disaggregation of the work force of industries, according to occupation or income group.

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INTRODUCTION

Changing expenditure programs of governments and shifting export patterns are common phenomena in several countries. Many studies may be cited which have as their aim the estimation of the regional impact of such changes.[1] In contrast the study of the impact of these macro-economic phenomena on urban and sub-city areas has been largely ignored. This situation exists despite the fact that urban social and economic problems are no less important than regional problems, although they are sometimes of a different character. Some conceptual frameworks have been proposed to estimate urban impacts,[2] but none have been implemented.[3] Regarding this situation as a deficiency in the literature of urban economics, it is the objective of this study to propose a model capable of implementation, and to estimate the effect of various macro-economic phenomena on urban employment patterns. Another objective is to assess whether or not

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[1] One of the more accessible studies is Wassily Leontief, et al., "The Economic Impact - Industrial and Regional - of an Arms Cut", Review of Economics and Statistics, XLVII, 3 (August, 1965), 217-41. A more general discussion is contained in Marvin Hoffenberg and Eugene J. Devine, "Influence of National Decisions on Regional Economies", in Werner Z. Hirsch, ed., Regional Accounts for Policy Decisions (John Hopkins Press, 1966).

[2] Two examples are: Barbara R. Bergmann, "The Urban Economy and the 'Urban Crisis'", American Economic Review, LIX, 4, Part 1 (September, 1969), 639-45; and Edwin S. Mills, "An Aggregate Model of Resource Allocation in a Metropolitan Area", American Economic Review, LXII, 2 (May, 1967), 197-210.

[3] The models require statistics that are unavailable.

the burden of impact is higher in areas of cities already beset by more than their share of problems.

An input-output system is the core of the model used in estimating the macro-economic effects on urban employment patterns. Input-output frameworks are fundamental components of Bergmann's model, one of Mills'[4] and many other urban and regional models. These frameworks are widely utilized in both regional and urban research since they depict aspects of the economy not found in other conceptual schemes, such as most econometric models. For example, the input-output framework depicts the inter-relation among a large number of commodity markets, and the relationship between industrial production and the use of primary factors. Since the distribution of industry varies over space, and especially within urban areas, the fine industry detail characteristic of input-output models is useful in providing the link between macro-economic phenomena and the spatial dimension of macro-economic influences. In the model proposed in this study the impacts by industry are related to urban areas and sub-city areas by utilizing statistics on the employed population classified by place of residence and industry affiliation. This data base, derivable from the decennial census, has not previously been related to input-output systems for the purpose of studying macro-economic effects on urban employment patterns. The disaggregation according to area of resi-

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[4]Edwin S. Mills, "Markets and Efficient Resource Allocation in Urban Areas", Swedish Journal of Economics, LXXIV, 1 (March, 1972), 100-117.

dence takes on particular significance in an urban context where, on the one hand, the population classified by area of residence cannot be assumed to correspond to that classified by area of work, and on the other hand, influences on employment patterns seem to be more meaningfully aggregated on a place of residence basis. Most social problems that may be influenced by unemployment and reductions in income, for example, are more apparent from the vantage point of the home than of the workplace.

The major disadvantage of developing a model capable of implementation is that it necessitates the omission of important aspects of the urban economy. Aspects related to urban land use are perhaps the most important omission of the model developed in this study.[5] On the other hand many sophisticated urban models in which land use variables are endogenous tend to be weak in their treatment of manpower, by considering it to be a homogeneous factor of production.[6] This treatment ignores the fact that manpower varies substantially in quality within an urban area and is one dimension of urban disparities that has received attention in the literature.[7]

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[5] Urban land use data on a sub-city basis are unavailable in Canada.

[6] This is characteristic of Mills' models, for example.

[7] A review of the literature on urban disparities is contained in Timothy Schiltz and William Moffitt, "Inner-City/Outer-City Relationships in Metropolitan Areas: A Bibliographic Essay" Urban Affairs Quarterly, VII, 1 (September, 1971), 75-108.

Several arguments may be advanced for limiting the scope of the model to employment patterns. While not denying the importance of land use each argument emphasizes the importance of employment patterns in an urban setting. For example, one argument arises from the widespread feeling that urban unemployment is linked to other social problems. Thus Thompson argues that chronic unemployment "can originate in either structural or cyclical change" when structural forces such as discrimination in hiring practices are present, and that chronic unemployment is related to various urban problems such as slum formation.[8] Lithwick, in his study on urban poverty in Canada, draws the link to employment: "--- full employment is a necessary requirement for constraining an increase in urban poverty at any point in time".[9] The exact mechanism by which these problems are interrelated is not entirely clear from these discussions although the greater income and feeling of dignity and initiative that follows from having a job, as opposed to receiving welfare payments or unemployment insurance, would seem to be at least a part of the mechanism. To pursue this interesting question satisfactorily would require a separate study. The point that requires emphasis, given our domain of interest, is that unemployment is seen by some urban economists as being related to and perhaps even the source

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[8]Wilbur R. Thompson, A Preface to Urban Economics (John Hopkins, 1965). pp. 218-219.

[9]N.H. Lithwick, Urban Poverty, Research Monograph No. 1 (Central Mortgage and Housing Corporation, 1971), p. 32.

of other typically urban social problems.

A strong concern for employment patterns in urban areas may also be justified on empirical grounds. An examination of the facts reveals that urban Canada is not so free of problems of unemployment, compared to national standards, as is sometimes thought. An unemployment rate for metropolitan areas and associated central cities based on 1961 census statistics is presented in Appendix A, Table A1. The national male rate constructed using the same statistical source as this table is 4.2%, a rate that is exceeded in five of the seventeen metropolitan areas and nine of the seventeen central cities, including Montreal, Toronto and Vancouver. The national female rate of 2.9% is exceeded by rates in eight metropolitan areas and seven central cities. Table A2 in Appendix A indicates six metro areas with higher male and female rates in 1971 than the Canadian averages of 7.4% and 8.9% respectively,[10] including Montreal and Vancouver. The conceptually preferable Labour Force Survey estimates, available only for the larger metropolitan areas, do not contradict these results - the unemployment rates of both Montreal and Vancouver exceed the Labour Force Survey national rate of 6.2%.[11] The unemployment rate of Toronto is not much less than the national rate according to both measures of the unemployment rate.

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[10]The source is Table 1 of reference noted in footnote 1 of Table A2.

[11]The source is Table 12 of reference noted in footnote 2 of Table A2. The comparison is made on the basis of 1971 statistics. There are no estimates, derived from the Labour Force Survey, of urban unemployment rates in 1961.

Within metropolitan areas it is easy to find census tracts with unemployment rates much higher than the national or city rates. In the central city of Montreal, for example, the 1961 male unemployment rate in the low income district bounded by Ste Catherine, Sherbrooke, Bleury and St. Denis (census tracts 49, 53 and 54) is 9.4 %, more than twice the city rate.[12] The female rate, 5.1%, is just under twice the rate for the city. Rates in some other census tracts are over three times the city average.

In summary, the evidence suggests that unemployment rates in several cities, including the largest in Canada, are high by national standards and that there is also substantial variation within metro area boundaries. The evidence helps to justify a study of influences on employment patterns in urban areas. The justification is stronger when the empirical evidence on urban unemployment is coupled with the argument that the problem of unemployment is related to other social problems of the city.

More than just the scope of the model has to be limited if the objective is implementation. The range of application must also be limited since it would be impossible to adequately assess influences on employment in all Canadian cities, for example. The applications are thus limited to the Montreal and Toronto metropolitan areas. As

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[12] Census tract unemployment rates, comparable to those in Table A1, may be calculated by dividing the population looking for work by the labour force; these statistics are presented on a census tract basis in: DBS, 1961 Census of Canada, Population and Housing Characteristics by Census Tracts Bulletin CT-4 (Ottawa, 28-8-1963), Table 3.

Canada's largest urban areas it is expected that the inter-relation among social problems is more highly developed than in smaller cities.[13] In addition, the unemployment rates of the two metropolitan areas and of component census tracts are not low by Canadian standards and in the case of many census tracts, exceed the Canadian rate by a wide margin.

In the next chapter the literature is reviewed. The model is developed in Chapter III. Aspects of the spatial pattern of the employed population which are relevant to the operation of the model are examined in Chapter IV. Implementation problems are discussed in Chapter V, and the results of the applications are portrayed in Chapter VI. The concluding chapter summarizes the findings, points out limitations and discusses possible related avenues for future research.

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[13] This may be due in part to greater degrees of residential segregation. According to Thompson, "As our urban areas grow to giant size, the long standing practice of residential segregation by income threatens to sever all contact between slum dwellers and the middle-and upper-income classes". Thompson, op. cit., p.6.

II

DETERMINANTS OF EMPLOYMENT CHANGE IN AN URBAN AREA - SOME THEORETICAL CONSIDERATIONS

The study of macro-economic influences on urban employment patterns may be approached from several different directions, each having practical and theoretical advantages and disadvantages. In order to justify any one approach it is useful to survey the literature on the employment change process in an urban context. Such a review is also useful in providing some background against which a chosen methodological approach can be rationally discussed and the results generated by it interpreted.

As mentioned in the introductory chapter there are few studies directly addressed to the problem of determining macro-economic effects on urban employment patterns. There are, however, several studies of indirect interest to our central topic. An interesting peculiarity of the literature is that relevant studies containing an urban focus tend to ignore the employment change process while those focusing on employment change tend to ignore the urban context. The cost, in terms of loss of valuable information about cities, is high in both cases.

Assume there is a fall in demand[1] due to either a fall in public

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[1] A fall rather than a rise in demand is considered in order to simplify the discussion. There are also theoretical reasons why the conceptual framework, developed in the next chapter, is more appropriate under the assumption of a fall rather than a rise in demand. In our context the question of effects of a fall in demand is of more interest than the effects of a rise since social problems are more aggravated thereby.

expenditure or a fall in exports. This fall in demand will be reflected in a fall in output and employment. The fall will vary in degree by industry, since we are assuming a fall in only some components of final demand, not all components. The concern of this chapter is with the factors influencing inter-city and inter-neighbourhood differences in employment reductions. Factors influencing inter-neighbourhood differences are of particular interest since these have been ignored in the literature despite the existence of substantial inter-neighbourhood differentials in the degree of social and economic problems within large cities. The reasons why areas may experience different levels of unemployment, given a fall in demand, may be traced to two sources - the residential location choice decision and the hire-fire decision. These are now discussed in turn.

1. Determinants Associated With Residential Location Choice

In an inter-neighbourhood setting an individual or family will be influenced by the distance to work, the attractiveness of neighbourhoods (neighbourhood factors) and by financial resource constraints when choosing a residential location. The outcome of all residential choices in a neighbourhood, of explicit decisions to move to or from the neighbourhood and of implicit choices to remain in the neighbourhood, determine the industrial affiliation pattern of the residents. Residential choice also determines the quality or occupational pattern of the residents in a neighbourhood. Both the industrial affiliation and occupational pattern of the residents of an area is related to the area's susceptibility to unemployment vis-à-vis other neighbourhoods since, given some fall in demand, industries and occupations will be differentially

affected.

This basic argument involves several implicit assumptions requiring elaboration and justification. The first models of an urban area assumed all jobs were located in the centre of the city and that workers maximized utility by choosing residential sites such that the distance to work was minimized.[2] These models did not seem to allow for the possibility of inter-neighbourhood diversity in terms of industrial or occupational affiliation of residents and thus oversimplified the depiction of urban structure. Relaxation of the assumption requiring all jobs to be located at the centre of the city and allowance for the existence of more than one industry would seem to permit the possibility of inter-neighbourhood diversity. Suburban industries could then differ from industries attracted to the central business district and the industrial affiliation of residents in suburban neighbourhoods would tend to be more biased toward suburban industries than would the affiliation of residents in more central locations, assuming individuals attempt to minimize the distance travelled to work. The features of multiple employment locations in an urban area and of a number of industries with different production functions are built into a recent model developed by Hartwick and Hartwick,[3] though they have not explored the possibility of inter-neighbourhood diversity in characteristics of residents which would seem to be a logical outcome

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[2]Boventer provides a good survey in:
Edwin von Boventer, "Towards a United Theory of Spatial Economic Structure", Papers, Regional Science Association, X (1962), 163-91.

[3]John M. Hartwick and Philip G. Hartwick, "Efficient Resource Allocation in a Multinucleated City", Discussion Paper 86, Queen's University, Kingston, 1972.

of their assumptions.

The empirical basis of the assumptions of journey-to-work minimization and multiple employment locations seems to be fairly well established. Due to the possibility of traffic congestion distance is more appropriately measured in units of time than in physical terms. One of the few empirical studies using time distance found that in Detroit "minimization is a potent influence".[4]

Haig provided one of the earliest applications of the tools of economics to the study of multiple employment locations.[5] Mills gives a more modern discussion. He argues that firms in some industries will be prepared to pay more for central locations, which are in relative short supply and more expensive than the more decentralized locations. The firms in these industries will be typified by less rapidly diminishing returns on the ratios of capital, labour and other factor inputs to land than the firms submitting lower bids for central sites.[6] Mills'

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[4]The actual time spent in travel between residence zones and workplace zones was compared to a minimum time obtained by solving the linear programming transportation problem, and to an "indifference time" obtained on the assumption that workers are indifferent to travel time. From these figures an indifference index was calculated which was zero if the actual time equalled the minimum time, indicating extreme sensitivity to distance travelled, or one in value, if the actual time equalled the indifference time. The index was found to have a value of .39 which is closer to zero than to one. See John R. Hamberg, et al., "Linear Programming Test of Journey-to-Work Minimization", Highway Research Record, No. 102 (1965), 67-75.

[5]Robert Murray Haig, "Toward an Understanding of the Metropolis: II. The Assignment of Activities in Urban Regions", Quarterly Journal of Economics, XL, 3 (1926).

[6]Mills uses this argument to account for inter-industry differentials in suburbanization; see Edwin S. Mills, Urban Economics (Scott, Foresman and Company, 1972), pp. 93-5.

figures indicate that population (housing) is the most suburbanized, followed by manufacturing and retailing, then services and finally wholesaling. Population and all industry groups are becoming more suburbanized as the century proceeds.

Actually, as technology changes within an industry, the newer establishments may take on a different intra-urban locational pattern than the older.[7] Employees affiliated with the older firms would tend to live nearer the location of these firms than those affiliated with the newer firms. Since the marginal costs of older firms may change at different rates from those of newer, for reasons of technological differences, a reduction in demand at the industry level may be felt more by the older (or newer firms), and employment levels in neighbourhoods accessible to older firms would thus tend to be influenced more (or less) than neighbourhoods accessible to the newer firms. Considering the effect of impacts that differ by industry, a fall in some component of final demand affecting centralized industries more than suburbanized industries would tend to result in a greater employment reduction in central neighbourhoods than suburban neighbourhoods.

Distance to work is not the only factor entering the residence location decision and may not even be important for some sub-populations.

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[7]There may even develop a territorial division of functions of a firm as Haig explained in 1926: Haig, op. cit., pp. 415-416.

Hamberg et al. found that the higher income groups were more indifferent to travel time to work than lower income groups.[8] Other studies have shown that neighbourhood effects, such as neighbourhood quality, neighbourhood prestige and zoning influence the choice of residential site; these effects have been isolated by studies of the determinants of property values.[9] The consequence of these effects is that higher income households tend to live together in districts separate from lower income households. This variety of segregation between neighbourhoods tends to be greater in larger cities.[10]

The significance of residential segregation to an argument concerning intra-urban influences on employment patterns may be appreciated as soon as it is recognized that some industries employ a higher proportion of high earnings individuals. If these industries are forced to reduce their work force more than others, then, other things equal, the higher quality areas of a city will tend to find themselves with more of the newly unemployed workers than other areas in the city. This conclusion is valid even if industries do not have different location preferences and even if distance to work is an insignificant factor in the choice of residence site. Areas with low representation

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[8] Hamberg et al. op. cit., p. 74.

[9] R.R.G. Ridker and J.A. Henning, "The Determinants of Residential Property Values with Special Reference to Pollution", Review of Economics and Statistics, LXIX, 2 (May, 1967), 246-57. See also John F. Kain and John M. Quigley, "Measuring the Value of Housing Quality", Journal of the American Statistical Association, LXV (June, 1970), 532-48.

[10] See footnote 8, Chapter I.

of high earning workers will be less vulnerable than areas with high representation. These conclusions would be reversed if lower earnings industries were more vulnerable in terms of employment reductions than other industries.

The phenomenon of residential segregation has only recently been depicted by formal urban models, and then only in primitive forms. Mills and MacKinnon state:

> "Under some restrictive conditions it can be shown that, if the population consists of two or more groups which differ only in exogenously determined incomes, then the higher income groups live further from the CBD and in the lower density neighbourhoods than the lower income groups, in both equilibrium and optimum solutions."[11]

Later they added:

> "It would be desirable to introduce population types that are diverse in skills or endowments of productive assets. What can be said about the optimum residential mixing of such diverse groups?"[12]

Perhaps of even greater interest would be the unemployment and other social implications of different neighbourhood mixings of population. It is not surprising, given the main thrust of recent research, that this point is not raised in this excellent review article of formal urban models.

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[11] Edwin S. Mills and James MacKinnon, "Notes on the New Urban Economics", The Bell Journal of Economics and Management Science, IV, 2 (Autum, 1972), 596.

[12] Ibid. p. 597.

It is interesting to note that the formal models that permit more than one industrial district do not recognize different sub-populations while the ones that do, assume only one centrally located industrial district. This is indicative of the early stage of development of formal urban models. Other aspects of individual choice that would appear to influence urban structure have not yet appeared in formal urban models. Choice of mode of transit to work is one example. Also, individual rather than family units are assumed although labour force participation of married women may be a "necessary" precondition enabling wider choice of neighbourhoods.[13] Inter-neighbourhood variations in labour force participation of married women may in itself be a determinant of inter-neighbourhood differences in influences on employment patterns resulting from given reductions in components of final demand. The reason for this is that the particular final demand change may result in a greater impact on industries employing high proportions of female employees. The existence of such "female" industries has long been recognized and has been cited as a factor influencing inter-regional industrial location choices.[14]

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[13]Skoulas refers to interdependence of individual and family decisions, though not specifically of residence site and labour force participation: N. Skoulas, Determinants of the Participation Rate of Women in the Canadian Labour Force: An Econometric Analysis (Information Canada, 1974), p. 37, footnote 11.

[14]Robert Murray Haig, "Toward an Understanding of the Metropolis: I. Some Speculations Regarding the Economic Basis of Urban Concentration", Quarterly Journal of Economics, XL, 1 (February, 1926), 194-5.

2. Determinants Associated With The Hire-Fire Decision

Up to this point the discussion has assumed non-discriminatory behaviour on the part of employers when faced with the decision of which employees to lay off. Yet discrimination by businesses when laying off employees is another potential source of variation in the spatial impact of employment change. There has been a preoccupation in the United States with racial discrimination, this showing up in many of the text-books in urban economics. Hirsch, for example, states "Not only has there been higher unemployment among non-whites, but they long have been the first to be let go when a recession sets in".[15] According to Mills, "Poorly paid workers in general and blacks in particular tend to be the last to be hired and the first to be fired".[16] It is granted that these authors and also Thompson admit to other forms of discrimination yet at least one empirical study, by Gilman, has found that although non-whites are more adversely affected by declines in demand for labour, it "is due mainly to their unfavorable occupational distribution".[17]

The proposition that occupation or skill is a factor entering the business decision as to whom to lay off is supported by the theory of labour as a quasi-fixed factor.[18] Briefly, this theory is based on

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[15]Werner Z. Hirsch, Urban Economics Analysis (McGraw Hill, 1973), p. 168.

[16]Mills, op. cit., p. 150.

[17]H.G. Gilman, "The White/Non-White Unemployment Differential", in Mark Perlman, ed., Human Resources in the Urban Economy (Resources for the Future, 1963), p. 102.

[18]Walter Y. Oi, "Labor as a Quasi-Fixed Factor", Journal of Political Economy, LXX, 6 (December, 1962).

the premise that a firm finds it profitable to incur fixed costs related to its work force, in the form of hiring a specific stock of workers and in training designed to improve worker productivity. The implication is that "Decisions regarding the labor input can no longer be based solely on the current relation between wages and marginal value products but must also take cognisance of the future courses of these quantities".[19] In more concrete terms, the more specific the training a group of workers receives the more insensitive it will be to lay off resulting from reductions in product demand. Also, the more training a worker has when hired the less vulnerable he will be to employment lay off since rehiring costs are higher and an educated person would be more likely to require higher outlays for specific training.

The hypotheses suggested by this theory were not rejected by the empirical analysis of Oi. Of most relevance in our context is the finding that "Low wage occupations, corresponding to low degrees of fixity, do experience relatively greater changes in employment".[20] In a more recent study Clark found that durable goods industries "hoard" labour, the labour hoarding lag in his best model ranging from a low of 1 month to a high of 22 months.[21]

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[19] Ibid., p. 539.

[20] Oi, op. cit., p. 549.

[21] C. Scott Clark, "Labor Hoarding in Durable Goods Industries", American Economic Review, LXIII, 5 (December, 1973), 823.

Hellman indicates the possibility of classifying industries according to the degree of fixity of their labour forces. He hypothesizes, "The greater the proportion of training costs paid for by the firm or industry, the greater the stability of employment within that industry".[22] He sees labour fixity varying among cities according to their industrial structure and postulates that cities with industries characterized by low fixity are more vulnerable to cyclical unemployment.

But there are intra-urban implications too. If we accept with Oi that earnings can be taken as a proxy for labour fixity, and this may not be legitimate for all industries, then, given our previous conclusion regarding residential segregation, it follows that the tendency will be for workers laid off to reside in areas where average incomes are lower. This conclusion would appear to hold true whether or not households select residence sites so as to minimize the distance to work and even if the total employment reduction is similar in proportional terms in all industries. And other things equal, industries characterized by higher degrees of work force fixity will lay off fewer employees, implying that the impact on the low average income areas would be even higher in relation to the higher average income areas. Because of the existence of residential segregation the intra-urban implications would seem to be more interesting than the inter-urban although these have been ignored in the literature.

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[22]Daryl A. Hellman, "The Spatial Distribution of Unemployment by Occupation: A Further Note", Journal of Regional Science, XIII, 3 (December, 1973), 464.

3. Determinants of Inter-Urban Differentials in Impact

Why should a cutback in one government program or a reduction in exports of a particular product have a greater impact on one large urban area than another? The Heckscher-Ohlin theory of international and inter-regional trade would attribute a difference to differences in industrial structure, which in turn is a consequence of differences in resource endowment.[23] Since mobility of resources has been increasing with time, and relatively immobile resources have been decreasing in importance compared to mobile factor and intermediate inputs, it is doubtful if the industrial structures of large cities, which are not too far separated from each other, would differ greatly. A large proportion of industrial and commercial activity of large cities is geared to the requirements of that particular city. If the populations of two large cities have comparable value systems and levels of income the commercial and industrial activity demanded by these populations should not differ greatly. On the basis of these considerations it is expected that inter-city differences in the industrial structure of large cities would not be as significant as inter-neighbourhood differences in the attributes of neighbourhood populations within cities. This proposition, however, must remain a hypothesis at this stage of the inquiry.

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[23] Bertil Ohlin, Inter-regional and International Trade, Revised Edition, (Cambridge, 1967).

4. Summary and Implications

The purpose of this chapter has been to survey the various factors influencing the spatial pattern of employment change, given a change in a component of final demand. The first point made is that the impact on employment will vary in intensity by industry. Then, if the proportion of the employed affiliated with each industry varies by area, there will be a tendency for the area impact to be uneven, being stronger in areas with relatively high proportions of the employed affiliated with industries receiving the brunt of the impact.[24] Within urban areas the proportion of the employed affiliated with each industry was expected to vary among areas as a consequence of the residence site decision. Since the required industry impacts may be estimated using an input-output system, and the spatial impact could be traced, utilizing census information on the industrial affiliation of the employed tabulated by area of residence, this approach offers good possibilities for implementation.

A second approach related to the above was based on the possibility that (a) the impact would vary by type or technology of the firm, given the industry, and (b) that the proportionate affiliation of the employed with the different types of establishment would differ from area to area depending on, among other factors, which type of establishment was most accessible to the area. Without any knowledge of the establishment affiliation of the employed, this approach would

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[24] The proportion was expected to vary by urban area as a consequence of spatial variation in resource endowment, implying, according to the Heckscher-Ohlin theory, specialization by area in production.

appear to be impossible to implement. Moreover, the direction of any area bias due to omitting this factor in an estimation model cannot be anticipated with the available data.

A third potential approach is based on the expectation that, given the industry, some sub-populations of the employed stand a greater chance of being affected by lay-off decisions than do others. If these sensitive sub-populations tend to reside in neighbourhoods different from the other sub-populations these neighbourhoods should experience greater fluctuations in unemployment. Since the more sensitive sub-populations are expected to have lower earnings and less skill they will tend to reside in older and less attractive areas of the city. Available information would seem to rule out the possibility of quantifying these discriminatory effects on an industry basis.[25] Another disadvantage of this approach is that it has been developed under the assumption that employment in only one firm has changed. Aside from this assumption being unrealistic, by ignoring the effect of a firm's behaviour on suppliers, etc., this approach could give inaccurate estimates of area influences on employment patterns for two reasons. First, the firms indirectly affected by a decision to reduce output and employment may lay off employees with different characteristics who tend to live in other areas of the city. Secondly, if firms in many industries lay off employees in a discriminatory manner the depressing

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[25]Earnings data are unavailable from the Labour Force Survey which would probably be the best source of information. Also the industry detail available from the Labour Force Survey is limited.

effect on market wage rates of the lower grades of labour will be stronger and these effects will induce firms to revise their lay-off policies. While the first objection to the approach could be met by employing an input-output system to estimate indirect effects on other industries, the second problem mentioned is less resistant to solution.

At least, however, the direction of area bias due to discriminatory lay-off policies is known - the impact would tend to be underestimated in poor districts and overestimated in rich districts of a city. Besides indicating a source of bias this lay-off discrimination effect also provides a clue to how an urban area should be subdivided for studies of influences on urban employment patterns. The subdivision should be based on the average incomes of residents so that poor districts are kept separate from the more affluent districts.

In the next chapter a model capable of estimating area influences on employment patterns is developed. It is based on the first approach mentioned in this summary.

III

THE CONCEPTUAL FRAMEWORK

Assume that there is a reduction in some component of aggregate demand; for example, of federal expenditure on a public program or of exports of a particular commodity group. Assume further that it is of interest to estimate the impact on the employed population of Canada's largest cities, Montreal and Toronto, and on the neighbourhoods comprising these cities. Based on the discussion of the preceding chapter, the most promising approach is to estimate, by using an input-output system, the impact on the aggregate employed population on an industry basis, then to use statistics on the industry affiliation of the employed classified by city and neighbourhood to calculate area impacts. These two components of the estimation framework, the input-output system and the area allocation system, are now discussed in turn.

1. The Input-Output System

In an ideal setup, it would be desirable to produce urban manpower impacts by using an inter-regional or inter-urban input-output system.[1] The information requirements of these systems are so great that few countries possess them. An inter-regional system does not exist for Canadian regions. Even with such a system, however, one

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[1] Such as that developed in: W.W. Leontief and A. Strout, "Multi-Regional and Input-Output Analysis", in Tibor Barna, ed., Structural Interdependence and Economic Development (MacMillan, 1963), Chapter 7.

would require additional information and techniques to estimate the manpower effects on a neighbourhood basis.

Some analysts have proposed, for regional analysis, the use of national input-output systems, together with regional information on production activity but not on the inter-regional flows of commodities. A group of economists from Harvard, for example, developed a three step model for regional analysis, the first step of which estimated the impact of an assumed change in final demand on the country as a whole using a national input-output model.[2] Use of a national input-output system ensures that regional estimates produced in later stages are consistent in the sense that regional effects add up to the national totals.

A well developed system of input-output accounts has been produced for Canada.[3] Two models have been developed from these accounts - an "open" model which estimates the direct and indirect effects of assumed changes in final demand, and a "household" model which differs by regarding the household sector as part of the productive system, thus enabling the quantification of induced effects due to altered household incomes to be added to the direct and indirect effects.

These models are now developed in some detail, using whenever possible the basic notation and notational conventions used by the United

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[2]Wassily Leontief et al., "The Economic Impact-Industrial and Regional - of an Arms Cut", The Review of Economics and Statistics, XLVII, 3 (August, 1965).

[3]A description of an early version of the accounts and related models is contained in Dominion Bureau of Statistics, The Input-Output Structure of the Canadian Economy, 1961, Volume 1 (Ottawa, 1969).

Nations.[4] Capital letters are used to denote matrices, small letters to denote column vectors, a prime superscript to denote the transpose, and a circumflex over a vector to denote a diagonal matrix with elements on the main diagonal corresponding to the elements of the vector. An asterisk superscript denotes either a sub-matrix or a matrix related to that immediately to the left of the asterisk. Rather than using parameters to denote the dimensions of matrices the exact dimensions corresponding to associated matrices in the Canadian Input-Output System are noted.

The Open Input-Output System

The economic system described by the open model is assumed to be composed of a set of sectors or industries each of which produces one or more commodities (goods and services), and of households, governments and export markets which are the final consumers of the commodities. It is further assumed that within a given time period, the year 1961 in this study, the value of deliveries of commodities between sectors are known, along with the value[5] of deliveries of commodities to final consumers.

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[4]United Nations, A System of National Accounts (New York, 1968).

[5]Basic value as defined by the United Nations, ibid., pp. 17-18.

With these general assumptions three balance requirements or definitional relations may be specified.[6] The first states that domestic production of each commodity equals the net use of that commodity by other industries plus the use by final domestic consumers, plus exports, minus imports:

(1) $q = Ui + e + x - m$

- where q is a column vector of total domestic production by commodity,
- U is a matrix, the jith element of which is the use of commodity j by the ith industry,
- i is the unit column vector, performing the function of summing each row of matrix U (i is also used as a general row index in describing the location of an element in a matrix but this use is in no way confusing with the use as a unit column vector),
- e is a column vector of total domestic final demand by commodity,
- x, m are column vectors of exports and imports by commodity.

The dimensions of q, e, x and m equal the number of commodities produced (644 in the Canadian accounts); the dimension of U equals the number of

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[6]The national input-output system is continually undergoing modification. The model developed here differs from that reported in the publication: Dominion Bureau of Statistics, op. cit., pp. 135-164. It also differs from the latest version described in R.B. Hoffman "Statistics Canada Input-Output Models", (Working paper of the Structural Analysis and Productivity Research Division of Statistics Canada, May 1973).

commodities by the number of industries and i has dimension required for conformability with U, 187 (industries) in the Canadian accounts.

The second definitional relationship states the equality of total domestic production by commodity to commodity production summed over all industries:

(2) $q = V'i$

- where V', is the transpose of V, the jith element of which is production of commodity j by industry i.

The third identity equates gross output by industry (column vector g) to the sum of the industrys' outputs of each commodity:

(3) $g = Vi$

In order to relate output levels by commodity or industry to final demand some assumptions relating to the technical conditions of production are required. First, the use of commodity j by industry i is assumed to be a constant proportion of the level of output of industry i. In matrix form this is written:

(4) $Ui = Bg$

- where B is technical input coefficient matrix of dimension equal to the number of commodities by the number of industries; the jith element is the quantity of commodity j needed to produce one unit of output of industry i.

Industries or processes are permitted to produce more than one commodity, an important relaxation of the traditional Leontief assumptions. On the other hand, production methods are assumed to remain of a very simple type: utilization of a process is assumed to use up inputs in proportion to the total value of output (relationship (4)),

and to yield output of commodities in fixed proportion. Moreover, industries are assumed to supply a fixed share of the market for each commodity produced. This assumption may be written:

(5) $Vi = Dq$

- where D is a commodity output coefficient matrix, each row of which represents an industry; the ijth element is the quantity of commodity j produced per dollar of output by industry i.

The final assumption requires imports of each commodity to be a fixed proportion of domestic consumption of the commodity - this is an extension of the fixed market share assumption.

(6) $m = \hat{u}(q + m - x)$

- where $\hat{u}$ is an import share matrix of dimension equal to the number of commodities; the elements on the main diagonal are the ratios of the quantity of each commodity imported to the quantity domestically consumed (less imports).

Regarding the elements of $\hat{u}$, B, and D as structural parameters, measured in a reference year, the above relationships may be manipulated to express output, disaggregated either by industry or commodity, as a function of the structural parameters and the level of demand by final consumers in the economy. The equation may then be used to estimate the impact on output of assumed changes in final demand. These estimates are only plausible to the extent that the underlying assumptions are plausible, and in this regard it must be emphasised that the assumptions are less realistic the longer the period for which the model is applied. To be more specific, the periods must be short enough to severely restrict opportunities for substitution of production technique and to

limit possibilities for perception of and reaction to changing market conditions between industries.

The specific relationship linking domestic output and final demand may be derived as follows:

Given (1) $q = Ui + e + x - m$

(2) $q = V'i$

(3) $g = Vi$

(4) $Ui = Bg$

(5) $Vi = Dq$

(6) $m = \hat{u}\ (q + m - x)$

The first step is to remove m from (1) by using relationship (6). Appropriate substitution yields:

(7) $q = (I - \hat{u})\ Ui + (I - \hat{u})\ e + x$

Relationships (3) and (5) are now used to substitute g for q in (7). The result of appropriate substitution is:

(8) $g = D(I - \hat{u})\ Ui + D(I - \hat{u})\ e + Dx$

Finally, Ui may be removed from (8) by using relationship (4) - the result after rearranging is the desired relationship between output by industry, the coefficient matrices D, B, and $\hat{u}$ and the exogenous final demand components e and x.

(9) $g = \{I - D(I - \hat{u})B\}^{-1}\ D\ \{(I - \hat{u})\ e + x\}.$

Given an assumption concerning the relationship between sectoral output and primary input usage a formula relating final demand change to primary input change may be derived. The basic assumption regarding primary input use states that the quantity of input j used by sector i is a constant proportion of the level of output of sector i. This is

part of the industry technology assumption. In matrix terms it is written:

(10) $Y = C\hat{g}$

- where Y is a matrix of quantities of primary inputs disaggregated by industry,
  and C is a matrix of primary input coefficients, with similar dimension. A typical element is the value of primary input j consumed per dollar of output in industry i.

The primary input of most interest in this study is wages and salaries. Letting w be a row containing wages and salaries paid by industry the relation to output is given by:

(10A) $w = C^{*}\hat{g}$

- where C^{*} is the wages and salary coefficients in matrix C.

The final demand vector e may be disaggregated by source and type. Let E be the associated matrix, it has a number of columns corresponding to each type of final demand. Primary factors may be consumed directly by final consumers; let matrix F, with dimension equal the number of primary factors by number of types of domestic final demand, contain this information. w^{*} may be used to denote the wages and salary row of matrix F.

Regarding elements of the coefficient matrices B, D and $\hat{u}$ as parameters it is seen that (9) is a linear relationship between output by industry and final demand including exports. It is thus possible to attach a "change" operator to each of the variables and obtain an equation relating the changes in industrial output to any assumed change in final demand. Letting "d" denote the change operator this

equation is written:

$$(11)\quad (dg) = [I - D\ (I - \hat{u})\ B]^{-1}\ D\ [(I - \hat{u})\ (de) + (dx)]$$

Once (dg) is known it is then possible to calculate the change in primary factor usage by industry. Regarding the primary input coefficients of matrix C as parameters this relationship is written, using (10):

$$(12)\quad (dY) = C\ (d\hat{g})$$

and the impact on wages and salaries paid is

$$(13)\quad (dw) = C^{*}\ (d\hat{g})$$

Consumption of primary factors by final consumers may also change by the (exogenous) amount indicated by (dF), the impact on wages and salaries is denoted (dw^{*}).

In the applications described below it is always assumed that a component of final demand changes by some fraction of its reference year value and that the commodity pattern in the reference year is not altered. Thus, governments are assumed to possess the freedom to reduce total expenditure on education, for example, by a certain percentage, but not to influence the reference year pattern of expenditure by commodity or indeed the ratio of commodity to primary factor expenditure. The impact on industries and primary factors is then calculated by multiplying the education column of the final demand matrices E and F by the assumed fraction and all other columns, including the export vector, by zero in order to get (de) and (dF), after which formulas (11) and (12) are applied.

The assumptions of fixed input, marketing and import coefficients are necessary in order to derive the impact of final demand changes on industrial output and primary factor use though little is known of the actual changes in these coefficients through time. Any estimates based on these assumptions should thus be viewed with caution. The most that can be said for the estimates is that they are consistent with the assumption of a given technical structure. To guard against misuse of the estimates more emphasis in the applications will be placed upon comparision between highly aggregated (by area and industry group) impacts that result from different sources than on the degree of impact of any one source. Also, the main concern is with short run influences; thus the assumption of invariant structural relations is less inappropriate.

The "Household" Model

Although the open model is useful in estimating the direct and indirect effects of final demand change on industrial output it ignores repercussions on commodity demand arising from induced changes in personal income. These "induced" effects are allowed for when the consumer or household sector is regarded as an industry which uses inputs, or consumption goods and services in this case, in order to produce the output income. The benefit of getting a more comprehensive estimate of the impact of final demand changes is compensated to some extent by the fact that the assumption of constant consumption input coefficients is not entirely appropriate. These coefficients ideally should be considered behavioural in nature rather than technical since marginal changes in income are likely to affect the commodity pattern of consumption as a result of differing income elasticities of demand between

products. Again it is possible to downplay the importance of this assumption by focusing in the applications on comparisons between estimates emanating from different exogenous factors rather than on magnitudes of specific impacts.

The mathematical structure of the household model corresponds to that of the open model. The only differences to note are in the definitions of the matrices. The production matrix, V, is augmented by a row depiciting the household industry and five columns depicting "output" of this industry: wages and salaries, supplementary labour income, net income of unincorporated business, investment income and transfer income by the household industry. These five forms of output are not produced by the other industries. In 1961 wages and salaries were by far the largest component:

	Millions of dollars, 1961
Wages and salaries	19,827
Supplementary labour income	919
Net income of unincorporated business	3,638
Investment income received plus imputed rent	2,195
Net transfers	2,279
Total	28,859

(Source: unpublished worksheet of Structural Analysis Division, Statistics Canada).

The intermediate input matrix, U, is augmented by five rows depicting inputs in dollar terms, of the household sector into each industry including itself - these input categories are the same as the

output categories noted above but in this matrix they are disaggregated by industry. The government transfer category is not considered an input since the transfers to persons originate not from industries but from the public sector, regarded as exogenous in the model. The government transfers row in matrix U thus contains zeros. One column is augmented in matrix U; this contains the commodity inputs to the household sector. These inputs are regarded as personal consumption of goods and services in the open model. The inputs to the household sector include labour services taking the form of payments to maids, private tutors, baby sitters, etc.

Similar assumptions are employed in constructing the new parameters in the augmented coefficient matrices D and B. The new non-zero elements of the augmented matrix D are the outputs of the household sector going to wages and salaries, supplementary labour income, net income of unincorporated businesses, investment income and transfer income, each divided by the total income (which is the total output) of households. The new parameters in the augmented matrix B are formed by dividing the payment (by industry) to the five categories of household input by the total value of output by industry. The import coefficient vector is unaffected except by being augmented by five zero elements, required in order to be conformable with other redefined matrices. Imports of household services are assumed to be zero.

The primary input matrix is augmented by the two new rows depicting personal income taxes and personal savings by the household sector. Wages and salaries by industry no longer appear in the primary input matrix since they are incorporated into the matrix of intermediate

inputs, U. The major output of interest in this study is the impact by industry on wages and salaries. It is obtained from equation (13) using the open model. In the closed model it is obtained by multiplying the estimated change in output by industry, (dg^*), by the coefficients of matrix B (augmented by the household industry column) indicating the wages and salary input per unit of output, by industry.

In more human terms the models portrayed here indicate the source of employment lay off when public expenditures are cut or exports reduced. First, a man may be laid off if he works for a firm whose products are directly sold to the government or exported - these are the direct effects. Secondly, a man may be laid off if he works for a firm that supplies commodity inputs to a firm which reduced its inputs as a result of a reduction in output. The reduction in output might be prompted by a fall in demand attributable to either final or intermediate consumers of commodities. These are the indirect effects. Since the direct and indirect effects result in lower household incomes, and thus lower consumption, a man may be laid off if he works for a firm catering to the demand of households - these are the induced effects. The area impact question, concerned with where these men live, is dealt with in the next section.

2. The Area Allocation System

The area allocation system translates the national impact by industry into area impacts by industry. Let n_{ik} denote average employment in man-years in 1961 in industry i and area k, and a_{ik} the estimated change in man-years of employment in industry i and area k.

If the industry classification is defined to correspond to that in the input-output system, the area impact may be estimated by the following formula:

$$(14A)\quad a_{ik} = n_{ik} \cdot (dw_i)/w_i, \quad \text{if } i \text{ is an endogenous industry,}$$

or

$$(14B)\quad a_{ik} = n_{ik} \cdot (dw_i^*)/w_i^*, \quad \text{if } i \text{ is an exogenous sector,}$$

where the elements of vector (dw) are given by equation (13), and the elements of vector dw^* are given by the assumption concerning the change in the component of final demand. The total area impact is:

$$(15)\quad \Sigma_i\, a_{ik} = a_{.k} = \Sigma_i \{\{n_{ik}(dw_i)/w_i\} + n_{ik}(dw_i^*/w_i^*\}\}$$

Since employment levels differ by area, differences among areas in the degree of employment impact are detectable by expressing the impact in proportional form; from (15) the proportional impact is:

$$(16)\quad a_{.k}/n_{.k} = \{\Sigma_i \{n_{ik}(dw_i)/w_i\} + \{n_{ik}(dw_i^*)/w_i^*\}\}/n_{.k}$$

Similar formulas may be used to estimate the impact on sub-populations of the employed. The only revision would be the addition of a third subscript to a_{ik} and n_{ik} indicating the sub-population. A specific interest in this study is in the impact on the male as compared to the female employed populations. Such a disaggregation, in addition to the industry disaggregation, permits analysis of the reasons for the total impact on one area exceeding that on another.

There are several assumptions implicit in the above approach. The first is that the impact on employment in each industry is proportional to the impact on wages and salaries. This in turn involves the assumption that wage rates are unaffected by changes in industry

output. This assumption is more appropriate given reductions rather than expansions in output, since wage rates tend to be inflexible in the downward direction. Fortunately, the situation of contraction is of more interest in an urban context where unemployment rates very significantly within an urban area and it is thus of interest to estimate where increases in unemployment are most likely to occur.

A second assumption of the proposed approach is that the aggregate employment impact by industry is distributed spatially according to each area's share of total employment (in the base year 1961) in the industry. In practice some urban areas would be expected to fare better than others either on account of factors related to costs of production, costs of transportation, marketing arrangements or for other reasons.[7] For similar reasons the plants located in one area of a city may be affected differently than those located in another area of the same city, even though the plants belong to the same industry. Use of an inter-urban input-output system would have permitted the explicit recognition of only some of these factors.

A third assumption is that sub-populations of the employed are similarly affected, executives in an industry being laid off at the same occupational rate as janitors, for example. This may not be unrealistic if the concern is with urban area level impacts, since urban areas will contain a good cross section of occupations, and underestimates of some unstable occupations will tend to be balanced by overestimates of the more secure occupations. Within most cities, however, a representative sample of occupations will be found in only

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[7] Such as emigration of unemployed labour, which is common in times of recession as recent arrivals return to rural origins.

some neighbourhoods and not in the poor districts of the core, where one would expect to find a greater representation in the less secure occupations, nor in the affluent suburbs where the more secure occupations would probably be more predominant. This is not to say that sub-metro impacts would be too unreliable to be of use but only that they should be interpreted with care. Indeed, the estimated impact on poorer districts could be regarded as minimum estimates and that on the more affluent districts as maximum estimates. Since public concern is expected to be directed toward the impact on the poor districts this bias is in the desired direction for if the minimum impact is high the true impact would be at least as high and possibly even higher.

According to the proposed approach the sole source of inter-metro and intra-metro differences in influences on employment patterns is inter-area differences in the industrial affiliation structures of the employed populations. Arguments supporting such differences, particularly of differences in the industrial affiliation of the employed among component parts of a given metropolitan area, were advanced in Chapter II. In the next chapter the proposition of differing industrial structures will be tested empirically. Given the hypothesis of differing industrial affiliation patterns is not rejected we shall then proceed to consider problems of implementing the model proposed in this chapter.

IV

THE SPATIAL PATTERN OF THE EMPLOYED POPULATION IN THE MONTREAL AND TORONTO METROPOLITAN AREAS

1. Scope and Definitions

Though several arguments have been advanced yielding the conclusion that the pattern of industrial affiliation of the employed may differ among component parts of an urban area there remains the possibility that either the behavioural assumptions are unfounded or that the effects of certain behaviour patterns are off-setting. One may easily conceive of situations in which a neighbourhood will possess a mix (by industrial affiliation) of employed persons that is similar to that of the whole urban area. For example, the neighbourhood may be close to a new industrial park for light industry and for this reason contain some employed persons affiliated with these industries, yet be the traditional home of better-off workers affiliated with heavy industry. Without having advanced any single theory containing a few variables that could account for intra-urban differences in the pattern of industrial affiliation of the employed, we have, while portraying the more realistic situation of several routes by which such differences could arise, also opened up the possibility of actual inter-area differentiation being insignificant in magnitude. This question will be pursued empirically in this chapter though the development will be guided to some extent by the theoretical issues raised in Chapter II. It will only be desirable to procede with the implementation of the estimation model if inter-area patterns are found to differ according to some cirteria of

significance.

For the purposes of the empirical work in this chapter some terms require more precise definition. The "pattern of the employed" of an area is the series $n_{ik}/n_{.k}$ for all i, where n_{ik} denotes the number of employed persons resident in area k and affiliated with industry i, and $n_{.k}$ is the total number of employed resident in the area. By "the employed" we include all persons with a job enumerated in the 1961 census of Canada, i.e., the wage-earners, who comprised 83.0% of the labour force, the self-employed comprising 14.5% of the labour force (of which 42.4% were in agriculture) and unpaid family workers, comprising the remaining 2.5% (of which 76.3% were affiliated with agriculture).[1] This group of employed persons differs conceptually from the Labour Force Survey employed population by excluding 14 year olds but by including members of the armed services and Indians living on reserves. Both sub-populations exclude inmates of institutions who may have had a job.

The census employed population was adjusted so as to refer to the year 1961 rather than to the census date. This meant expanding the figures in some industries and reducing them in others. The adjustment factors are presented in Appendix C. The method used to accomplish this is explained in Chapter V. The adjustment is required so that statistics on the employed population are consistent with the Input-Output accounts, developed from annual series of statistics. Fortunately, the census is

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[1] Statistics from which these percentages were calculated appear in: DBS, 1961 Census of Canada, Volume III (Part: 2), Labour Force: Industries (Ottawa, 1965), Table 9. The labour force as defined here excludes persons seeking work for the first time.

taken at a time of year when adjustment factors, at least in aggregate, are relatively close to unity.[2]

The male-female dichotomy of the employed population was retained since the industry affiliation patterns of men and women were expected to differ, for reasons sketched in Chapter II.

The area definitions of the two study areas, Montreal and Toronto, correspond to the census metropolitan area (MA) boundaries of 1961. Although these were not delineated with the objective of approximating labour market area boundaries (which would be ideal in the intended application) the criteria of delineation resulted in large enough area boundaries to include most of the commuting shed. There are no statistics on journey-to-work patterns in 1961 that would permit one to calculate the actual degree of correspondence, however.

These metropolitan areas were each subdivided by DBS into three large component parts - the central city, urban fringe and rural fringe - and further subdivided into census tracts. For the purpose of the present analysis it was felt that the major divisions (three parts) would provide too little sub-metro detail while the census tract subdivisions would provide too much detail, there being over 300 census tracts in each of the Montreal and Toronto MAs in 1961.

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[2]According to the labour force survey the factor for the employed in May 1961 was 1.0073 for males and .9972 for females. The June figures were 1.0380 and 1.0155 respectively. Statistics Canada, Seasonally Adjusted Labour Force Statistics, January 1953 - December 1971 (Information Canada, February, 1972).

In order to obtain a manageable number of sub-metro areas on which to base further analysis, and one that would have some rationale in our application, the following approach was taken. The average annual earnings of employed wage earners was computed on a census tract basis, the census tracts of both the Montreal and Toronto MAs were then sorted into descending order according to the magnitude of average annual earnings per employed person, and the tracts were then grouped into four equisized classes. The first quarter of census tracts in the array was called "highest income tracts", the second "high income tracts", the third "low income tracts" and the final quarter of tracts was called "lowest income tracts". Knowing the location of each tract within the MA, it was then possible to subdivide each MA into 12 groups of census tracts - four income districts in each of the central city, the urban fringe and the rural fringe. This system of areas would permit the detection of central city - fringe variations in the pattern of the employed, variation according to income district and perhaps interactions between the two sources of variation. The census tracts belonging to each of the twelve districts in both Montreal and Toronto are listed in Appendix B.

The final definitional point concerns the choice of year. The year 1961 was chosen since this was the most recent year in which census statistics on the employed population by industry affiliation were available, and for which an input-output table was constructed. Since the determinants of inter-area variation in the pattern of the employed are expected to persist through time it is likely that the results of this analysis would be applicable to more recent years.

2. The Employed Population in Montreal and Toronto

Before comparing the intra-urban pattern of the employed by industrial affiliation, some general characteristics of the urban areas, as revealed by the spatial distribution of the employed population, may be noted. Table 4.1 presents the employed population in each major part of the MA, expressed as a percentage of the total employed in the MA. This table reveals the relative insignificance of the rural fringe as a place of residence of the employed population, and as a result it was added to the urban fringe. The two areas together are referred to as the "fringe" in the following discussions.

TABLE 4.1. Percentage of Employed Males and Females Resident in the Central City, Urban Fringe and Rural Fringe Areas of the Montreal and Toronto MAs, 1961

Area	Montreal MA			Toronto MA		
	Percent of employed			Percent of employed		
	Males	Females	Total	Males	Females	Total
Central city	58.72	67.41	61.31	36.77	45.95	39.84
Urban fringe	40.78	32.18	38.22	60.09	52.66	58.28
Rural fringe	.50	.41	.47	2.14	1.39	1.88
MA	100.00	100.00	100.00	100.00	100.00	100.00

(Source: Appendix D).

The table also reveals that the central city contained a greater proportion of the male and female employed than the fringe in Montreal and vice versa in Toronto. The central city boundary in both cases is political, having no economic or social significance beyond delineating a more central part of the urban area. Further, the table indicates that

the female employed are more likely to reside in the central city than the fringe than are the male employed. This pattern occurs in both MAs, thus suggesting that either female participation rates are higher in the central city than the fringe (while the male rate is constant or lower in the central city than the fringe) and /or that the female-male ratio is higher in the central city than the fringe. Whatever the reason, these different distributions of the female and male employed populations are significant in light of the theoretical discussion of the last chapter and warrant closer inspection.

The corresponding percentages for the districts based on average income within both the central city and fringe reveal that the percentage of employed females who lived in each of the income districts of the central city exceeded the corresponding male percentages, and vice versa for the fringe. (See Table 4.2). This pattern existed in both the Montreal and Toronto MAs. Table 4.2 also indicates the tendency of the employed living in the central city to live in lower income tracts. Both employed males and females resident in the central cities were about three times as likely to live in the lowest income tracts than the highest income tracts and the disparity was even wider in the fringe areas with the difference that the tendency was to live in higher income tracts over the lower.

TABLE 4.2. Percentage of Employed Males and Females Resident in the Central City, Fringe and Income Districts of the Montreal and Toronto MAs, 1961

Area	Montreal MA			Toronto MA		
	Percent of employed			Percent of employed		
	Males	Females	Total	Males	Females	Total
1. Central City	58.72	67.41	61.31	36.77	45.95	39.84
Highest income tracts	5.16	7.13	5.75	3.84	5.71	4.47
High income tracts	14.66	15.13	14.80	6.13	9.00	7.09
Low income tracts	22.88	25.84	23.76	9.63	12.16	10.49
Lowest income tracts	16.01	19.30	16.99	17.16	19.07	17.79
2. Fringe	41.28	32.59	38.69	63.23	54.05	60.16
Highest income tracts	14.78	11.30	13.74	30.01	23.25	27.75
High income tracts	15.39	11.85	14.33	20.97	19.48	20.47
Low income tracts	7.42	5.88	6.96	9.63	9.14	9.47
Lowest income tracts	3.70	3.56	3.66	2.63	2.19	2.48
3. MA	100.00	100.00	100.00	100.00	100.00	100.00

(Source: Appendix D).

3. Industrial Affiliation Pattern of the Employed - Informal Analysis

These aggregate patterns of the employed population are suggestive of tendencies in industrial affiliation patterns. The patterns suggest that affiliation with industries employing large numbers of females relative to males will be stronger in the central city areas than the fringe, and that affiliation with lower paying industries will also be stronger in the central city than the fringe.

Such tendencies can be checked by inspection of census statistics in conjunction with the adjusted statistics on the employed population. Female-male ratios by industry group are presented for both Montreal and Toronto MAs in Table 4.3. The overall female-male ratio is higher in Toronto than Montreal and varies substantially among industries.[3] It is higher than average in both MAs in the following industry groups: semi-durable goods sector, retail trade sector, community services sector, finance and real estate sector and the public sector.

TABLE 4.3. Female-Male Employee Ratios by Industry Group, Montreal and Toronto MAs, 1961

Industry Group	Female-male employee ratio	
	Montreal MA	Toronto MA
1. Primary	.060	.141
2. Perishable goods	.371	.363
3. Semi-durable goods	.719	.575
4. Durable goods	.143	.217
5. Construction	.029	.040
6. Transportation - communications	.179	.224
7. Wholesale trade	.241	.321
8. Retail trade	.457	.672
9. Finance - real estate	.700	.911
10. Community services, etc.	.829	1.000
11. Public sector	.812	.882
Average (all industries)	.426	.503

(Source: Appendix D).

[3]The three-digit industries comprising the eleven industry groups of Table 4.3 and succeeding tables are listed in Appendix E.

Average annual earnings are expected to differ between industries as a consequence of factors such as different skill requirements, different degrees of concentration and unionization and inter-industry variation in the seasonal stability of employment. Average annual earnings in the 12 months preceding the 1961 census of wage earners in selected industry groups are portrayed in Table 4.4.

In this table the industry group number refers to the industry group in Table 4.3 and the numbers in brackets mean that only part of the industry group is included. Thus the earnings of wage earners in forestry and mining are not listed separately in Table 4.4 although they comprise part of the primary sector, industry group number 1. The industry groups with both male and female earnings less than average were agriculture, a part of the primary industry sector, the food and beverage sector (a major part of the perishable goods sector) the two industry groups textiles and clothing, representative of the semi-durable goods sector the retail trade sector and the community services, etc. sector. Of these, the semi-durable sector, retail trade sector and community services sector also had higher than average female-male employee ratios. We would expect to see the employed resident in the central city to be more affiliated with these "female" industries than the employed resident in the fringe, for the simple reason that female participation relative to male was higher in the central city. Also, within the central city and the fringe, we would expect the employed resident in the lower income tracts to be more closely affiliated with these low paying industries than the employed resident in the higher income tracts.

TABLE 4.4. Annual Average Earnings of Wage Earners, 12 Months Preceding the 1961 Census, by Sex and Selected Industry Group

Industry group (selected)		Average earnings ($) Males	Females
1.(pt)[1]	Agriculture	1,362	765
1.(pt)	Mines, quarries, oil wells	4,364	2,886
	Manufacturing	3,998	2,052
2.(pt)	Food and beverage	3,498	1,742
3.(pt)	Textile	3,420	1,931
3.(pt)	Clothing	3,547	1,676
4.(pt)	Paper and allied products	4,512	2,342
4.(pt)	Metal fabricating	4,037	2,453
4.(pt)	Machinery	4,352	2,625
4.(pt)	Transportation equipment	4,184	2,830
4.(pt)	Electrical products	4,608	2,560
4.(pt)	Chemical and chemical products	4,888	2,333
5.	Construction	3,047	2,290
6.	Transportation - communication	3,882	2,445
7.	Wholesale trade	4,110	2,289
8.	Retail trade	3,189	1,600
9.(pt)	Community services, etc.	3,477	1,897
10.	Finance - real estate	4,921	2,310
11.(pt)	Public administration, etc.	4,008	2,603
	Average (all industries)	3,679	1,995

(Source: DBS, 1961 Census of Canada, Earners: Earnings and Employment (Ottawa, 1965), Table 28.)

[1]The number refers to the industry group listed in Table 4.3. The abbreviation "(pt)" means that only part of the industry group is presented.

Table 4.5 presents the percentage of employed resident in six parts of each MA and affiliated with the eleven industrial groups. These industrial sectors are in turn grouped according to whether or not they are high or low paying (according to the average earnings of both male and female employees in 1961) and to whether or not they had higher than average female-male ratios in both metropolitan areas. This table permits hypotheses regarding the industrial affiliation of the employed resident in component parts of MAs to be explored in an informal manner.

The percentage of the central city employed population in the "high female ratio, low paying" industry groups is seen, from Table 3.5, to exceed the corresponding fringe percentages in eight out of twelve possible cases. Three of the four exceptions are associated with the retail trade sector; in the lower income tract areas in both MAs and the higher income tract areas of Toronto the percentage affiliated with the retail trade sector in the fringe is higher than the corresponding percentage in the central city. This may be due at least partly to the location of jobs in this sector, there being more available at the fringe than in the central city, together with the fact that lower income employees prefer to work in nearby locations, as mentioned in Chapter II. In the U.S. Mills' figures show a majority of retail jobs in suburban locations.[4] His figures also show the

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[4]Edwin S. Mills, Urban Economics (Scott, Foresman and Company, 1972), p. 94.

TABLE 4.5. Pattern of Industry Affiliation of the Employed Resident in the Component Parts of the Montreal and Toronto MAs, 1961

Industry group	Employed, % of total; Montreal MA				Employed, % of total; Toronto MA			
	Higher income tracts		Lower income tracts		Higher income tracts		Lower income tracts	
	Central city	Fringe	Central city	Fringe	Central city	Fringe	Central city	Fringe
A. High female-male ratio, low paying								
Semi-durable goods	14.01	13.03	18.63	14.19	11.21	13.80	14.60	14.21
Retail trade	10.20	9.99	11.29	11.75	11.90	12.89	12.41	14.77
Community services, etc.	13.67	11.57	13.88	11.35	19.11	11.14	17.45	14.36
B. High female-male ratio, high paying								
Finance-real estate	8.19	6.67	4.31	3.68	12.40	7.08	5.33	5.87
Public sector	16.29	12.42	12.71	13.68	16.96	12.60	11.62	9.98
C. Low female-male ratio, low paying								
Perishable goods	3.50	4.04	5.53	5.15	2.31	3.86	4.74	3.96
D. Low female-male ratio, high paying								
Durable goods	10.87	16.29	10.58	14.66	7.41	15.69	11.77	11.78
Transportation-communications	10.89	12.26	11.01	10.68	8.74	9.30	9.15	7.43
Wholesale trade	6.99	6.61	4.88	4.53	6.45	7.41	5.09	7.22
E. Others								
Primary	.34	.48	.35	.50	.57	.63	.47	1.08
Construction	5.05	6.64	6.83	9.83	2.94	5.60	7.37	9.34
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

decentralization of jobs between 1947 and 1963 to be faster in the retail sector than any other of his major industrial sectors.

Within both the central city and fringe, affiliation with these industries is higher in the lower income tract than the higher income tract areas in ten out of twelve comparisons. This is not unexpected given the way in which the central city and fringe were subdivided, but it illustrates the possibility that affiliation patterns may differ in the desired characteristics (indicated in this case by the wages they pay) of their work forces.

The employed population affiliated with the "high female-male ratio, high paying" industries (finance - real estate and the public sector) constitute a higher proportion of total employed in the central city areas than the fringe, in six out of eight instances. Within both the central city and the fringe the employed affiliated with these industries are more represented in the higher income tracts than the lower in six out of eight comparisons. Both tendencies accord with expectation.

The employed affiliated with the only "low female-male ratio, low paying" industry group (the perishable goods sector) are a higher proportion of total employed in the higher income tracts of the fringe than in the higher income tracts of the central city, but a lower proportion in the lower income tracts of the fringe than in the lower income tracts of the central city. Since this is a "male" industry, affiliation is expected to be higher in both areas of the fringe. The higher representation in the central city lower income tracts than the fringe lower income tracts may be explained by the possibility that

perishable goods industries tend to locate in central areas and the lower paid workers within the industry choose nearby residences, while the higher paid prefer to live in the fringe and commute longer distances to work. Within both the central city and the fringe the lower income tract areas are preferred over the higher in both MAs.

Actually, the construction industry also has a very high proportion of male employees and the male employees received lower than average earnings in the year preceding the 1961 census. The only reason it was not grouped with the perishable goods industry was that the earnings of the female employees were higher than average. It is interesting to note, however, that the employed in this industry are better represented in the fringe area than in the central city, and within the central city and fringe, they are better represented in the lower income tract area than in the higher. Both tendencies are in accord with expectation based on the fact that aggregate female-male ratios of the resident employed are higher in the central city than the fringe and construction should be considered to be a low paying sector. The higher representation of construction workers in fringe than in central locations is probably contrary to popular expectation, however.

The employed affiliated with the three "low female-male ratio and high paying" industries (durable goods sector, transportation - communications sector and wholesale trade sector) should be more highly represented than expected in the fringe areas (where female participation relative to male is lower) than in the central city areas - this is the case in fact in eight of the twelve comparisons. Two of the four

exceptions are associated with the wholesale trade sector in Montreal, where the percent of employed residents in both income class districts in the central city exceeds the corresponding percentages in the fringe. Within the central city and fringe the affiliation is stronger with these industries in the higher income tract areas than in the lower, which is as expected since these are high paying industries.

The primary sector was not grouped with other sectors since the earnings in mining were above average and those in agriculture below average. Representation was higher in the fringe area than in the central city, when both lower and higher income tract areas are compared. This could reflect not only higher male participation relative to female in the fringe but also that job locations in this sector are more common in the fringe.

In summary, it has been shown that the industrial affiliation patterns of sub-metro areas do differ and that the way in which they differ is predictable, given the nature of the industry in relation to two characteristics of the sub-metro area: female participation relative to male and average annual earnings of the area. Some of the exceptions to the patterns may be explained by other explanatory factors which were discussed but not quantified, such as the industry location pattern. Finally, one specific pattern has been discovered which is explainable but probably contrary to popular opinion - the higher representation of construction workers in fringe areas than in central city areas. Other instances of this nature could be referred to and it is probable that a similar analysis employing a finer industry breakdown would reveal still more anomalies.

4. Industrial Affiliation Pattern of the Employed - Formal Analysis

Although the above interpretation of the patterns does not conflict with the theoretical considerations, and indeed appears to support the theory in numerous instances, the question of whether the patterns could have arisen by chance remains to be answered. Analysis of variance techniques may be used to test the hypothesis that the industry affiliation pattern of sub-metro areas is due to chance.

The model seeks to account for variation in the proportion of an area's employed population affiliated with one of the 11 industry groups (n_{kit}), by an over-all mean (μ), a row or "income district" effect (α_k), a column or "industry" effect (β_i), an interaction effect (s_{ki}), and a random deviation (ε_{kit}) from the mean position of the t^{th} item (Montreal or Toronto) receiving the area effect at level k and the industry effect at level i. The random deviations, ε_{kit}, are assumed to have independent normal distributions with mean zero and common variance. The variance arises from the fact that many factors, associated with industry location, residential location, choice of workplace, employment participation decisions and perhaps other decisions, are not represented explicitly in the model yet may still interact to affect n_{kit}, for reasons mentioned in the theory review chapter. Assuming the within group mean square to be an estimate of the population variance an F test may be applied to test for significant row, column and interaction effects.

The results of analysis of the total, male and female patterns of employment are reported in Table 4.6. The interaction effects are significant in each of the three experiments. Significant area-industry

TABLE 4.6. Summary of Analysis of Variance Experiments

(a) Total employed population

Source	NDF	SS	Mean Sq.	F Statistic
k Effect	3	.01	.00	.00[1]
i Effect	10	1675.36	167.54	119.13**[2]
k x i	30	137.07	4.57	3.25**
Within	44	61.88	1.41	
Total	87	1874.32		

(b) Male employed population

k Effect	3	.02	.01	.01[1]
i Effect	10	1555.73	155.57	155.57**[2]
k x i	30	144.91	4.83	4.83**
Within	44	44.04	1.00	
Total	87	1744.69		

(c) Female employed population

k Effect	3	.01	.00	.00[1]
i Effect	10	4434.17	443.42	87.11**[2]
k x i	30	364.71	12.16	2.39**
Within	44	223.97	5.09	
Total	87	5022.86		

** indicates significance at the .01 level.

[1] k (or income district) effects are close to zero since the sum of proportions over industries in each row sum to 1.00.

[2] i (or industry effects) are strong since the industry groups contained widely differing numbers of employees in both Montreal and Toronto.

interaction effects indicate that given the area of residence of an employed person, some industry affiliations are preferred over others even when one discounts the fact that some industries contain many more employees than others. Alternatively, significant area-industry interaction effects would indicate that given the industry affiliation, the employees in an industry are not indifferent with respect to what income class area they live in.

These results thus accord with the indications obtained from perusal of the tables and with the theoretical discussion. The industrial affiliation pattern of the employed does appear to vary between component parts of the metropolitan areas and the variation is not random but systematic in character, reflecting either inter-area differences in the social and economic environment of the areas or different (intra-urban) locational and manpower requirements of industries.

V

IMPLEMENTATION PROBLEMS

In implementing the model developed in Chapter III problems of two basic sorts were encountered - those arising from the input-output system and from the census statistics. These will be described in turn.

The Canadian input-output system was designed primarily for national applications, not regional, urban or intra-urban. Some of its features are not ideal for the type of application proposed in this study though none are too serious.

The industry detail, for example is very fine in the primary sectors, which are relatively unimportant in a metropolitan area, though very crude in some typically urban sectors such as retail and wholesale trade. This feature is true of even the largest Canadian tables which break down the economy into about 190 sectors, only two of which are trade sectors. This feature should be compared to that of a system designed especially for a city, such as Artle's system for Stockholm. Artle states:

> "No less than 14 of the 62 production sectors represent wholesale and retail trade. This should not appear surprising, however, when it is remembered that the present study focuses upon a large city which is also a trading centre".[1]

Montreal and Toronto too may be regarded as large trading centres. Does this high degree of aggregation have any significant consequence,

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[1] Roland Artle, The Structure of the Stockholm Economy (Cornell University Press, 1965), p. 30.

however, given the intended application of this study? The answer hinges upon whether or not a finer breakdown of these sectors would lead to differences in degrees of impact on the sub-sectors, when some change in final demand is assumed. Even then, these differential sectoral impacts would be translated into differential area impacts only if the representation of some retail and wholesale sectors (in terms of percentages of the wholesale and retail employed population) was higher in some areas of the city than others.

With regard to the retail sector, most of this service is provided to final consumers, and to the household sector in particular. Non-retail trade industries may purchase some office supplies from retail outlets but most of their inputs are obtained directly from other industrial sectors including the wholesale trade sector. Thus the impact would not vary among different retail trade sectors if one is considering the impact of a change in exports or of public expenditures of various sorts as we intend to do. Indeed, the impact would not vary between different retail trade sectors even if we were interested in the impact of a change in consumer expenditure, provided that the product mix of consumption remained unaltered. If one considers the input-output system in which the household sector is endogenous an analogous comment applies, for in that case the product mix of consumption cannot vary by the assumption of fixed technology of the household sector.

The wholesale trade sector differs from the retail sector in that it provides services to other industries, and to a lesser extent than the retail sector, to final consumers. Certain sectors within

wholesale trade can therefore be expected to be influenced more than others by changes in export demand or public expenditures depending on what commodities are most affected by the assumed demand changes and the intermediate commodity demands. And if wholesale trade sectors are differentially affected there arises the possibility that the area impact will differ depending on the particular mix of the employed affiliated with wholesale sectors.

Empirically it is quite easy from published sources to examine if the mix of labour force affiliated with different wholesale trade sectors in the central city differs from that in the fringe. This mix is portrayed in Table 5.1. If we exclude the "wholesalers, n.e.s." sector on the grounds that it may be too heterogeneous for comparison then from Table 5.1 one may count thirteen of the nineteen other wholesale trade sectors whose labour force in both metro areas is either more or less represented in the central city than in the fringe. Of the six exceptions all but "drugs and toilet preparations" and "hardware, plumbing and heating equipment" are almost equally represented in the central city and fringe of both MA's. Of those wholesale sub-sectors in which the preference for either the central-city or the fringe is similar in both cities the margin of preference exceeded one percent in five sub-sectors in Montreal and seven in Toronto. These deviations from the norm are of insufficient magnitude to justify a modification of the input-output system.

Of the problems associated with census statistics on the employed population perhaps the most noteworthy is that they refer to employment activity during the week prior to enumeration in June 1961. To be

TABLE 5.1. Distribution of the Labour Force Affiliated with the Wholesale Trade Sectors in the Central City and Fringe of the Montreal and Toronto MAs, 1961

Wholesale trade sector	Labour Force in Montreal MA		Labour Force in Toronto MA	
	Central City (%)	Fringe (%)	Central City (%)	Fringe (%)
Total	100.00[2]	100.00[2]	100.00[2]	100.00[2]
Livestock	.14	.21	.34	.44
Grain	.26	.37	.22	.17
Coal and coke	1.73	.96	1.09	.66
Petroleum products	4.60	6.10	10.46	10.77
Paper and paper products	2.93	2.91	2.60	2.70
General merchandise	.30	.18	.13	.16
Food	14.61	10.19	12.02	9.57
Tobacco products	1.60	1.16	.93	.97
Drugs and toilet preparations	3.65	2.48	2.90	2.92
Apparel and dry goods	6.93	4.87	4.26	3.14
Furniture and house furnishings	2.03	1.74	1.91	1.82
Motor vehicles and accessories	4.51	4.99	6.51	7.01
Electrical machinery etc.	6.77	7.27	5.16	6.56
Farm machinery and equipment	.77	1.17	1.20	1.28
Machinery and equipment n.e.s.[1]	12.49	18.21	12.18	14.14
Hardware, plumbing, heating equipment	6.96	6.17	4.46	5.49
Metal and metal products n.e.s.[1]	2.35	3.56	3.30	3.32
Lumber and building materials	7.62	9.85	8.81	9.71
Scrap and waste materials	2.55	1.72	3.91	1.88
Wholesalers, n.e.s.[1]	17.09	15.79	17.51	17.18

(Source: Calculated from labour force figures in: DBS, 1961 Census of Canada, Labour Force: Industries (Ottawa, 1965), Table 2.)

[1] n.e.s. = not elswhere specified.

[2] Figures below do not add up to exactly 100.0 due to rounding error.

consistent with the input-output system, whose coefficients are based on economic activity during the entire year 1961, it was necessary to put the statistics on an annual basis. Industry specific adjustment factors were obtained for this purpose from two sources, the industrial establishment survey which supplied information on most sectors except the agriculture, forestry, fishing and trapping, and the public sectors; and the Labour Force Survey which filled these gaps.

The specific approach was to multiply the census employed population by the ratio of the survey annual average employees to June survey employees, all figures being disaggregated by industry and sex. The figures from the Labour Force Survey are available in unpublished form from the Labour Force Survey Division, Statistics Canada. They are presented in Table 5.2, along with the adjustment factors. National figures were used as a basis for calculating the factors since the sample size of industry statistics is not too large. The similar statistics for the other industries were not available from either published or unpublished sources though were obtained by a special tabulation of establishment survey employment by three digit SIC industry groups. In the rare cases in which no industry information was available, factors of 1.0 were used. The male and female factors by 3-digit SIC industry groups are presented in Appendix C, rather than in Table 5.2, since the SIC industry groups are so numerous.

The factors were then applied to a special tabulation of the census employed population broken down by three digit SIC industry, sex, and census tract; at least to those sets of tracts belonging to the Montreal and Toronto MAs. Then the statistics of each census tract were aggregated to the industry groups corresponding to the input-output

TABLE 5.2. Industry Employment and Adjustment Factors Available from the Labour Force Survey Source, 1961

Industry	1961 Average ('000)		June, 1961 ('000)		Factors	
	Males	Females	Males	Females	Males	Females
Agriculture	622	59	644	68	.966	.868
Forestry	85	*	88	*	.966	(.966)**
Fishing and trapping	17	*	33	*	.515	(.515)**
Public administration and defence	276	80	296	91	.932	.879

* less than 10,000.

** male factor used since no other information.

system (listed in Appendix E). At this point a couple of minor problems came to light. First, the education and health services sectors were not divided into public and private branches though to be compatible with the input-output system such a division was necessary. The employed population affiliated with these sectors was divided into public and private branches using the ratio of national wages in public education (and health) to that of total education (health). These factors were .979 and .972 for education and health services respectively in 1961.[3] Employment in "religious organizations" was edited out of the census employment figures - this being in accordance with the treatment in the input-output system. The last problem to report was that the

[3]These factors were calculated from statistics obtained from internal worksheets of the Canadian input-output system, Input-Output Division, Statistics Canada.

construction sector of the input-output system differed conceptually from that of the census by including construction activity by all industries. There did not appear to be any way of adjusting the census statistics for the construction sector so that it would be conceptually consistent. A basic problem confronting simple methods of adjustment would be to determine how many construction workers may have reported construction as their industry of employment when in fact it was only construction activity in other sectors. A direct solution to the problem would be to subtract from all non-construction sectors employees in construction type occupations, but these detailed cross tabluations were not available on a small area breakdown.

TABLE 5.3. Labour Force[1] in which Industry of Employment was Either Unspecified or Undefined; Canada, Montreal and Toronto, 1961

Area	Number, industry unknown		Percent of labour force	
	Males	Females	Males	Females
Canada	116,579	42,014	2.47	2.37
Montreal MA	15,084	6,877	2.66	2.85
City	9,305	4,371	2.78	2.70
Toronto MA	13,599	3,651	2.57	1.40
City	7,971	2,046	3.98	1.70

(Source: DBS, 1961 Census of Canada, Labour Force: Industries, (Ottawa, 1965), Tables 1A and 2.)

[1]Excludes persons seeking work who have never been employed.

In certain cases the industry of employment was either unspecified or undefined. The numbers and percentages of the total labour force in Canada, Montreal and Toronto are recorded in Table 5.3. The metropolitan area and city percentages of labour force with industry unknown is not too far out of line with the Canada percentages. Rather than employing arbitrary methods of assigning an industry to the employed whose industry was either unspecified or undefined this population was deleted from the file.

This concludes the discussion of problems associated with the input-output system and the census statistics that had to be confronted before the model developed in Chapter III could be implemented. The end result of the examination and adjustment of statistics was a table of employment statistics on the employed population disaggregated by sex, industry affiliation and census tract of residence. These statistics were adjusted to be as conceptually consistent with the input-output system as possible. After census tracts and associated statistics were aggregated to form the eight average income districts described in Chapter IV the data base was ready for use in conjunction with the input-output system. The applications of the model form the subject of the next chapter.

VI

RESULTS OF THE SIMULATION EXPERIMENTS

1. Introduction

In this chapter the simulation experiments and their interpretation will first be discussed, then the results of the specific applications will be described and summarized. In general the experiments involved the specification of the component of final demand which would be assumed to change, the specification of magnitude of change to be assumed and the calculation of urban area impact using the input-output and area allocation systems.

Before being more specific about the actual components of final demand that were assumed to change and the magnitudes of the assumed changes it is worthwhile to clarify the interpretation of this type of experiment. The applications are comparative statics experiments showing the effects of changes in 1961 magnitudes, the year on which the input-output and area allocation systems are built. This kind of experiment involves in principle an unspecified period of time, a period equal to the unknown length of time required for the equilibrating adjustment to take place.[1] This time period may differ depending on the particular component of final demand change assumed, for the simple reason that industries will be affected differently and the rate of adjustment to unforeseen changes in demand may differ by industry.

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[1]This description of the interpretation of comparative statics experiments follows that contained in: Lars Werin, A Study of Production, Trade and Allocation of Resources (Almquist and Wikseils, 1965), p. 94.

Thus to express the induced change in employment as a percentage of the base year level of employment does not result in a good measure of the magnitude of impact since the time dimension of this measure remains unspecified. It is, however, a useful measure for comparing area impacts induced by a given change in a component of final demand. The measure is even useful for comparing the impact of changes in different components of final demand provided that it is remembered that the impacts distributed over time may differ. It is illegitimate, however, to interpret the induced change in employment divided by the base year employment level as a measure of the increment or decrement in the base year unemployment rate since the time dimension of the numerator of this measure may be inconsistent with that of the denominator, which is one year.

In the actual simulation experiments carried out it was assumed first of all that changes occur in current expenditure rather than capital expenditure. If changes in capital expenditures were assumed more attention would have had to be paid to location theory in the model previously described. Secondly, it was assumed that expenditures were reduced rather than increased - this makes more tenable the assumption that labour income changes are translated proportionally into employment or man-hour changes for then it is more reasonable to assume that the wage rate by industry remains constant. If an increase in expenditure were assumed, the increase in labour income by industry might partly reflect increases in wage rates, necessitated to attract the desired labour, although in 1961 the unemployment rate was relatively high so that upward pressure on wage rates may have been

relatively low. A third assumption stated that the size of the expenditure reduction was two hundred million dollars, spent on goods and services according to the 1961 pattern of expenditures of the particular component of final demand. This is a high enough figure to generate noticeable employment impacts in urban areas and yet not too high in relation to the base year expenditures of any of the export commodity groups or federal expenditure programs simulated. By assuming an equal dollar change in expenditure for each component of final demand, rather than a given percentage change in each component, it was possible to compare the employment impacts of different sources of expenditure change.

The specific categories of aggregate demand simulated were (a) total net government expenditure, net government expenditure on (b) defence, (c) health and (d) education; and (f) total exports, and exports on the following commodity groups: (g) grain, (h) metallic ores and concentrates (i) oil, gas and services incidental to mining, (j) lumber and sawmill products, (k) paper and paper products, (l) iron and steel basic products, (m) non-ferrous metal basic products, (n) machinery and equipment, (o) automobiles trucks and parts, (p) electrical and communications equipment, and (q) chemical products. These product groups coincide in composition with those in the forty input-output commodity groups system with similar titles.[2] The intra-commodity group distribution of exports was assumed to correspond to that of the 1961 patterns.

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[2]These are published in : Dominion Bureau of Statistics, The Input-Output Structure of the Canadian Economy, 1961, Volume 1 (Ottawa 1969), pp. 237-241.

More imaginative types of simulations experiment are possible with the model. Linear combinations of government expenditure programs or of export changes could easily be calculated. Further, given the commodity composition of exports by country (available in unpublished form in Statistics Canada), it would be possible to simulate the impact of geographical shifts in the relative importance of countries as demanders of Canadian produced commodities.

2. Influences on Metropolitan Area Employment Patterns

Table 6.1 presents the estimated metropolitan area employment impacts expressed as a percentage of the 1961 employed population. More specifically the metropolitan area impacts, in terms of man-years for the 192 industry groups, were aggregated across industries and expressed as a ratio to the total MA employment for 1961. Table 6.1A presents the impacts estimated by using the open input-output system while Table 6.1B is based on the household input-output system estimates. Thus, assuming a two hundred million dollar reduction in total government expenditure, the male employed population in the Montreal MA is estimated by the open system to fall by just over one half of one percent (.51) of its average level in 1961. The estimate is higher, 1.15 per cent, if allowance is made (by using the household model) for the repercussions on spending of induced changes in income. Since two hundred million dollars was about one half of one percent of GNP in 1961 one may form a measure of the employment multiplier by expressing the percentage change in employment as a ratio of the percentage change in GNP; the multiplier was approximately 1.0 in the first instance and

TABLE 6.1A. Percentage Impact on the Employed Population, by Sex, of the Montreal and Toronto MAs, by Source of Impact, Open Model, 1961*

Type of final demand change assumed	Percentage impact on			
	Montreal MA		Toronto MA	
	Males	Females	Males	Females
Government, total	.51	.79	.48	.72
Defence	.51	.20	.35	.18
Health	.59	2.28	.54	1.86
Education	.53	1.43	.55	1.11
Exports, total	.27	.15	.26	.16
Grain	.18	.10	.20	.12
Metallic ores	.15	.09	.15	.11
Oil, gas, etc.	.14	.18	.13	.17
Lumber, etc.	.22	.12	.23	.16
Paper, etc.	.18	.12	.20	.14
Iron, etc.	.35	.13	.28	.14
Non-ferrous prods.	.20	.11	.18	.10
Machinery, etc.	.55	.27	.89	.47
Autos, etc.	.35	.14	.51	.27
Electrical prods., etc.	.90	.62	.80	.65
Chemicals	.35	.24	.32	.23

*Using the notation of Chapter III, part 2., the percentage impact is $\{100 \cdot \Sigma_i \Sigma_k (a_{ikl} + a^*_{ikl})\} \div \Sigma_i \Sigma_k (n_{ikl} + n^*_{ikl})$, where i = 1...190 industries, k = the census tracts belonging to the Montreal or Toronto MA and l denotes either the male or female employed population. A $200 million change in each source of final demand is assumed. This assumption enables the impact on the employed population (a_{ikl} and a^*_{ikl}) to be estimated by the model.

TABLE 6.1B. Percentage Impact on the Employed Population, by Sex, of the Montreal and Toronto MAs, by Source of Impact, Household Model, 1961*

Type of final demand change assumed	Percentage impact on			
	Montreal MA		Toronto MA	
	Males	Females	Males	Females
Government, total	1.15	1.38	1.10	1.32
Defence	1.21	.84	.98	.81
Health	1.13	2.79	1.10	2.39
Education	1.13	2.02	1.17	1.73
Exports, total	.68	.55	.67	.56
Grain	.78	.74	.81	.77
Metallic ores	.67	.63	.67	.66
Oil, gas, etc.	.49	.49	.53	.54
Lumber, etc.	.93	.87	.95	.91
Paper, etc.	.73	.71	.76	.73
Iron, etc.	.96	.69	.85	.69
Non-ferrous prods.	.74	.64	.68	.61
Machinery, etc.	1.30	.92	1.79	1.21
Autos, etc.	.93	.70	1.09	.84
Electrical prods., etc.	1.94	1.57	1.75	1.59
Chemicals	.85	.75	.80	.73

*See footnote to Table 6.1A for the precise formula indicating how the measures in this table are calculated.

2.0 when the household model estimates are used.

The specific sources of final demand change listed in these tables correspond to those mentioned in more precise terms above. The percentage impacts are seen to vary quite widely depending on the source of final demand change assumed. In addition, given the source of final demand change, the impact on males can be quite different in magnitude from that on females; although the metropolitan areas appear to be quite similarly affected, suggesting that the industrial bases do not differ substantially. The impact on the male employed population exceeds that on the female, as a result of assumed changes in all categories of final demand except total government, health and education. Comparing Table 6.1A to 6.1B one finds similar patterns of impact with the difference that the impacts recorded in Table 6.1B consistently exceed the corresponding ones of Table 6.1A. But no matter what model is used, the Montreal impact is similar in magnitude to that of Toronto, given the source of final demand change. This result is in accord with expectation based on the argument presented in Chapter II, that the industrial structures of MAs like Montreal and Toronto will not differ substantially. It is a significant result since it means more trust can be put in the estimates of the induced effects when the direct plus indirect effects are of similar magnitude for the two metro areas.[3]

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[3]This point may be illustrated by the extreme case in which one city receives some impact from the direct and indirect effects and the other city receives none. In the one city retailing and other locally supplied services should be affected but not in the other.

3. Intra-Metropolitan Area Influences

In Table 6.2 the impact on the central city, calculated as a proportion of the 1961 central city employed population, is expressed as a ratio of the corresponding fringe impact. These measures indicate that consistently the impact on the central cities is less than on the fringe areas given the source of final demand change. The only exception of any significance is the health final demand category which, when changed, is estimated to have an impact on the central city exceeding that on the fringe. This is true of both the open and household model estimates. Assuming a decrement in the sources of final demand these results suggest that the resulting fall in employment in most cases would be greater, in proportional terms, in the fringes than the central cities.

The disparity in impact between central city and fringe is in every case less when account is taken, by means of the household model, of the induced effects. This shows up in Table 6.2 by the household model ratios being closer in magnitude to 1.0 than the corresponding open model ratios. This feature may be explained by the argument that the induced effects are spread more evenly over the industries than the direct and indirect effects embodied in the open model estimates. If this is the case and the open model impacts fall more heavily in proportional terms on the fringe, then the employed in the fringe must be more affiliated with the sensitive industries than are the employed in the central city. The central city must therefore contain a higher proportion than the fringe of its employed population affiliated with the insensitive industries, which are relatively more affected when the

TABLE 6.2. Impact on the Employed Population of the Central City Relative to the Fringe, Montreal and Toronto MAs, by Source of Impact, Open and Household Models, 1961

Type of final demand change assumed	Central city impact, proportion of fringe impact*			
	Montreal MA		Toronto MA	
	"Open"	"Household"	"Open"	"Household"
Government, total	1.033	1.003	1.006	1.004
Defence	.629	.791	.700	.865
Health	1.456	1.282	1.500	1.293
Education	.860	.943	.803	.913
Exports, total	.824	.915	.882	.958
Grain	.876	1.004	.888	.996
Metallic ores	.833	.975	.897	.996
Oil, gas, etc.	.883	.988	.864	.960
Lumber, etc.	.894	1.001	.916	.996
Paper, etc.	.856	.983	.913	.996
Iron, etc.	.815	.925	.882	.972
Non-ferrous prods.	.759	.913	.823	.957
Machinery, etc.	.670	.803	.691	.790
Autos, etc.	.891	.974	.707	.854
Electrical prods., etc.	.606	.707	.634	.748
Chemicals	.768	.901	.768	.902

*The central city (fringe) impact is, using the notation of Chapter III, part 2., $\{\Sigma_i \Sigma_k \Sigma_l (a_{ijk} + a^*_{ikl})\} \div \Sigma_i \Sigma_k \Sigma_l (n_{ikl} + n^*_{ikl})$

where i = 1...190 industries, k = census tracts of the central city (or fringe) of Montreal or Toronto and l = males, females. A $200 million change in each source of final demand is assumed.

household model is applied. "Sensitivity" is used in the above context to indicate industries with a relatively high proportional response and the set of "sensitive" industries is thus different according to the source of final demand change assumed.

The generally greater impact on fringe areas than on central city areas is a significant and unexpected result. It is unexpected because in 1961 the unemployment rate of the central cities of the Montreal and Toronto MAs exceeded that of the fringe areas. These results suggest that declines in the categories of government expenditure here considered (except for the health category) would have redressed somewhat the disparity between central city and fringe unemployment rates. Also, reductions in export of the commodity groups would have tended to reduce the disparities.[4]

Urban areas are complex entities, however, and it is worthwhile to examine more detailed influences on urban employment patterns. Within the central cities and fringe there exist both poor and affluent neighbourhoods, for example, and it is possible that the employed population in the poor areas of the central city are being influenced to a greater degree than the employed in affluent areas.

In order to investigate this possibility the impacts on the employed in the lowest and highest average income tracts (poor and rich districts) were aggregated, and the central city impacts for both rich and poor districts were kept separate from the corresponding fringe impacts. Again, the impacts were expressed as a proportion of the

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[4]Any labour hoarding effect would tend to counteract these patterns of impact.

appropriate base year population in order to permit inter-area comparisons in the degree of impact on the employed. The results are presented in Table 6.3. A proportion exceeding 1.0 indicates that the employed in the lowest average income tracts are affected more, in proportional terms, than the employed population in the highest average income tracts. In most cases the impact is estimated to be higher in the rich districts than in the poor districts, again a surprising outcome.

There are a few instances in which the employed in the poor districts are affected more than those in the rich - for example, a reduction in exports of automobiles and parts are estimated to affect the employed in the poor districts of the Montreal and Toronto central cities by 5% and 18.9% respectively, more than the employed in the rich districts. If there existed a labour hoarding effect the disparity of impact would be even greater. Looking only at the aggregate central city and fringe impact these undesired tendencies, undesired on the grounds that the poor areas already had more than their share of social and economic problems, were not detectable.

The extent to which the influences on urban employment patterns are undesireable depends as much or more on the degree of the area impact as on the impact in one area relative to another. The area impacts generated by the household model, expressed as a percentage of the base year employed population, are portrayed in Tables 6.4A (Montreal) and 6.4B (Toronto). Reductions in all categories of government expenditure and in exports of machinery, etc., and electrical products, etc., resulted in the greatest impacts on the rich and poor

TABLE 6.3. Impact on the Employed Population in the Poor Districts Relative to the Rich Districts, Central Cities and Fringes of the Montreal and Toronto MAs, Household Model Estimates, 1961

Type of final demand change assumed	Poor district impact, proportion of rich district impact*			
	Montreal		Toronto	
	Central city	Fringe	Central city	Fringe
Government, total	.901	1.040	.829	.925
Defence	.930	.789	1.037	.958
Health	.757	1.323	.735	1.014
Education	.795	1.174	.560	.808
Exports, total	.909	.833	1.016	.953
Grain	1.000	.900	1.038	1.100
Metallic ores	.901	.821	.820	.955
Oil, gas, etc.	.836	.814	.750	.931
Lumber, etc.	1.021	.956	1.010	1.010
Paper, etc.	.898	.825	1.013	.960
Iron, etc.	1.012	.845	1.142	.937
Non-ferrous prods.	.868	.827	.969	.925
Machinery, etc.	.838	.726	1.048	.672
Autos, etc.	1.050	.943	1.189	.895
Electrical prods., etc.	.719	.521	1.126	.721
Chemicals	.774	.701	.909	.841

*The poor and rich district impacts are calculated using the formula presented in the footnote to Table 6.2 with the difference that the area summation applies only to the census tracts in the central city or fringe with either lowest, or highest, average income employees. The census tracts falling in each district are indicated in Appendix B.

TABLE 6.4A. Percentage Impact on the Employed Population, in the Poor and Rich Districts of the Central City and Fringe of the Montreal MA, by Source of Impact, Household Model, 1961

Type of final demand change assumed	Percentage impact on*			
	Poor districts		Rich districts	
	Central city	Fringe	Central city	Fringe
Government, total	1.18	1.27	1.31	1.22
Defence	.93	1.01	1.00	1.28
Health	1.84	1.88	2.43	1.42
Education	1.32	1.75	1.66	1.49
Exports, total	.60	.60	.66	.72
Grain	.77	.72	.77	.80
Metallic ores	.64	.60	.71	.73
Oil, gas, etc.	.46	.44	.55	.54
Lumber, etc.	.93	.89	.91	.93
Paper, etc.	.71	.66	.79	.80
Iron, etc.	.83	.82	.82	.97
Non-ferrous prods.	.66	.67	.76	.81
Machinery, etc.	.99	1.06	1.18	1.46
Autos, etc.	.83	.83	.79	.88
Electrical prods., etc.	1.36	1.36	1.89	2.61
Chemicals	.72	.73	.93	1.04

*See footnote to Table 6.3 on the subject of how the measures in this table are calculated.

TABLE 6.4B. Percentage Impact on the Employed Population, in the Poor and Rich Districts of the Central City and Fringe of the Toronto MA, by Source of Impact, Household Model, 1961

Type of final demand change assumed	Percentage impact on*			
	Poor districts		Rich districts	
	Central city	Fringe	Central city	Fringe
Government, total	1.12	1.11	1.35	1.20
Defence	.84	.92	.81	.96
Health	1.50	1.41	2.04	1.39
Education	1.07	1.27	1.91	1.57
Exports, total	.61	.61	.60	.64
Grain	.80	.88	.77	.80
Metallic ores	.64	.65	.78	.68
Oil, gas, etc.	.48	.54	.64	.58
Lumber, etc.	.93	.94	.92	.93
Paper, etc.	.73	.72	.74	.75
Iron, etc.	.80	.75	.70	.80
Non-ferrous prods.	.63	.62	.65	.67
Machinery, etc.	1.29	1.25	1.23	1.86
Autos, etc.	.94	.94	.79	1.05
Electrical prods., etc.	1.34	1.37	1.19	1.90
Chemicals	.70	.69	.77	.82

*See footnote to Table 6.3 on the subject of how the measures in this table calculated.

districts of the central city and fringe areas of both Montreal and Toronto. Not only are the area impacts high, in some of these simulations the employed in poor districts are affected more than those in rich areas. Concern of public authorities would probably be strongest in these situations, since they would be influenced not only by the high degree of area impact but, in addition, by the relatively high degrees of impact on poor districts.

It may be of interest to public authorities to know which sub-populations are most likely to be affected by employment change - males compared to females, for example, or low income workers compared to high. It may also be of interest to know why the employed in one sub-metro area are affected more than those in another, when a particular component of final demand is assumed to change. The answer to this type of question is the subject of the next section.

4. Reasons for Differences in Area Impact

More detailed estimates generated by the model may be inspected in order to reveal specific sub-city areas and specific sub-populations receiving the brunt of the impact. The impact of an assumed change in the export of electrical products, for example, is higher on the lowest average income (poor) district of central city Toronto than on the highest average income (rich) district. Table 6.5 presents the percentage impacts on sub-populations of the employed living in the highest and lowest average income tracts of Toronto's central city and fringe. From this example it is evident that the impact on males is approximately the same in both rich and poor areas of the central city

TABLE 6.5. Sub-metro Percentage Impact on the Employed Population of the Toronto MA, by Industry Group and Sex, Using the Household Model Under the Assumption of a $200 Million Change in Exports of Electrical Products, 1961

Industry group[1]	Percentage impact on the employed population			
	Poor districts		Rich districts	
	Central city	Fringe	Central city	Fringe
		(males)		
1 Primary	.75	.73	.77	.76
2 Perishable	.88	.88	.88	.88
3 Semi-durable	1.15	1.13	1.20	1.30
4 Durable	4.61	5.42	7.46	7.59
5 Trade	.95	.95	.96	.96
6 Community	.93	.88	.97	.93
7 Other services	.63	.62	.89	.80
8 Public sector	.00	.00	.00	.00
Total	1.37	1.39	1.34	1.95
		(females)		
1 Primary	.76	.75	.90	.82
2 Perishable	.89	.88	.87	.88
3 Semi-durable	1.05	1.06	1.18	1.33
4 Durable	11.32	10.28	13.36	11.74
5 Trade	.93	.94	.94	.94
6 Community	.99	1.03	1.06	1.01
7 Other services	.97	.93	.97	.95
8 Public Sector	.00	.00	.00	.00
Total	1.30	1.33	.98	1.76
Total (male & female)	1.34	1.37	1.19	1.90

[1]The trade sector consists of the wholesale and retail trade sectors and the "other services" sector comprises the construction, finance, real estate, and transportation-communication sectors of the eleven industry group classification. See Appendix E.

but the impact is higher on the female employed in the poor areas than in the rich areas. Females affiliated with durable goods industries are affected much more than those affiliated with the other industry groups. It is interesting to note that the female impact is higher in the rich districts than in the poor districts of the central city in each of the industry groups, yet the aggregate female impact is lower. How is this possible? The reason lies in the fact that the female employed in the poor areas are more represented in the durable goods industry than are the female employed in the rich areas of the central city. Indeed, the percentage of the female employed in poor areas affiliated with the durable goods industry group is almost twice that of the corresponding rich area percentage (4.54% as compared to 2.40%).[5]

In this same example the impact on the rich districts of the fringe surpasses that on the poor districts of the central city by quite a margin - 1.90% vs. 1.34%. The impact is higher on both the male and female employed resident in rich fringe areas. Again, among industries, the impact is greater on the employed affiliated with the durable goods industry group. The impact on the employed affiliated with the durable goods industry is higher in the rich areas of the fringe than the poor areas of the central city because of the type of durable goods industries that fringe residents prefer to be affiliated with. Specifically, a preference (relative to that of the employed in poor central city tracts) is indicated for those durable goods industries that happen to be most strongly influenced by an assumed change

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[5]The percentages were calculated from data in Appendix D.

in the export of electrical products. Not only does the fringe area (in this example) have an unfavorable mix of employed affiliated with durable goods industries, the percentage of the fringe employed population affiliated with all durable goods industries was higher than the corresponding central city percentages:

Percentage of employed affiliated with durable goods industry, Toronto			
Central City, poor areas		Fringe, rich areas	
Males	Females	Males	Females
7.89	2.40	9.91	8.81

(Calculated from statistics in Appendix D.)

From these examples it is clear that the impact can vary substantially by industry and this, together with inter-area differences in the affiliation pattern of the employed, accounts for differences among areas in the aggregate impact. Assuming a reduction in the export of electrical products the impact was estimated to be greatest on the employed affiliated with the durable goods industries in all the sub-metro areas of Toronto examined. Figures on annual average earnings cited in Chapter IV suggest that this sub-population of the employed is comparatively well off. These figures referred to the national average, however, and the similar average annual earnings figures for the employed resident in the poor areas of central city Toronto were probably much lower.

It is unnecessary to take a detailed look at the impacts generated by each of the other sources of final demand change assumed although to illustrate a contrasting pattern of impact, reference might be made to

the effects of a change in one of the categories of government expenditure. An assumed change in expenditure on health services, for example, generates the largest area impacts of any other sources of final demand change considered and falls more on the central cities than fringes. From Table 6.4A it may be noted that the impact is greater on the rich areas than on the poor areas of central city Montreal but greater on the poor areas than on the rich areas of the metropolitan fringe areas. The impact on sub-populations of the employed, from this source of final demand change, is portrayed in Table 6.6. In each of the four sub-metro areas of Montreal the impact is greater on the female than male employed and consistently so on the employed affiliated with other sectors. In the fringe the poor areas are affected more than the rich areas because the female employed in the public sector are affected more. Also, the female employed affiliated with the public sector constitute a higher proportion of the total female employed in the poor areas of the fringe than in the rich areas - 30.19% vs 19.98%.[6] The opposite situation exists in the central city where the impact on the employed affiliated with the public sector is greater in the rich areas than in poor areas and the proportion of both males and females affiliated with the public sector is higher in the rich areas. Thus the intra-public sector effects work in the same direction as the inter-sectoral effects.

The inspection of detailed impacts generated by assumed changes in export of electrical products and government expenditure on health

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[6]Calculated from data in Appendix D.

TABLE 6.6. Sub-metro Percentage Impact on the Employed Population of the Montreal MA, by Industry Group and Sex, Using the Household Model Under the Assumption of a $200 Million Change in Expenditure on Health Services, 1961

Industry group[1]		Percentage impact on the employed population			
		Poor districts		Rich districts	
		Central city	Fringe	Central city	Fringe
			(males)		
1	Primary	.92	.75	.78	.77
2	Perishable	1.16	1.17	1.11	1.11
3	Semi-durable	1.02	1.02	1.14	1.16
4	Durable	.56	.53	.49	.47
5	Trade	.91	.91	.92	.92
6	Community	.81	.77	.79	.82
7	Other services	.68	.65	.79	.77
8	Public sector	5.09	4.12	6.80	4.35
	Total	1.23	1.14	1.50	1.15
			(females)		
1	Primary	.72	.58	.39	.69
2	Perishable	1.06	1.14	1.08	1.06
3	Semi-durable	1.01	1.03	1.26	1.32
4	Durable	.61	.60	.48	.46
5	Trade	.90	.90	.91	.91
6	Community	.75	.77	.77	1.00
7	Other services	.88	.87	.87	.86
8	Public sector	12.32	10.15	12.49	7.61
	Total	3.02	3.69	4.01	2.28
	Total (male & female)	1.84	1.88	2.43	1.42

[1]The trade sector consists of the wholesale and retail trade sectors and the "other services" sector comprises the construction, finance, real estate, and transportation communication sectors of the eleven industry group classification, see Appendix E.

services has yielded much more information than provided by the aggregate central city and fringe impacts. The higher aggregate impact on the fringe than on the central city induced by a change in the export of electrical products implied that it would tend to reduce central city-fringe disparities in unemployment rates. The more detailed impacts indicated some low average income tracts in the central city could still receive a relatively large impact and that certain sub-populations of the employed would be particularly influenced. The greater impact on the central city than fringe induced by a change in expenditure on health services was seen to affect more the rich areas than poor areas of the central city. The rather surprising result that fringe areas consistently seemed to be influenced more by employment changes than central city areas may thus be assumed to be part of a more complicated reaction and the source of inter-area differences in impact may be traced to two sources - the mix of sectors affected by the particular change in final demand and to the sectoral affiliation pattern of the employed in each area. The more detailed impacts, revealing as they do specific areas and sub-populations strongly influenced by final demand change, are thus of potential interest to public authorities.

It is difficult to assess from the intensity of the sub-metro impact if there is a justification for public employment creating or retraining policies or policies designed to assist community groups to solve their own problems; the reason is that the time dimension of the impact is unknown. Other arguments may of course be advanced for these policies. By looking at more narrowly defined sub-populations the case

for public assistance can often be strengthened although other information on social and family conditions of the sensitive sub-populations would be required before adequate policies, of a community specific nature, could be formulated. Considering the effects of an assumed change in export of electrical products, examined above in some detail, it might be desirable to know the family conditions of women in durable goods industries who are resident in the lowest average income tracts of the central cities before policies designed to offset these effects were formulated.

It may be noted that the relative area impacts are opposite to that noted above if one is considering the effect of an increase in expenditure on the same categories of aggregate demand. This means that there would be a tendency for the demand for employed persons living in the fringe to increase relative to that in the central city. The supply response to this increased demand could be in terms of an increased work week on the part of those presently employed, an increase in the employed population resident in the fringe or an increase in the work week of the central city employed population. Also, the number of employed persons resident in the central city might increase to meet the demand. The variables affecting the actual response pattern would include, on the demand side, the quality of new employees desired and the intra-urban location of the establishments expanding to meet the increased demand.[7] On the supply side, the major factors influencing

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[7]Since some groups of unemployed may find the new jobs inaccessible, due to poor public transportation, even though the jobs are available in the same metropolitan area that they live in.

the response pattern would include the availability of population with the desired characteristics willing to work at the going wage rates at the required work places. Adjustment mechanisms would include wage rates and migration rates. A separate study would be required to adequately explore these processes. Clearly, the model developed in this study should not be used for the purposes of simulating the effects of increases in categories of aggregate demand since the various factors discussed in this paragraph are not represented.

VII

SUMMARY, LIMITATIONS, SUGGESTED RESEARCH

The purpose of this concluding chapter is to briefly summarize the findings of this study, to draw attention to some limitations of the model and to indicate areas in which additional research would seem profitable.

After specifying the major concern of this research (with the effect of assumed changes in the demand for goods and services on sub-metro areas) the first task was to review the various determinants of changes in intra-urban unemployment rates. This review revealed the complexity of the issue. It was evident that household decisions, as regards employment participation and choice of residence site, and business decisions concerning choice of workplace site and technology of production, could be regarded as interacting with each other and with other factors to determine the relationship between place of residence and place of work of sub-populations of the employed labour force. This relationship, together with some knowledge of the hire-fire decisions of businesses, permitted a rudimentary and informal understanding of the determinants of changes in sub-metro unemployment rates. The possibility of integrating the processes into a formal model were ruled out, although preliminary approaches were identified.

The approach selected as most promising for the analysis of the effect of assumed changes in the demand for goods and services on intra-urban unemployment rates depended for its success on differences between neighbourhoods in the industrial affiliation pattern of their employed

residents. A look at the distributions of the employed population of parts of the metropolitan area suggested that differences did indeed exist, at least in the Montreal and Toronto MAs in 1961. The hypotheses of different affiliation patterns by area were not rejected by analysis of variance experiments.

A model was then developed which would permit the simulation of the sub-metro impact of changes in selected components of aggregate demand. This model utilized an input-output conceptual framework and census statistics on the sub-metro distribution of the employed population by industry affiliation. This approach enabled the inclusion of the effects of indirect demand for goods and services (that demand change caused by reduction in inputs by industries directly affected by the assumed change) in the calculation of the total impact on the employed population. It also permitted calculation of induced employment effects (those induced by the effect of changed labour income on consumption of goods and services).

Various problems were encountered in the implementation of the model, but some solutions were found and the remaining problems were judged to be not serious enough to greatly affect the quality of the estimates.

The next step in the study involved the choice of components of final demand change, the employment effects of which would be simulated. It was decided to select shocks that could be regarded as exogenous to the domestic market economy - federal government expenditure programs and the export of commodity groups. Although the nation has some control over federal government expenditure programs, exports are

largely exogenous. Individual cities were assumed to have no control over the effects of either of these sources of demand change.

The results of the simulation experiments indicated that the aggregate impact would fall more heavily on the fringe areas than central cities of Montreal and Toronto. Within fringe and central cities the lowest average income tracts were often affected more than the highest average income tracts, depending on the particular component of aggregate demand change assumed. Closer inspection of the area impacts revealed that certain sub-populations, those affiliated with specific industry groups, would be especially hard hit by a reduction in demand. It was argued that the model was more applicable to the study of impacts of the reduction of demand. In a situation of growth the results indicated that the fringe areas would fair better than the central city areas though the labour and supply reactions not embodied in the model would imply that the disparities in impact estimated by the model would have to be discounted by some unknown amount.

The fact that the impact on the lowest average income tract areas were never substantially different than that on the other districts in the metropolitan areas seemed to argue against any public policy recommendations. It was recognized, however, that there might be a rationale for policy directed to assist certain sub-populations living in the lowest average income tracts.

When one considers certain limitations in the model used to estimate the sub-metro impacts, and the possible attendant biases in the estimates, the case for area and individual-specific public policy and analysis is strengthened. It is quite possible, for example, that

a firm will not lay off the different grades of labour in a proportional manner, as our model assumes, but will lay off the less qualified grades in greater proportion than the more skilled grades.[1] This policy would have economic rationale, as Oi and others have argued.[2] Employee unions may ensure that this is the outcome too, either by seniority rules or perhaps by greater bargaining strength of unions representing the more skilled workers. Since the lower skilled are more likely to reside in the lowest average income tracts of a city than the highest, any greater tendency of these workers to be laid off in times of business slowdown will show up by greater impacts than our model has estimated on the lowest average income tract areas relative to the highest. This would appear to be a promising area of future research - to analyse the relative sensitivity of sub-populations of the employed population to hire - fire decisions and the consequent sub-city area implications. The underlying theory of this work could utilize the conceptual developments of Oi, Clark and Gilman,[3] making modifications such that the theory might be tailored to an urban labour market context.

Another possible problem with the model proposed in this study is that it does not allow for the effect of closure of businesses,

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[1]On the other hand the model employed in this study is of the comparative statics variety and, although in the short run the employers may find it desirable to discriminate by skill level, the longer run equilibrium ploicy may work to restore the initial employee-skill structure.

[2]The theoretical argument and empirical support are summarized in Chapter II.

[3]These developments are briefly surveyed in Chapter II.

though in times of general or sectoral business slowdown closure may be common. The smaller and older businesses of an industry may be particularly sensitive to reductions in sales. These sensitive businesses may be more commonly located in the central cities than the fringe, and employ the more accessible central city labour. The skill requirement of these older businesses may also be lower than that of the newer businesses and for this reason the labour forces would be more likely to reside in the lower income tract areas. This area of research has not received substantial attention in the past but it may be fruitful in identifying the source of urban social and economic problems and suggestive of public policies.

A related issue that has received a little more attention is the urban manpower implications of plant location and expansion.[4] Mills notes the tendency of all industries to decentralize, though at different rates.[5] Other authors have noted that fringe locations may be inaccessible to many central city residents, due to inadequacies in public transportation.[6] Thus if there are expansions and new businesses being formed at the fringe at a rate faster than in the central city the tendency will be for unemployment rates to fall in the fringe areas

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[4]The subject has received little attention in Canada, due perhaps to data problems.

[5]The agrument and evidence are briefly reviewed in Chapter II.

[6]These issues are summarized in most textbooks in urban economics. Another recent review is Bennett Harrison, "Ghetto Economic Development", Journal of Economic Literature, XII, No.1 (March, 1974), p. 25.

relative to the central city. This might be offset to some extent by intra-urban and inter-urban migration. Actually, few empirical studies can be found addressing themselves to these questions though they would seem to be important aspects of urban structure.

If future research does find that the interaction of individual and businesses decisions of the type sketched above is responsible for the persistence of central city - fringe disparities in unemployment rates, public action aimed at the integration and re-integration of the unemployed of lower average income districts of metropolitan areas may be indicated. One proposal that has gained some support in the United States is, according to Harrison, to recruit

> "ghetto residents for federal state and local (government) jobs located outside the ghetto. Jobs in this sector have been found to be far superior to private sector jobs which ghetto dwellers now hold or aspire to, in terms of relative wages and benefits, cyclical stability, modest skill requirements and central place orientation".[7]

It is possible that the model developed in this study could be modified to study the impact of this policy. In essence the policy requires alteration of the skill requirement of public service jobs, plus perhaps more on-the-job training. In terms of the model this means that governments have the freedom to alter the occupational mix when providing certain services. In this study only two types of labour were distinguished, male and female. From the census data base more labour distinctions, according to skill, education or income, could

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[7] Harrison, ibid., p. 26

be made on an industry basis by sub-metro area. These two elements, a new government function vector specifying goods, services and detailed manpower requirement per unit of public service output, and more detailed sub-metro tabulations of the employed (and perhaps unemployed) labour force would form the main ingredients of any such modified model.

APPENDIX A

Urban Area Unemployment Rates, 1961 and 1971

TABLE A1. Male and Female Unemployment Rates of the Census Metropolitan Areas and Associated Central Cities, June, 1961

	Unemployment rate(1)			
	Metropolitan area		Central city	
	Male	Female	Male	Female
Calgary	3.7	3.8	3.5	3.6
Edmonton	4.1	2.8	4.2	2.7
Halifax	2.8	2.7	3.2	2.4
Hamilton	4.3	3.9	5.2	4.1
Kitchener	3.1	3.1	3.0	3.0
London	3.1	2.0	3.2	2.0
Montreal	3.9	2.7	4.8	2.8
Ottawa-Hull	3.0	2.2	3.1	2.2
Quebec	4.0	2.2	4.7	2.3
St. John's (Nfld.)	5.8	3.1	5.2	2.8
Saint John	5.8	2.5	7.0	2.5
Sudbury	3.1	4.1	3.0	3.6
Toronto	3.4	2.6	5.5	2.8
Vancouver	6.2	4.6	7.7	4.4
Victoria	3.4	3.9	5.3	3.6
Windsor	6.4	5.3	7.3	5.0
Winnipeg	3.5	2.5	4.3	2.5

(1) Source: DBS, 1961 Census of Canada, Wage Earners: Earnings and Employment, III:3, (Ottawa, 1965), Table 2 and 4. The unemployed, those looking for work with previous work experience plus the new job seekers, were divided by the total labour force in deriving these estimates of the unemployment rate.

APPENDIX A (concluded)

TABLE A2. Unemployment Rates of Selected Census Metropolitan Areas, June, 1971

	Unemployment Rate			
	Census(1)			LFS(2)
	Total	Male	Female	Total
Calgary	7.5	6.7	9.0	2.9
Edmonton	7.4	7.0	8.0	4.0
Halifax	6.9	6.3	8.0	n/a(3)
Hamilton	7.6	6.1	10.4	n/a
Kitchener	6.0	5.2	7.4	n/a
London	6.5	5.8	7.6	n/a
Montreal	9.3	9.0	10.0	6.9
Ottawa-Hull	6.4	5.8	7.3	n/a
Quebec	8.1	7.9	8.4	n/a
St. John's (Nfld.)	8.3	9.0	7.0	n/a
Saint John	7.4	7.1	7.8	n/a
Sudbury	6.2	4.6	10.0	n/a
Toronto	6.9	6.2	8.0	5.9
Vancouver	9.4	8.9	10.2	7.7
Victoria	8.4	8.1	8.9	n/a
Windsor	8.8	8.4	9.7	n/a
Winnipeg	7.4	6.9	8.2	5.3

(1) Source: Statistics Canada, 1971 Census of Canada Advance Bulletin, Labour Force Activity (Ottawa, February, 1974), Table 2.
(2) Source: Statistics Canada, The Labour Force, XXVIII, No. 6 (Ottawa, July, 1972), Table 20.
(3) n/a = not available.

APPENDIX B

Census Tract Composition of Sub-Metro Areas

The following lists of census tract numbers correspond to the numbering used in the 1961 census of Canada. Within each sub-metro area, identified by the title, the census tracts are arranged in decending order on the basis of average wages and salaries of wage earners. All the tracts of the Montreal and Toronto MAs were first arranged into decending order according to average wages and salaries and the first second, third and fourth quarters of tracts were then labeled highest, high, low and lowest average income tracts.

Montreal MA, central city, highest average income tracts:

089 092 096 091 094 093 103 101 095 090 111 118 102 237
100 235

Montreal MA, urban fringe, highest average income tracts:

331 261 112 330 328 384 334 310 315 262 338 329 339 260
320 324 319 386 385 275 403 276 309 274 437 426 335 250
464 451 254 356 296 277 303 273 256 392 431 383 305 445
354 316 435 294 421 252 301 271 293 454 452

Montreal MA, rural fringe, highest average income tracts:

419 326 327 460 332

APPENDIX B (continued)

Montreal MA, central city, high average income tracts:

176 088 005 104 211 183 236 231 238 110 175 233 004 002

232 228 117 058 230 178 006 003 080 224 083 179 180 007

001 225 229 182 193 177 084 181 212 173 222 188 008 108

Montreal MA, urban fringe, high average income tracts:

291 366 389 292 278 453 253 391 407 304 344 360 286 302

446 352 266 463 387 415 314 368 362 287 333 380 289 312

465 290 439 413 251 288 255 374 350 341 311 409 280 417

367 404 308

Montreal MA, rural fringe, high average income tracts:

340 418

Montreal MA, central city, low average income tracts:

191 098 097 164 161 012 172 013 113 184 213 210 221 160

099 120 171 082 170 119 223 085 115 214 151 215 169 167

021 011 057 227 025 194 150 081 010 144 196 187 192 220

198 064 024 168 166 153 185 165 109 234 077 209 152 023

029 159 148 066 163 105 107 009 149 208 020 078 162 145

158 087 015 197 030 106 143 199 086 114 026 157 218 203

217 022 200 075 019 186 027

Montreal MA, urban fringe, low average income tracts:

345 265 313 420 284 441 400 281 285 351 270 283 375 430

342 306 447 279 422 462 267 365 371 373

APPENDIX B (continued)

Montreal MA, rural fringe, low average income tracts:

461 450 336

Montreal MA, central city, lowest average income tracts:

207 028 067 014 189 219 079 155 216 154 034 068 036 038

132 032 190 016 031 017 073 147 204 201 074 195 065 035

202 206 076 116 072 018 141 039 146 140 133 127 060 071

142 131 069 044 205 063 138 121 047 062 126 056 040 130

059 041 139 129 042 134 046 125 123 043 135 128 137 033

136 070 156 061 054 049 052 124 048 051 037 050 045 053

122 055 226

Montreal MA, urban fringe, lowest average income tracts:

358 370 381 382 269 425 440 411 376 282 372 307 393 268

443 337 295 272 364 321

Montreal MA, rural fringe, lowest average income tracts:

449 448

Toronto MA, central city, highest average income tracts:

034 080 064 082 092 081 094 066 093 051 086 079 083 019

065 085 048 132

Toronto MA, urban fringe, highest average income tracts:

267 266 263 197 265 261 259 194 301 453 257 192 198 196

182 276 161 401 193 290 260 191 270 169 403 189 136 206

256 138 280 271 258 160 402 282 248 269 255 274 272 451

190 281 264 279 275 291 162 404 278 170 199 212 201 137

APPENDIX B (continued)

512 407 286 163 168 452 184 254 502 247 262 164 200 249

285 551 500 214 450 284 501 153 203 171 155 166 149 202

186 277 406 176 213

Toronto MA, rural fringe, highest average income tracts:

513

Toronto MA, central city, high average income tracts

078 084 072 067 075 087 090 135 089 030 032 133 130 088

053 127 004 128 131 076

Toronto MA, urban fringe, high average income tracts:

183 283 273 253 204 165 216 141 139 237 553 143 154 550

195 142 224 217 222 159 252 268 294 188 208 172 405 156

175 510 300 185 218 148 146 240 167 147 511 205 187 215

245 221 207 410 174 250 219 144 157 223 181 296 236 295

552 289 173 287 242 251 180 239 140 288 238 145 179

Toronto MA, rural fringe, high average income tracts:

430 454 460

Toronto MA, central city, low average income tracts:

068 052 001 006 126 055 020 120 106 123 070 010 031 124

125 129 121 109 005 113 058 026 111 036 115 118 014 108

122 033 110 027 003 116

Toronto MA, urban fringe, low average income tracts:

246 234 177 209 151 241 400 178 225 226 152 292 210 211

243 343 232 235 220 297 299 233 227 298 229

APPENDIX B (concluded)

Toronto MA, rural fringe, low average income tracts:

580 431 531 581 532

Toronto MA, central city, lowest average income tracts:

035 007 016 022 095 021 107 069 023 002 097 117 009 017

102 025 098 028 119 112 011 054 029 071 012 100 040 008

015 114 018 037 105 024 096 038 013 039 049 056 042 099

046 044 047 134 103 041 060 062 061 043 057 150 045 063

101 074 059 050 073 104

Toronto MA, urban fringe, lowest average income tracts:

230 293 231 158 228 244

Toronto MA, rural fringe, lowest average income tracts:

432 514 533 530 455 582

APPENDIX C

Male and Female Employment Adjustment Factors, by 3-Digit SIC Industry Groups, Employment Survey Source

The following factors were obtained by dividing the 1961 average number of employed by the June, 1961 number of employed. In certain cases, marked by an asterik, the factors were assumed to equal 1.0 since the factors derived from the unpublished data base were based on very small numbers of employees and were considered unreliable. The few industry groups not represented in the file were also assigned a factor of 1.0.

S.I.C.	Factor		S.I.C.	Factor		S.I.C.	Factor	
	Male	Female		Male	Female		Male	Female
031	1.3588	1.0285	039	0.9330	1.0175	051	1.0000*	1.0000*
052	0.9460	0.8472	053	0.9885	0.9915	054	0.9934	0.9178
055	0.9862	1.1429	056	0.8736	0.8760	057	0.9387	0.9569
058	1.0188	0.9928	059	0.9952	1.2857	061	0.8850	0.9651
063	0.9853	0.9834	071	0.9928	1.0000	073	0.9655	1.0000
077	1.0740	0.9806	079	1.0496	1.1829	083	0.9388	1.0145
087	0.8909	1.0000	092	1.4359	1.0000	094	0.8785	0.9474
096	1.2589	1.0291	098	1.0766	1.0930	099	1.0354	0.9091
101	1.0143	0.9202	103	1.1184	1.0221	105	0.9864	0.8999

APPENDIX C (continued)

S.I.C.	Factor		S.I.C.	Factor		S.I.C.	Factor	
	Male	Female		Male	Female		Male	Female
107	1.0242	0.8594	111	1.1585	0.6828	112	1.4240	1.2346
123	0.9827	0.9756	124	0.9890	1.0172	125	1.0522	0.9434
128	1.0572	0.9461	129	1.0062	0.9974	131	0.9726	1.1789
133	1.1594	1.0263	135	1.0239	1.0909	139	1.0008	0.9821
141	0.9875	0.9266	143	1.0314	1.0735	145	0.9497	0.9883
147	0.8375	1.0000	151	2.3528	10.9143	153	1.0633	0.9695
161	1.2335	0.9775	163	0.9885	1.0233	169	1.0090	0.9867
172	1.0082	1.0378	174	1.0526	1.0027	175	1.0414	1.0153
179	0.9476	1.0608	183	1.0177	1.0406	193	1.1352	0.9982
197	0.9910	0.9858	201	1.0199	1.0051	211	1.0290	1.0385
212	1.0069	0.9938	213	0.9878	0.9872	214	1.0153	0.9915
215	1.0000	1.0000	216	0.9945	1.0830	218	1.0761	0.9805
219	1.0083	1.0127	221	0.9213	0.8512	223	1.0641	0.9928

APPENDIX C (continued)

S.I.C.	Factor		S.I.C.	Factor		S.I.C.	Factor	
	Male	Female		Male	Female		Male	Female
229	0.9600	1.0244	231	1.0520	1.0470	239	1.0029	1.0330
242	0.9844	1.0588	243	1.0242	1.0071	244	1.0659	1.0297
245	1.0708	1.0005	246	1.0802	0.9713	247	1.0637	0.9867
248	1.1082	1.0023	249	0.8854	1.0351	251	0.9711	1.0130
252	0.9637	0.9412	254	1.0138	0.9699	256	0.8904	0.9892
258	1.0095	1.0317	259	0.9930	0.9958	261	1.0159	0.9988
264	1.0088	1.0112	266	1.0201	1.0238	268	1.0891	1.1135
271	1.0001	0.9796	272	1.0278	1.0064	273	1.0215	0.9868
274	1.0073	0.9840	286	1.0042	1.0124	287	0.9840	1.0189
288	1.0330	0.9965	289	1.0017	0.9923	291	0.9941	0.9915
292	1.0932	1.0171	294	0.9993	0.9928	295	0.9912	0.9537
296	0.9991	1.0115	297	1.0041	0.9938	298	1.0304	1.0927
301	0.9810	1.0345	302	0.9932	0.9743	303	1.0457	1.0033

APPENDIX C (continued)

S.I.C.	Factor		S.I.C.	Factor		S.I.C.	Factor	
	Male	Female		Male	Female		Male	Female
304	o.9679	0.9650	305	0.9953	1.0323	306	0.9824	1.0166
307	1.0922	1.0307	308	1.0261	1.0113	309	1.0179	1.0210
311	0.9168	0.9749	315	1.0136	1.0069	316	0.9701	0.9151
318	1.0171	0.9813	321	0.9979	1.0204	323	0.9358	0.9959
324	0.9021	0.9822	325	0.9838	1.0367	326	1.1203	1.0044
327	0.9597	0.9981	328	0.7743	0.9630	329	1.0291	1.2340
331	1.0324	1.0590	332	0.9965	0.9602	334	1.1027	1.0258
335	1.0322	1.0123	336	1.0138	1.0367	337	1.0147	0.9423
338	1.0070	1.0000	339	1.0330	1.0264	341	0.9433	0.9944
343	0.9699	1.0106	345	1.0083	0.9773	347	1.0210	1.0302
348	1.0126	0.7990	351	0.9710	1.0651	352	1.0221	0.9667
353	1.1820	1.0500	354	0.9840	0.9787	355	0.9760	0.9424
356	1.0332	0.9510	357	1.0451	0.9890	359	0.9829	0.9574
365	0.9929	1.0210	369	0.8696	1.0000	371	0.9921	0.9840

APPENDIX C (continued)

S.I.C.	Factor		S.I.C.	Factor		S.I.C.	Factor	
	Male	Female		Male	Female		Male	Female
372	0.7468	0.9885	373	0.9990	0.9914	374	1.0125	0.9812
375	0.9705	0.9553	376	1.0174	1.0207	377	1.0416	0.9897
378	0.9930	0.9901	379	0.9823	1.0060	381	0.9910	1.0203
382	1.0280	1.1037	383	1.0008	1.0445	384	0.9825	0.8667
385	0.9554	1.0565	388	1.0000	1.0000	393	1.0412	1.0349
395	1.0308	0.9324	397	0.9963	0.9906	399	1.0104	1.0575
404	1.0139	0.9932	406	0.9082	0.8929	409	1.0018	1.0042
421	1.0137	1.0120	501	0.9972	0.9770	502	0.9508	0.9922
504	0.8829	0.7316	505	0.9132	0.9817	506	1.0148	0.9737
507	1.0169	1.0142	508	1.0144	0.9249	509	1.9940	0.9936
512	1.0338	1.0631	515	0.9954	0.9966	516	0.9721	0.9706
517	0.8976	1.0083	519	1.2609	1.0000*	524	0.9499	0.9900
527	1.0188	0.9725	543	1.0491	1.0454	544	1.0022	0.9896

APPENDIX C (continued)

S.I.C.	Factor		S.I.C.	Factor		S.I.C.	Factor	
	Male	Female		Male	Female		Male	Female
545	1.0189	0.9900	548	0.9054	1.0090	572	0.9916	0.9706
574	0.9928	1.0017	576	0.9362	0.9315	579	0.9414	1.0625
602	0.9351	0.9524	604	0.9732	0.9489	606	1.0308	1.0199
608	1.0153	0.9935	611	0.9929	1.0225	613	1.0877	0.9359
614	1.0454	1.1649	615	1.0755	1.0561	616	1.0117	1.0015
617	1.0410	1.0086	618	1.0442	1.0491	619	0.9995	0.9839
621	1.0091	1.0305	622	0.9903	0.9508	623	1.0007	1.0120
624	0.9927	1.0098	625	1.0182	1.0267	626	0.9896	0.9788
627	0.9971	0.9825	629	1.0249	1.0220	631	0.9981	1.0181
642	1.0252	1.0527	647	1.0888	0.9948	649	0.9521	0.9869
652	1.0044	0.9655	654	0.9574	1.0055	656	0.9869	1.0092
658	1.0180	1.0000	663	0.9495	0.9622	665	1.0168	1.0029
667	0.9155	1.0269	669	1.0079	1.0478	673	1.0093	1.0551

S.I.C.	Factor		S.I.C.	Factor		S.I.C.	Factor	
	Male	Female		Male	Female		Male	Female
676	0.9989	1.0259	678	0.9241	1.0000	681	1.0070	1.0173
691	0.9710	1.0856	692	0.8957	1.0641	693	1.0671	1.0549
694	1.0493	1.0512	696	1.0370	0.9939	697	0.9392	0.9845
699	1.0195	1.0516	702	1.0154	1.0079	704	1.0343	0.9912
731	1.0025	0.9794	735	1.0095	0.9866	737	1.1965	1.1208
807	1.0000*	1.0000*	851	0.9951	1.0182	853	1.2598	1.4366
859	0.9507	0.9930	861	1.0284	1.0077	862	0.9880	1.0314
864	1.0042	0.9975	866	1.0594	1.0428	869	1.0042	1.0197
872	0.7814	1.0344	874	1.0181	0.9713	875	1.0695	0.9390
876	0.9349	0.9916	877	1.0000*	1.0000*	879	0.9788	0.9158
891	1.6449	1.0585	893	1.0566	0.9319	894	1.0000	1.0000
896	1.0263	1.0000	897	1.0094	1.0904	899	1.0322	1.1717

APPENDIX D

Estimated Employed Population by Industry Group,[1] Sex and Sub-Metro Area, Montreal and Toronto MAs, 1961

	A. Employed Population of Montreal MA					
Category(2)	Primary	Perishable	Semi-dur.	Durable	Construction	Transp.
111	144	687	3,865	3,446	1,296	3,208
112	312	3,801	10,359	11,466	7,290	10,247
113	646	6,998	16,640	18,263	11,562	17,357
114	395	4,899	11,320	10,765	8,881	12,007
121	519	2,994	10,567	14,162	4,998	11,342
122	443	3,918	9,476	16,217	8,706	10,913
123	274	2,107	4,510	7,217	5,474	5,287
124	121	1,043	2,247	3,527	2,489	2,539
211	19	252	1,666	873	157	1,422
212	30	1,621	6,760	1,740	261	2,206
213	33	3,240	14,719	2,762	364	3,210
214	9	1,984	14,115	1,421	136	1,576
221	45	605	2,904	1,956	263	2,106
222	23	1,094	4,677	2,263	188	1,628
223	6	695	3,215	875	82	653
224	5	332	1,544	325	29	247
100	2,855	26,447	68,983	85,065	50,697	72,899
200	171	9,823	49,601	12,215	1,481	13,047
000	3,026	36,270	118,584	97,280	52,178	85,946

(1) Eleven industry groups identified in Appendix A.
(2) First digit: 1 = males, 2 = females, 0 = males & females
Second digit: 1 = central city, 2 = fringe, 0 = central city & fringe
Third digit: 1,2,3,4 = highest, high, low and lowest average income tracts, respectively; and 0 indicates the total.

APPENDIX D (continued)

Category(2)	A. Employed Population in Montreal MA					
	Wholesale	Retail	Finance	Community	Public	Total
111	2,736	2,349	2,966	3,625	3,036	27,358
112	5,110	8,708	3,888	6,686	9,878	77,745
113	7,437	14,239	4,575	11,258	12,318	121,292
114	4,529	9,520	2,349	11,884	8,349	84,898
121	6,787	6,272	6,044	7,362	5,509	78,336
122	4,962	8,755	3,286	6,010	8,058	81,580
123	2,147	4,492	1,164	3,110	4,791	39,339
124	977	2,366	505	1,631	2,206	19,617
211	836	1,503	1,481	3,552	4,350	16,112
212	1,344	4,218	2,996	5,425	7,569	34,172
213	2,252	7,217	4,554	9,663	10,347	58,363
214	1,084	4,162	2,214	8,797	8,077	43,574
221	1,192	2,880	2,456	6,009	5,098	25,513
222	1,053	3,362	2,272	5,110	5,097	26,768
223	444	1,751	989	2,475	2,096	13,281
224	165	851	402	1,714	2,428	8,041
100	34,685	56,701	24,777	51,566	55,493	530,116
200	8,369	25,945	17,364	42,745	45,062	225,822
000	43,054	82,646	42,141	94,311	100,554	755,988

(1) Eleven industry groups identified in Appendix A.
(2) First digit: 1 = males, 2 = females, 0 = males & females
Second digit: 1 = central city, 2 = fringe, 0 = central city & fringe
Third digit: 1,2,3,4 = highest, high, low and lowest average income tracts, respectively; and 0 indicates the total

APPENDIX D (continued)

B. Employed Population of Toronto MA

Category	Primary	Perishable	Semi-dur.	Durable	Construction	Transp.
111	188	430	2,223	1,507	633	1,575
112	163	1,022	3,870	3,860	1,865	3,956
113	254	2,489	6,360	7,695	3,937	6,194
114	728	4,581	10,096	13,230	12,494	9,239
121	1,424	5,502	20,133	24,757	10,303	15,476
122	623	4,903	14,489	20,522	8,600	12,410
123	335	2,155	6,480	7,450	6,083	4,936
124	256	493	1,682	1,698	1,733	939
211	53	156	1,115	343	74	882
212	53	485	2,694	1,044	132	1,399
213	42	1,076	4,845	1,642	130	1,636
214	52	1,935	9,628	2,162	156	1,752
221	159	1,346	6,753	5,116	625	3,031
222	108	1,825	7,821	5,345	432	2,323
223	53	826	3,911	1,617	210	1,000
224	42	189	853	288	66	254
100	3,972	21,575	65,332	80,720	45,649	54,725
200	562	7,837	37,620	17,557	1,826	12,278
000	4,534	29,412	102,952	98,277	47,475	67,200

(1) Eleven industry groups identified in Appendix A.
(2) First digit: 1 = males, 2 = females, 0 = males and females
Second digit: 1 = central city, 2 = fringe, 0 = central city & fringe
Third digit: 1,2,3,4 = highest, high, low and lowest average income tracts, respectively; and 0 indicates the total

APPENDIX D (concluded)

	B. Employed Population of Toronto MA					
Category(2)	Wholesale	Retail	Finance	Community	Public	Total
111	1,642	1,741	2,905	3,535	2,698	19,076
112	2,103	3,527	2,430	3,999	3,630	30,424
113	2,945	5,617	1,874	5,685	4,749	47,799
114	4,802	9,011	2,253	11,776	6,913	85,122
121	13,324	16,702	10,972	13,889	16,413	148,895
122	7,654	12,219	4,336	8,099	10,166	104,022
123	3,520	6,378	1,996	4,405	4,035	47,773
124	1,196	1,971	618	1,466	972	13,024
211	677	1,692	1,971	3,697	3,606	14,266
212	1,040	3,622	2,953	4,744	4,310	22,476
213	1,228	4,774	3,112	6,968	4,910	30,364
214	1,628	6,289	3,442	13,062	7,528	47,614
221	3,190	9,615	6,088	10,214	11,903	58,041
222	2,806	7,718	4,703	8,124	7,424	48,628
223	1,123	3,960	2,276	4,572	3,273	22,821
224	259	788	436	1,492	809	5,477
100	37,186	57,166	27,384	52,853	49,574	496,135
200	11,952	38,457	24,961	52,873	43,763	249,686
000	49,138	95,622	52,346	105,726	93,338	745,821

(1) Eleven industry groups identified in Appendix A.
(2) First digit: 1 = males, 2 = females, 0 = males & females
Second digit: 1 = central city, 2 = fringe, 0 = central city & fringe
Third digit: 1,2,3,4 = highest, high, low and lowest average income tracts, respectively; and 0 indicates the total

APPENDIX E

Industry Classification Schemes

Input-Output Industry Code and Title[1]		1960 SIC Codes	11 Industry Groups
1	Agriculture	001-021	1 (Primary)
2	Forestry	031-039	1 "
3	Fishing, hunting, trapping	041-047	1 "
4	Base metal, other metal mines	053-056,059	1 "
6	Uranium mines	057	1 "
7	Iron mines	058	1 "
8	Gold mines	051-052,	1 "
9	Coal mines	061	1 "
10	Petroleum, gas wells	063-066	1 "
12	Asbestos mines	071	1 "
13	Gypsum mines	073	1 "
14	Salt mines	077	1 "
15	Other non-metal mines	079	1 "
16	Quarries, sand pits	083,087	1 "
17	Services incidental to mining	092-099	1 "
18	Slaughtering, mean processors	101	2 (Parishable)
19	Poultry processors	103	2 "
20	Dairy factories	105	2 "
21	Process cheese mfgrs.	107	2 "
22	Fish products industry	111	2 "
23	Fruit, vegetable canners	112	2 "
24	Feed mfgrs.	123	2 "
25	Flour mills	124	2 "
26	Breakfast cereal mfgrs.	125	2 "
27	Biscuit mfgrs.	128	2 "
28	Bakeries	129	2 "
29	Confectionery mfgrs.	131	2 "
30	Sugar refineries	133	2 "
31	Vegetable oil mills	135	2 "

[1]Source: Input-Output Division, Statistics Canada, Ottawa (internal worksheet)

Input-Output Industry Code and Title[1]		1960 SIC Codes	11 Industry Groups
32	Miscellaneous food industries	139	2 "
33	Soft drink mfgrs.	141	2 "
34	Distilleries	143	2 "
35	Breweries	145	2 "
36	Wineries	147	2 "
37	Leaf tobacco processing	151	2 "
38	Tobacco products mfgrs.	153	2 "
39	Rubber footwear mfgrs.	161	3 (Semi-durable)
40	Tire, tube mfgrs.	163	3 "
41	Other rubber industries	169	3 "
42	Leather tanneries	172	3 "
43	Shoe factories	174	3 "
44	Leather gloves factories	175	3 "
45	Small leather goods mfgrs.	179	3 "
46	Cotton yarn, cloth mills	183	3 "
47	Wool yarn mills	193	3 "
48	Wool cloth mills	197	3 "
49	Synthetic textile mills	201	3 "
50	Fibre preparing mills	211	3 "
51	Thread mills	212	3 "
52	Cordage, twine industry	213	3 "
53	Narrow fabric mills	214	3 "
54	Pressed, punched felt mills	215	3 "
55	Carpet, mat rug industry	216	3 "
56	Textile dyeing, finishing	218	3 "
57	Linoleum, coated fabrics ind.	219	3 "
58	Canvas products industry	221	3 "
59	Cotton, jute bag industry	223	3 "
60	Miscellaneous textile ind.	229	3 "
61	Hosiery mills	231	3 "
62	Other knitting mills	239	3 "

[1]Refer to first page of Appendix E

APPENDIX E (continued)

Input-Output Industry Code and Title[1]		1960 SIC Codes	11 Industry Groups
63	Clothing industries	242-249	3 (Semi-durable)
64	Sawmills	251	4 (Durable
65	Veneer, plywood mills	252	4 "
66	Sash, door, other millwork plants	254	4 "
67	Wooden box factories	256	4 "
68	Coffin, casket industry	258	4 "
69	Miscellaneous wood industries	259	4 "
70	Household furniture industry	261	4 "
71	Office furniture industry	264	4 "
72	Other furniture industries	266	4 "
73	Electric lamp, shade industry	268	4 "
74	Pulp, paper mills	271	3 (Semi-durable)
75	Asphalt roofing mfgrs.	272	3 "
76	Paper box, bag mfgrs.	273	3 "
77	Other paper converters	274	3 "
78	Printing, publishing	286,288,289	3 "
79	Engraving, sterotyping ind.	287	3 "
80	Iron, steel mills	291	4 (Durable)
81	Steel, pipe, tube mills	292	4 "
82	Iron foundries	294	4 "
83	Smelting, refining	925	4 "
84	Aluminum rolling, extruding	296	4 "
85	Copper, alloy rolling	297	4 "
86	Metal casting, extruding n.e.s.	298	4 "
87	Boiler, plate works	301	4 "
88	Fabricated struct. metal ind.	302	4 "
89	Ornamental, arch. metal ind.	303	4 "
90	Metal stamp., press, coat. ind.	304	4 "
91	Wire, wire products mfgrs.	305	4 "
92	Hardware tool, cutlery mfgrs.	306	4 "
93	Heating equipment mfgrs.	307	4 "
94	Machine shops	308	4 "

[1]Refer to first page of Appendix E

Input-Output Industry Code and Title[1]		1960 SIC Codes	11 Industry Groups
95	Misc. metal fabricating ind.	309	4 (Durable)
96	Agricultural implement ind.	311	4 "
97	Miscellaneous machinery, equip. mfgrs.	315	4 "
98	Comm. refrig., air cond. mfgrs.	316	4 "
99	Office, store machinery mfgrs.	318	4 "
100	Aircraft, parts mfgrs.	321	4 "
101	Motor vehicle mfgrs.	323	4 "
102	Truck body, trailer mfgrs.	324	4 "
103	Motor vehicle parts, access. mfgrs.	325	4 "
104	Railroad rolling stock ind.	326	4 "
105	Shipbuilding, repair	327	4 "
106	Miscellaneous transp. equip. ind.	328,329	4 "
107	Small electrical appliances	331	4 "
108	Major appliances elect., non	332	4 "
109	Radio, television receivers	334	4 "
110	Communications equipment mfgrs.	335	4 "
111	Mfgrs. of elect. ind. equip.	336	4 "
112	Battery mfgrs.	337	4 "
113	Mfgrs. of electric wire, cable	338	4 "
114	Mfgrs. of misc. elect. products	339	4 "
115	Cement mfgrs.	341	4 "
116	Lime mfgrs.	343	4 "
117	Gypsum products mfgrs.	345	4 "
118	Concrete products mfgrs.	347	4 "
119	Ready-mix concrete mfgrs.	348	4 "
120	Clay products mfgrs.	351	4 "
121	Refractories mfgrs.	352	4 "
122	Stone products mfgrs.	353	4 "
123	Mineral wool mfgrs.	354	4 "
124	Asbestos products mfgrs.	355	4 "
125	Glass, glass products mfgrs.	356	4 "

[1]Refer to first page of Appendix E

Input-Output Industry Code and Title[1]		1960 SIC Codes	11 Industry Groups
126	Abrasives mfgrs.	357	4 (Durable)
127	Other non-metallic prods. ind.	359	4 "
128	Petroleum refineries	365	3 (Semi-durable)
129	Other petrol, coal prod. ind.	369	3 "
130	Explosives, ammunition mfgrs.	371	3 "
131	Mfgrs. of mixed fertilizers	372	3 "
132	Mfgrs. of plast., synth. res.	373	3 "
133	Mfgrs. of pharm., medicines	374	3 "
134	Paint, varnish mfgrs.	375	3 "
135	Mfgrs. of soap, cleaning comp.	376	3 "
136	Mfgrs. of toilet preparations	377	3 "
137	Mfgrs. of industrial chemicals	378	3 "
138	Other chemical industries	379	3 "
139	Scient., prof. equip. mfgrs.	381	3 "
140	Jewelry, silverware mfgrs.	382	3 "
141	Broom brush, mop industry	383	3 "
142	Venetian blind mfgrs.	384	3 "
143	Plastic fabricators, n.e.s.	385	3 "
144	Sporting goods, toy industry	393	3 "
145	Fur dressing, dying industry	395	3 "
146	Signs, displays industry	397	3 "
147	Misc. manufacturing ind. n.e.s.	399	3 "
148	Construction industry	404-421	3 "
149	Air transport	501	5 (Construction)
150	Services incidental to transp.	502,517-519	6 (Transportation communication)
151	Water transport	504	6 "
152	Railway transport	506	6 "
153	Truck transport	507	6 "
154	Bus transp. interurban, rural	508	6 "
155	Urban transit systems	509	6 "
156	Taxicab operations	512	6 "

[1]Refer to first page of Appendix E

Input-Output Industry Code and Title[1]		1960 SIC Codes	11 Industry Groups
157	Pipeline transport	515	6 (Transportation communication)
158	Highway, bridge maintenance	516	6 "
159	Storage	524-527	6 "
160	Radio, television broadcasting	543	6 "
161	Communication industries, n.e.s.	544,545	6 "
162	Post office	548	6 "
163	Electric power	572	6 "
164	Gas distribution	574	6 "
165	Water, other utilities	576-579	6 "
166	Wholesale trade	602-629	7 (Wholesale trade)
167	Retail trade	631-699	8 (Retail trade)
168	Fin., ins., real estate	702-737	9 (Finance - R.E.)
169	Education, related services	801-809 (pt.)	10 (Community)
170	Hospitals	821 (pt.)	10 "
171	Health services	823-827 (pt.)	10 "
173	Motion picture theatres	851	10 "
174	Other recreational services	853-859	10 "
175	Prof. services to business	861,864-866	10 "
176	Advertising services	862	10 "
177	Laundries, cleaners	874	10 "
178	Hotel, restaurants	875,876	10 "
179	Other personal services	871,872,877-879	10 "
180	Photography	893	10 "
181	Misc. repair, maintenance	894-897	10 "
182	Misc. services to bus., pers.	869-899	10 "
183	Operating supplies industry	Dummy Industry	
184	Office supplies	Dummy Industry	
185	Food dist., cafeteria	Dummy Industry	
186	Transportation margins ind.	Dummy Industry	
187	Laboratory supplies	Dummy Industry	

[1] Refer to first page of Appendix E

Input-Output Industry Code and Title[1]		1960 SIC Codes	11 Industry Groups
188	Travel, entertainment	Dummy Industry	
190	Advertising	Dummy Industry	
191	Machinery repair services	Dummy Industry	
188	Household sector	873	10 (Community)
189	Public hospitals, health services	821-7 (pt.)	11 (Public)
190	Public education	801-9 (pt.)	11 "
191	Defence	902	11 "
192	Public sector, n.e.s.	909,931,951,991	11 "

[1] Refer to first page of Appendix E

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