# FISCAL INTEGRATION AND MIGRATION

# FISCAL INTEGRATION AND SUBCENTRAL PUBLIC SECTOR INDUCEMENTS TO CANADIAN INTERPROVINCIAL MIGRATION

By

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ABSTRACT

Ideally, an efficient migration process would aid in alleviating regional economic disparity by shifting labour from low income, high unemployment regions to high income, low unemployment regions.

The possibility that fiscal influences might affect the spatial allocation of labour and other resources has for some time, however, been acknowledge by economists as a potential problem in federal states like Canada that are characterized by substantial inequality in revenue capacities across regional governments. Essentially, the argument is that unavoidable differences in government expenditures and taxes that result in such cases would affect the relative attractiveness of different regions to individuals and thereby the likelihood of residing there.

Despite recognition of this as an inherent problem in federal states, the issue of fiscally induced migration received almost no consideration in applied research on the causes of Canadian flows. Two developments have, however, brought the issue to the forefront of a number of important policy debates.

First, net migration gains by several economically depressed provinces in recent years have heightened interest in the possibility that personal and intergovernmental transfer payments from the federal government have enhanced the attractiveness of such regions and thereby affected the migration adjustment process.

A second significant event has been the skyrocketing oil and natural gas prices during the 1970s. Suspicion naturally arises that the resulting sizable fiscal surplus accruing to residents of Alberta might at least in part account for the dramatic increase in the popularity of that province to migrants.

The present study attempts to fill at least part of the gap in existing knowledge about fiscal influences on migration in Canada. It explores in detail the precise nature and magnitudes of subcentral government expenditure and tax effects. An econometric model of migration choice is developed and utilized in exploring this and several other issues associated with inducements to Canadian migration.

Evidence emerging from the econometric investigations supports contentions that fiscal factors have systematically affected Canadian migration. In addition, policy simulations conducted indicate that migration flows might be quite sensitive to changing fiscal realities.

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Overview

Because of the vast geographical expanse of Canada and the widely dispersed population, the role of labour migration in the economic adjustment process is of fundamental importance. Migration from low income regions with surplus labour to high income regions with labour shortages has been an important element in facilitating an efficient allocation of the Canadian labour force. Because of this, the migration process and economic development have been intimately related in Canada. Relocation of large segments of the population has been a crucial underpinning to sustaining economic growth in the country.

Most of the existing studies on the economic causes of migration in Canada have been within the broad framework provided by the human capital/gravity approach to migration modelling and have focussed on geographical differences in economic opportunity as being the key determinant of aggregate migration patterns. Consistent with the usual emphasis of studies within this framework, economists conducting research on Canadian migration have generally considered economic opportunities to be most appropriately reflected by income and employment prospects.

Until recently, economists have paid relatively little attention to the possibility that important economic inducements to migration flows might be an inherent aspect of the decentralized federal nature of the

Canadian public sector. The possibility that taxation, expenditure and redistributive policies of governments, and most especially subcentral governments, might affect locational choices of individuals, and hence migration flows, has not been extensively investigated in the past. This neglect is not surprising since such influences would historically have been of relatively minor significance in comparison to more obvious economic inducements to migration. In recent years, however, the relative lack of attention to this issue is becoming especially conspicuous for a number of reasons.

A particulary significant trend has been the very rapid growth, both absolutely and relatively, in the importance of provincial and local governments in the Canadian economy.[1] This growth, together with the existence of substantial differences in fiscal capacities among provinces, has imposed widely varying degrees of financial strain as provinces have attempted to fund their burgeoning expenditures.

Fiscal disparity among provinces is central to the divisive issues which have arisen in recent years concerning rapidly increasing oil and natural gas prices and the sharing of the resulting windfall revenues. The price increases have resulted in dramatic revenue gains for western provinces — especially Alberta — which have significantly worsened fiscal equality across provinces. The effect that the resulting large "fiscal surplus" has had on migration for Alberta naturally arises.

In addition to influences exerted by differences in "own revenues" among provinces, certain intergovernmental fiscal arrangements between the federal and the provincial governments may also be affecting migration flows. To offset some of the financial requirements of the provinces, a fairly elaborate system of federal-provincial grants and shared cost arrangements has emerged, most important of which, for the purpose of reducing revenue capacity differences, has been equalization payments.[2] Controversy has heightened in recent years, however, about the resource allocation implications of the very large transfer of funds to the revenue deficient provinces - particularly the Atlantic Provinces - by way of the equalization formula.

The primary objective of this study is to examine the nature and magnitude of subcentral fiscal forces on recent Canadian interprovincial migration flows. The effect that subcentral fiscal structure is having on migration flows for Alberta and the Atlantic Provinces is of particular interest. In later chapters, a multinomial logit econometric model of migrational choice, which incorporates fiscal influences, will be constructed and estimated. The model employed is a particular form of the general category of stochastic decision models described by McFadden (1974) and which are appropriate for analysing discrete,mutually exclusive choices of individuals.

The analysis is applied to aggregate annual data on interprovincial migration flows constructed by Statistics Canada from base data on moves by recipients of family allowances.[3] A detailed description of the methodology employed by Statistics Canada in compiling the data is given in each edition of the publication. A major impediment to migration researchers in the past has been the lack of a complete data set detailing Canadian migration patterns. The Statistics Canada data set is a valuable and readily accessible source of information on aggregate interprovincial migration flows. The data are available from June 1, 1961 to May 31, 1979 and will be extended on a regular basis by Statistics Canada in the future. Data on four categories of interprovincial migration flows are available from this source - children plus adults, children, adults and families. This study will focus on total flows of children and adults.

It is appropriate at this point to examine some of the recent trends in interprovincial migration flows since they are an important focal point for subsequent analysis in later chapters. The next section gives an overview of recent Canadian migration patterns. Chapter 4 relates these patterns to subcentral fiscal influences which have emerged in Canada.

## 1.2 Interprovincial and International Migration in Canada 1962 to 1979

Tables 1.1, 1.2, 1.3 and 1.4 present data in summary form on interprovincial and international migration flows by province for the eighteen-year period beginning June 1, 1961 and ending May 31, 1979.

Table 1.1 shows that for the period 1962 to 1966 all of the provinces with the exception of Ontario and British Columbia were net losers as a result of interprovincial migration. Ontario was the recipient of almost 28% of interprovincial migrants during the period, by far the highest percentage for any province, but high out-migration left its net gain of 85,369 from that source only slightly ahead of that for British Columbia with 77,747. When net international migration is taken into account, Ontario's total net gain for 1962-66 jumps to 224,523, far greater than that for any other province. Ontario received just over 53% of international migrants coming to Canada during the period.

The most noticeable event during the 1967-71 period, as shown in table 1.2, is the emergence of Alberta as a net gainer from migration — both

TABLES 1.1 - 1.4

## Interprovincial and International Migration In Canada

### Table 1.1 1962 - 1966

| | Nfld. | P.E.I. | N.S. | N.B. | Que. | Ont. | Man. | Sask. | Alta. | B.C. | Canada* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Provincial In-Migration | 32759 | 18191 | 104924 | 88591 | 218543 | 468174 | 132645 | 113749 | 230063 | 262345 | 1688338 |
| Provincial Out-Migration | -47972 | -21161 | -132048 | -114270 | -238402 | -382805 | -156116 | -115843 | -232047 | -184597 | -1688338 |
| Net Provincial Migration | -15213 | - 2970 | - 27125 | - 25679 | - 19860 | 85369 | - 23470 | - 42094 | - 1984 | 77747 | - |
| International Immigration | 2256 | 466 | 6241 | 4460 | 122897 | 287054 | 15433 | 8988 | 29394 | 60822 | 538555 |
| International Emigration | -11000 | - 240 | - 17200 | - 14000 | -124900 | -147900 | - 21600 | - 21400 | - 32000 | - 38900 | - 432100 |
| Net International Migration | - 8744 | 226 | - 10959 | - 9540 | - 2003 | 139154 | - 6167 | - 12412 | - 2606 | 21922 | 106455 |
| Total Net Gain From Migration | -23957 | - 4904 | - 38084 | - 35219 | - 21863 | 224523 | - 29637 | - 54506 | - 45900 | 99669 | 106455 |

### Table 1.2 1967 - 1971

| | Nfld. | P.E.I. | N.S. | N.B. | Que. | Ont. | Man. | Sask. | Alta. | B.C. | Canada* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Provincial In-Migration | 43582 | 18783 | 115863 | 95822 | 195124 | 574248 | 141295 | 114550 | 289452 | 356868 | 1971910 |
| Provincial Out-Migration | -62926 | -21545 | -132257 | -115420 | -317859 | -423536 | -181985 | -195948 | -257446 | -241903 | 1971910 |
| Net Provincial Migration | -19344 | - 2763 | - 16396 | - 19598 | -122735 | 150712 | - 40690 | - 81398 | 32006 | 114965 | - |
| International Immigration | 4322 | 811 | 10626 | 5840 | 116749 | 474710 | 35730 | 14324 | 59890 | 116353 | 890340 |
| International Emigration | -13800 | - 2400 | - 17300 | - 20300 | -144100 | -180400 | - 15100 | - 15700 | - 23700 | - 38900 | - 472400 |
| Net International Migration | - 9478 | - 1589 | - 6674 | - 14460 | 22649 | 294310 | 20630 | - 1376 | 36190 | 77853 | 417940 |
| Total Net Gain From Migration | -28822 | - 4352 | - 23070 | - 34058 | -100086 | 445022 | - 20060 | - 82774 | 68196 | 192818 | 417940 |

### Table 1.3 1972 - 1976

| | Nfld. | P.E.I. | N.S. | N.B. | Que. | Ont. | Man. | Sask. | Alta. | B.C. | Canada* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Provincial In-Migration | 61375 | 23206 | 125355 | 109878 | 185927 | 476052 | 145198 | 126671 | 352105 | 377217 | 2016000 |
| Provincial Out-Migration | -63232 | -19452 | -114047 | - 93079 | -263536 | -514612 | -172025 | -167423 | -293535 | -284933 | -2016000 |
| Net Provincial Migration | - 1857 | 3754 | 11308 | 16800 | - 77609 | - 38560 | - 26827 | - 40752 | 58570 | 92285 | - |
| International Immigration | 4604 | 1209 | 10812 | 8646 | 127470 | 451399 | 31762 | 10238 | 61671 | 131840 | 841022 |
| International Emigration | - 3500 | - 400 | - 4900 | - 3400 | - 82100 | -163300 | - 12500 | - 9100 | - 26300 | - 51900 | - 357200 |
| Net International Migration | 1104 | 809 | 5912 | 5246 | 45370 | 288099 | 19262 | 1138 | 35371 | 79940 | 483822 |
| Total Net Gain From Migration | - 753 | 4563 | 17220 | 22046 | - 32239 | 249539 | - 7565 | - 39614 | 93941 | 17225 | 483822 |

## Table 1.4 1977 - 1979

| | Nfld. | P.E.I. | N.S. | N.B. | Que. | Ont. | Man. | Sask. | Alta. | B.C. | Canada* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Provincial In-Migration | 30699 | 13923 | 70429 | 60732 | 82949 | 293586 | 76872 | 84665 | 265473 | 200745 | 1198500 |
| Provincial Out-Migration | -36579 | -12033 | - 68198 | - 55082 | -184960 | -299579 | - 99128 | - 74144 | -184010 | -162857 | -1198500 |
| Net Provincial Migration | - 5880 | 1890 | 2231 | 5650 | -102011 | - 5993 | - 22256 | 10521 | 81463 | 37888 | - |
| International Immigration | 1548 | 571 | 4324 | 3253 | 59587 | 160823 | 13418 | 6029 | 35499 | 45184 | 330793 |
| International Emigration | - 2721 | - 577 | - 4029 | - 3297 | - 61568 | - 99847 | - 5371 | - 4851 | - 10653 | - 32573 | - 226027 |
| Net International Migration | - 1173 | - 6 | 295 | - 44 | - 1981 | 60976 | 8047 | 1178 | 24846 | 12611 | 104766 |
| Total Net Gain From Migration | - 7053 | 1844 | 2526 | 5606 | -103992 | 54983 | - 14209 | 11699 | 106309 | 50499 | 104766 |

Source: Compiled from data in International and Interprovincial Migration In Canada, Statistics Canada 91-208.

* The Canadian totals include figures for the Yukon and Northwest Territories.

interprovincial (32,006) and international (36,190). Ontario increased its lead in net gains from interprovincial migration (150,712) as well as from international migration (294,310). Ontario continued to receive just over 53% of immigrants coming to Canada during the period and its share of interprovincial migrants increased slightly to just over 29%.

During the period 1972-76, as shown in table 1.3, a number of interesting changes occur. Three of the Atlantic Provinces — Prince Edward Island, Nova Scotia and New Brunswick — become net gainers from both interprovincial and international migration. Ontario, for the first time, has a net loss from interprovincial migration (-38,560) and it is only the continuing large net gains from international migration (288,099) which restore the province's status as a total net gainer. Alberta's net gain from interprovincial migration increased by 83% over that for the preceding five-year period. It was the destination choice for 17.5% of interprovincial migrants for the period 1972-76 while Ontario's share slipped to 23.6%. Ontario continued to dominate in popularity amongst international immigrants (53.7%) and the province's net gain from that source was 288,099 for the period.

During the three-year period 1977-79, as shown in table 1.4, Alberta overtook British Columbia to become the preeminent province in net gains through interprovincial migration — 81,463 versus 37,888 for British Columbia. During the three-year period, almost as many interprovincial migrants chose Alberta (22.2%) as Ontario (24.5%) despite the much smaller population of the former. Prince Edward Island, Nova Scotia and New Brunswick continued to have total net gains from migration and Saskatchewan also emerged as a net gainer from both interprovincial and international migration. Ontario continued to have a net loss from interprovincial migration (-5,993) and its popularity amongst international immigrants slipped somewhat to 48.6%. International migration once again restored Ontario as a net total gainer from migration (54,983) although it was now a distant second to Alberta (106,309).[4]

In summary, among the more notable trends over the eighteen-year period were: the decline of Ontario from the position of largest net gainer from interprovincial migration to being a net loser from migration and the close rivalling of Ontario by Alberta in popularity amongst interprovincial migrants; the emergence of Prince Edward Island, Nova Scotia and New Brunswick, and perhaps somewhat less surprisingly, Saskatchewan, as total net gainers from migration; the continuous total net migration losses to Newfoundland, Quebec and Manitoba; and, the continuing though somewhat diminished dominance of Ontario in popularity amongst international immigrants.

There were on average 382,729 interprovincial migrants annually during the eighteen-year period. This represented slightly less than 2% of the Canadian population in any given year. On average each year 144,484 people entered Canada while 82,652 Canadian residents emigrated from the country.

## 1.3 The Efficiency of Interprovincial Migration in Canada

Ideally, an economically efficient migration adjustment process would move labour from low income, high unemployment regions to high income, low unemployment regions in accordance with the dictates of marginal productivity theory and the human capital model of migration. A number of the facts described above, however, do not appear to conform well with the standard formulations of the human capital model. The relatively slow out-migration from the poorer Canadian provinces — especially the Atlantic Provinces — despite continuing sizable average income disparities between them and the wealthier provinces is one example of this. The existence of large reverse flows to low income, high unemployment rate provinces is a second example. In fact, as mentioned previously, three of the Atlantic Provinces are net gainers through migration. Another fact which appears difficult to rationalize within the existing formulations of the human capital model is the very dramatic increase in popularity of Alberta amongst migrants and especially interprovincial migrants during the past few years. Although unemployment rates are significantly lower in Alberta than in most other provinces, average income figures for that province would not appear to suggest expected earnings prospects sufficient to totally explain the migration flows. In 1979, Alberta ranked only second, behind British Columbia, in terms of average income per capita and only marginally ahead of Ontario, although expectations of future prospects have probably been more optimistic for Alberta.

There have been various attempts to shed more light on observed aggregate flows.[5] For example, some researchers have incorporated variables in regression equations which are intended to capture differences in the social, cultural composition of regional populations. Others have undertaken more detailed micro-analysis of more homogeneous subgroupings of the total migrant population in attempts to find a rational basis for the observed aggregate flows within the conventional framework of the human capital model. The present study, however, will explore the possibility that some of the anomalies associated with aggregate flows might be explained by subcentral government fiscal influences. The explicit inclusion of variables in a migration model that reflect subcentral government taxation and expenditure effects on Canadian migration is a direct extension of Courchene's (1970) initial inquiry into the effect of personal and intergovernmental transfers on Canadian migration patterns.

## 1.4 Outline of the Thesis

This chapter has provided background information which is of relevance to the remainder of the study. It gave a brief summary of recent Canadian migration patterns and raised the possibility that subcentral fiscal influences might be influencing such flows. The subsequent chapters are oriented towards examining this issue in detail along with several other issues associated with the causes of Canadian migration.

The remainder of this study is divided into seven chapters. Chapter 2 provides a review of the literature on the basic gravity model/ human capital approach to migration modelling, especially as it has been applied in the Canadian context. The chapter also relates the relevant fiscal federalism literature on fiscal inducements to locational choice to the more conventional migration literature. Chapter 3 develops the multinominal logit model used in the estimation and evaluates its advantages over more conventional migration models. Chapter 4 presents a fairly detailed analysis of consolidated provincial-local fiscal data. The primary intent of the chapter is to examine the nature and magnitudes of potential subcentral fiscal inducements to migration and to consider the advantages and weaknesses of various alternative measures suitable for inclusion in an econometric migration model. Chapter 5 gives a detailed description of variables. Results of the econometric estimations and policy simulations are discussed in Chapters 6 and 7. Chapter 8 presents a summary of the study and discusses some of the possibilities for future research.

## FOOTNOTES TO CHAPTER ONE

1. Consolidated provincial-local government expenditures grew almost 10-fold between 1962 and 1977, the latest year for which data were available at the time of the econometric work in this study. In 1977 they accounted for about 26% of gross national expenditures. Over the same period, federal expenditures increased by only a factor of 6.5 and were about 17% of gross national expenditures in 1977. (Source: Provincial and Municipal Finances, Canadian Tax Foundation, various years.)

2. For a detailed discussion on equalization in Canada and the problems which currently plague it, see the Economic Council of Canada publication Financing Confederation Today and Tomorrow, Supply and Services Canada, 1982.

3. Statistics Canada (various issues), International and Interprovincial Migration in Canada, 91-208, annual, Ottawa: Supply and Services Canada.

4. Very recently, data for 1980 flows were also released by Statistics Canada. The patterns are basically the same as those revealed in table 1.4. Net interprovincial migration flows by province for 1980 were: Nfld. (-1,018), P.E.I. (374), N.S. (-1,102), N.B. (627), Que. (-31,292), Ont. (-19,578), Man. (-15,906), Sask. (-383), Alta. (30,933), B.C. (39,430).

5. The existing Canadian migration studies will be reviewed in detail in Chapter 2.

# CHAPTER TWO

# ECONOMIC INDUCEMENTS TO MIGRATION: AN OVERVIEW OF THE LITERATURE

## 2.1 Introduction

Because of the importance of migration to economic adjustment and development, a voluminous body of research has emerged in this area. When this literature is combined with theoretical research on resource allocation in such diverse fields as labour and regional economics, international trade and fiscal federalism, the wide ranging implications of movements in population become apparent. Most of this literature, however, can be divided into two very general categories – that relevant to the determinants or causes of migration flows and that dealing with the consequences or implications of migration adjustment.

The present study falls within the former category with the primary focus being the migration impact of subcentral fiscal capacity disparity among Canadian provinces. It will be argued in this and the next chapter that such influences do exist in Canada and that they are relatively distinct from more conventional inducements to migration such as earnings differentials and employment prospects and as such warrants explicit consideration in migration models.

The purpose of the remainder of this chapter is to prepare the foundation of the analysis in subsequent chapters by placing the present study in the context of the existing literature. The discussion in this chapter is intended to highlight issues examined in the remainder of the study. It will provide a framework that will give guidance for policy analysis, for constructing the model of Canadian migration, and for interpreting the estimation results.

The incorporation of fiscal influences in a migration model is a refinement to the standard human capital/gravity model framework. Section 2.2 provides a general overview of these approaches to migration modelling and attempts that have been made to integrate them. Sections 2.3 through 2.5 review the methodology and empirical evidence from the existing literature, especially that for Canada. Section 2.3 focuses on the effects of income and employment prospects on migration flows while section 2.4 investigates the role of distance in the context of migration. Section 2.5 examines issues associated with population, information flows, federal government transfers, social/cultural factors and other influences on migration. Section 2.6 takes an initial look at the nature of potential subcentral public sector influences on migration in Canada and the justification for incorporating these influences in models of Canadian migration. The section also reviews the existing empirical evidence from U.S. studies which have examined public sector influences on locational choice.

## 2.2 The Human Capital/Gravity Model Approach to Modelling Migration Flows

Typically, models of the causes of relatively unrestricted migration within a country can be placed in one of two broad categories — gravity models and human capital models. In practice, this distinction is somewhat artificial since any given model usually has elements of both types. Gravity models concentrate most heavily on the roles of population and distance on migration flows while human capital models place greater emphasis on economic variables.

The gravity model is an attempt to explain migration flows by analogy to concepts in physics.[1] The general form of the gravity model in the migration context is

$$(2.1) \qquad M_{ij} = G \cdot \frac{P_i^{\alpha} \cdot P_j^{\beta}}{D_{ij}^{\gamma}}$$

where $M_{ij}$ is gross migration flow per period of time from i to j, G is a constant, P is some measure of regional mass (in this case regional populations) and $D_{ij}$ is distance from i to j. Taking logs of both sides of equation (2.1), it becomes possible to estimate the parameters of the following equation by standard multiple regression procedures, where $u_{ij}$ is an error term reflecting the fact that (2.1) is not strictly deterministic.

$$(2.2) \qquad \ln M_{ij} = \ln G + \alpha \ln P_i + \beta \ln P_j - \gamma \ln D_{ij} + u_{ij}$$

In the pure form of the gravity model as given in equations (2.1) and (2.2) economic variables do not appear explicitly, and in fact, it is possible to derive the gravity model from simple probability considerations.[2] The probabilistic interpretation of the gravity model suggests either that economic factors are unimportant in determining the pattern of migration or, equally implausibly, that their influence is adequately reflected by the population and distance variables. Gravity type models have been used extensively to analyse migration flows, particularly by geographers and regional economists.

The gravity model framework is flexible to some extent. In equation (2.1), the population exponents permit the incorporation of agglomeration or deglomeration effects while the distance exponent permits some flexibility in the treatment of that variable. Other measures of mass besides population could be used – for example, total regional product, income, annual retail sales or employment. It is also possible to further complicate the influence of distance by introducing the concept of intervening opportunities.[3]

Most economists conducting research on migration, however, have naturally tried to emphasize the underlying economic justification for observed migration flows. Various authors have attempted to find an economic rationale for the gravity model. Niedercorn and Bechdolt (N & B, 1969) derived gravity type models of spatial interaction of individuals in different locales under fairly restrictive conditions including the presumption that people derive utility from such interaction.

Although the assumption of utility maximizing behaviour of individuals is standard in economics, spatial flows in the N & B model are not motivated by conventional economic variables such as average income or employment opportunities. Vanderkamp (1977) has pointed out that the assumptions underlying the N & B model make it more applicable to (for example) travel or communications flows across space since migration is not typically motivated by a desire to interact with other individuals. He then demonstrates that it is possible to derive a gravity model of migration flows motivated by flows of information on job vacancies, at least under appropriate conditions, including that the economy is in an interregional equilibrium stationary state. The motivation for individuals to migrate in Vanderkamp's model is reminiscent of the probability interpretation of the gravity model. Flows of information on job vacancies are positively related to regional population and inversely related to distance and provide a justification for flows of individuals in the opposite direction.

The N & B and Vanderkamp articles leave the impression that although it is possible to make particular assumptions that will result in migration flows that conform with the predictions of the gravity model, the complexity of economic phenomena in a dynamic setting are unlikely to result in flows of that nature. The Vanderkamp article, however, provides valuable insights into the migration adjustment process in a country in regional equilibrium and hence the limitations of the gravity model in a disequilibrium setting. Vanderkamp offers convincing arguments that in a stationary state economy, most important components of migration which are in response to job vacancies can reasonably be expected to accord with the predictions of the gravity model. Included are migration from intra-company transfers and return migration motivated by employment opportunities. Migration flows which are unlikely to be compatible with the simple form of the gravity model, even in a stationary state economy, include all types that are unrelated to labour market conditions such as migration patterns of retired people moving to warmer climates or people who move from a rural to an urban setting without changing jobs.

If the latter types of migration are numerically relatively unimportant at the interregional level, the gravity model should provide a fairly accurate portrayal of migration flows in a stationary state economy. As such, the gravity model provides an important reference point for explaining actual migration in a real world economy in regional economic disequilibrium. The gravity model framework, however, provides no guidance to identifying economic factors potentially affecting migration flows, although as mentioned, their influence could perhaps be very crudely accommodated within the gravity equation. A major trend evident in the migration literature, however, has been the attempt by economists to break away, to the extent possible, from the vagueness of the gravity model framework and to explicitly express economic influences in migration models. This has necessitated an appropriate underlying theoretical foundation, but ties to the simpler gravity model still remain.

Sjaastad (1962), following the lead of Becker (1962) and Schultz (1961), and the earlier writings of Hicks (1932), has recognized migration choice as another human capital decision facing individuals. Viewed in this framework, a rational individual would choose that location for which his present discounted value of future benefits (minus costs associated with migrating) were at a maximum. The human capital criterion for migration provides a link between the underlying motivations of individuals and regional economic conditions, even if the human capital criterion is much narrower than the standard assumption in economics of utility maximizing behaviour. Although problems arise in evaluating benefits and costs for individual migrants, in the case of aggregate flows economists have usually considered measures of average economic conditions prevailing in different locations as being reasonably accurate approximations to the average benefits associated with migration. Differences in these measures provide economic justification for observed migration flows which are seriously at odds with the simple probabilistic predictions of the pure gravity model.

A fairly large body of work has emerged which tends to support, in many respects, the human capital model. A 'typical' human capital, aggregate migration model would be of the following general functional form.[4]

$$(2.3) \qquad M_{ij} = f[Y_i, Y_j, U_i, U_j, P_i, P_j, D_{ij}, X_i, X_j, u]$$

where the Y's are measures of average expected earnings, the U's are measures of labour market conditions, the X's are vectors of variables (economic and/or noneconomic) which might be deemed to be of relevance in particular circumstances, u represents nonmeasurable or nonsystematic factors which might affect migration and the other variables are as previously defined.[5] The strong gravity model overtones of most models is suggested by the inclusion of the population and distance variables in equation (2.3).

A wide variety of actual specifications of equation (2.3) have been employed in econometric investigations. For example, explanatory variables for sending-and receiving-regions sometimes appear in ratio or difference form and the equation is sometimes estimated in semi- or double-log versions. Some researchers have estimated simultaneous equation models to allow for the possibility that migration may itself affect some of the explanatory variables in equation (2.3).[6] Kau and Sirmans (1979) used a compromise procedure. Rather than specifying a full simultaneous system, they estimated a recursive model in which past migration stock variables appeared as explanatory variables for migration flows in later periods. The necessity for simultaneous equations or recursive models most obviously arises if the explanatory variables are defined for the end of the period over which the migration flow has been measured. We will return later to a consideration of the possible influence of past migration on current migration flows.

The discussion in this section has provided a brief introduction to the basic human capital/gravity model framework. In the next three sections, we discuss some of the issues associated with modelling migration behaviour within that framework and examine the available empirical evidence.

## 2.3 Earnings and Employment Prospects and Migration

Expected income and employment opportunities are generally considered to be the primary motivating factors behind most migration decisions. The purpose of this section is to give consideration to the role of income and labour market variables in econometric models of aggregate migration behaviour and to examine some of the issues and controversies centering around these.

The human capital model predicts that individuals would be attracted to regions by expectations of high average earnings and repelled by poor earnings prospects. Most researchers have found evidence of this in aggregate econometric studies.[7] In general, however, sending-region income variables have performed less well than those for receiving-regions. The former usually have smaller estimated coefficients and the coefficients are often statistically insignificant.[8] It has been argued (Lowry, 1966) that such evidence indicates assymetry in the push-pull effects exerted by, respectively, sending- and receiving- region incomes on migration and raises questions about the efficacy of migration adjustment as a possible corrective for alleviating regional poverty. One issue of interest is whether such assymetries can be detected in the present study. Other things equal, their existence is evidence of an aspect of inefficiency in migration adjustment.

A few studies have even found the sending-region income variables to have a counterintuitive positive sign.[9] Possible arguments in support of this finding are that a certain level of income is necessary to finance migration or that people in higher income brackets are generally more willing to move than others since with higher earnings their expected payoff, or return on investment from migrating, is greater. O'Neill (1970), as an alternative explanation, has emphasized the possible consumption aspect of the migration decision. She has suggested that if migration itself is a "normal" consumption good, the propensity for out-migration should rise with increasing average incomes.

Courchene's (1970) estimation results for individual years from 1952-67 indicate an increasing responsiveness of migration to differences in provincial incomes over time. The coefficient estimates for both the origin and the destination provinces increase significantly (in absolute value) over the period. This is indicative of improved efficiency in migration adjustment because it means that a given difference in incomes elicits a larger migration response. According to conventional economic analysis, this should result in a more rapid convergence of regional income differences as the marginal productivity of labour is lowered (increased) in the destination (origin) region. Of course, if Myrdal's (1957) cumulative causation hypothesis is applicable, convergence of regional incomes need not occur. Myrdal argued that it would be the most productive workers who would be induced to move. With such a migration response the poorer regions could be left even more destitute and the marginal productivity of labour in the destination regions might increase. In any event, it is of interest to examine in this study whether increasing responsiveness of migration to differences in provincial incomes can be detected for our more recent data set.

When using incomes as explanatory variables in aggregate migration models, care has to be taken to ensure that the measures chosen reflect as closely as possible the earnings that a typical migrant might expect to receive. This necessitates, for one thing, that sources of income not likely to be of relevance to migrants be excluded from the measure chosen. For example, investment income which is independent of place of residence should not be included. Transfer payments to individuals should be included, however, since there is evidence that such payments affect migration decisions (Courchene, 1970). Measures of 'earned income' are too narrow in scope since they ignore the potential influence of such transfers as unemployment insurance payments.

Some recent literature has been concerned with further refining the definition of the income measure used in migration studies. The appropriateness of using mean regional income as a measure of expected future earnings has been questioned, especially where income growth is proceeding at different rates in different regions,[10] but empirical findings are not, in general, supportive of this position. Bowles (1970) did find that a measure of the present value of expected lifetime income differentials performed better than a measure of current income differentials. Fields (1979), on the other hand, used a Markov chain approach to derive an expression for the present discounted value of expected future income in a migration model. Although the variable coefficients were highly significant statistically, the overall explanatory power of the model was notably inferior in comparison to a more general linear specification using median real income measures. In an earlier study (Fields, 1976), the two models performed equally well. Grant and Vanderkamp (1976) found that average gross income of the entire sample population performed much better than two alternative measures of expected income: gross income figures for all movers and gross income for subcategories of movers. This latter result suggests that migrants' expectations are in fact formed more on the basis of general average regional income levels than on more precise approximations to their own actual prospects.

Several recent micro studies have found evidence about the relationship between income and migration which differs somewhat from the predictions of the human capital model and the results obtained using aggregate data. Lansing and Morgan (1967), Lansing and Mueller (1967), Wertheimer (1970), Yezer and Thurston (1970) for the U.S. and Marr and Millerd (1980) and Grant and Vanderkamp (1980) for Canada generally find that the migration leads to higher incomes only after a number of years following the move. Robinson and Tomes (1982), on the other hand, using 1971 census data and a structural probit model, found evidence that the probability of an individual migrating does depend on potential wage gains after adjustment for selectivity bias. Further research using micro data should shed more light on the actual economic gains realized by migrants.

Overall, the evidence suggests that average regional income is an appropriate measure to use in aggregate migration studies. Total population is a preferable base to either total labour force or total employed individuals because of the inclusion of personal transfers to individuals in the income measure. There is also evidence that failure to adjust for cost of living differences gives markedly inferior empirical results.[11] For longitudinal multiregion studies there is a need for cost of living adjustment both cross-sectionally and over time.

We turn now to a discussion of the effect of labour market conditions on migration flows and issues associated with modelling these influences.

Measures of regional unemployment rates are perhaps the most popular way of reflecting labour market conditions in models of aggregate migration behaviour. High regional unemployment rates might be expected to discourage in-migration and encourage out-migration and findings of a number of studies support these expectations.[12] Quite often, however, regional unemployment rates have not performed especially well in econometric models. Many studies have found them to have perverse signs and/or statistically insignificant coefficients.[13]

Lansing and Mueller's (1967) analysis suggests that the ambivalent performance of regional unemployment rates especially those for the sending region, may be at least partly explained by the fact that unemployment tends to hit hardest the young, low skill, low education workers - among the least mobile groups in society. They argue that the unemployment push effect on this group may be weak but that the effect of unemployment on in-migration, and hence net migration, is likely to be more real.

Vanderkamp (1971) has argued that regional unemployment rates would not be expected to perform well since they are highly correlated with national rates and because of the differential impact overall unemployment conditions are likely to have on different categories of migrants. Specifically, he argues it would be expected that return migration would be positively related to general unemployment rates as frustrated migrants returned home. On the other hand, the number of new migrants will be negatively related to the average level of unemployment rates, at least in part because high probabilities of finding employment will accentuate average expected earnings differentials among regions.

Vanderkamp argues that these complications lead to ambiguous expectations about the effects of regional unemployment rates on migration patterns. Vanderkamp's analysis suggests that a single measure reflecting national labour market conditions, such as the national unemployment rate, might be required in some cases to capture the cyclical influence of labour market conditions on migration and this possibility will be explored in this study. It would not seem to argue against the probable systematic influence of separate regional rates, however. In partial support of Vanderkamp's hypothesis about frustrated return migrants, Gauthier (1980), using a special compilation of data from the 1971 Census, found that return migrants to Newfoundland accounted for about one-half of all in-migrants to the province. Furthermore, these return migrants had the highest unemployment rates of all groups surveyed and average incomes just slightly greater than those who hadn't left the province.

Courchene (1974) has suggested that differences in regional unemployment rates may represent an equilibrium rather than a disequilibrium situation. He argues that if wages are relatively insensitive to labour market conditions, migration will adjust regional unemployment rates to equate average expected post migration conditions among regions. He offers as an example, the case of Ontario and British Columbia where the former has historically had lower wages but substantially lower unemployment rates than the latter. If Courchene's argument is accepted, then regional unemployment rates may be viewed, at least in part, as a residual element in the migration process and their individual influence on migration would be difficult to isolate in single equation econometric analyses.[14]

Fields (1979) has questioned the appropriateness of including separate regional rates on the grounds that they represent average labour market conditions rather than the marginal probability of potential new migrants finding employment. He suggests that more dynamic measures of labour market conditions, such as labour turnover statistics (quits, new hires, layoffs), are more appropriate indicators of actual circumstances facing migrants than regional unemployment rates. Field's point suggests that additional variables reflecting dynamic factors in labour markets may be justified in migration models. It does not, however, argue convincingly that regional unemployment rates should not affect migration patterns. For aggregate migration flows, rates of growth in regional employment are perhaps the most appropriate measures reflecting labour force dynamics and will be tested in this study.

It has also been argued that the unemployment rate level in the sending-province might be expected to have a negative impact on outmigration if having a job is a prerequisite to financing a move (Grant and Vanderkamp (1976), p. 22). Although this situation could apply for specific individuals, it seems unlikely to be a significant consideration for the case of aggregate flows in Canada given the high standard of living and the easily accessible sources of credit for financing moves.[15] It could be the case that high unemployment rate regions in Canada have residents with the greatest locational affinities for historical reasons, but this is quite a different argument concerning regional propensities to migrate.

Although all of the points raised above highlight the potentially complex relationship between labour market conditions and migration, and are interesting in their own right, they nevertheless leave the impression of being, at least to some extent, ex post rationalizations for a perplexing phenomenon. It is difficult to accept that regional unemployment rates do not exert a systematic influence on aggregate migration patterns, particularly when substantial differences across regions have persisted for long periods of time, as in Canada.

One alternative explanation for the poor performance of unemployment rates in econometric models is that they have historically been highly correlated with other explanatory variables in the models such as income levels or populations. If migration patterns have been relatively unchanged for substantial periods of time, it will naturally be difficult to discriminate amongst the differential impacts of separate influences. When historical patterns are disturbed, as they have been in recent years, separate economic influences including the effects of unemployment rates, could likely be more easily isolated. Another possibility is that failure to include fiscal influences may have biased the coefficients for the unemployment variables.

A further consideration with regard to income and unemployment rates concerns whether sending and receiving region variables should appear separately or in difference or ratio form. In principle, the decision on the appropriate form ultimately depends on how economic conditions among regions affect migrant perceptions and behaviour. One advantage of entering them separately in the model is that this permits examination of the degree of symmetry between sending and receiving region coefficients. This procedure does, however, increase the number of coefficients to be estimated and hence increases chances of multicollinearity among variables in the model and reduces the degrees of freedom. This is a relevant consideration if the number of observations is small such as in the estimations for individual years reported in Chapter 7.

To summarize the discussion in this section, it would seem appropriate to include properly defined average income variables as well as unemployment rate variables in an aggregate econometric model of the determinants of Canadian interprovincial migration. Arguments have also been presented which suggest that the income variables should be adjusted to reflect cost of living differences, both over time and among provinces. It has been argued that there may possibly be justification for including other variables which indicate aspects of labour market conditions not reflected by regional unemployment rates. The discussion also highlighted various issues and points of controversy in the literature which will provide useful background in later chapters.

## 2.4 Distance and Migration

Empirical work has established distance to be one of the most consistent and powerful influences on migration flows.[16] The negative effect of distance appears incontestable. Exactly why distance should have such a strong effect is not quite so clear, however. In the pure gravity model, distance is a measure of friction but it is difficult to identify the precise nature of the interfering influences. Financial costs associated with migration are one possibility although it seems unreasonable to suggest that they account for more than a small part of the negative impact of distance. Vanderkamp (1971) has identified three additional costs: (1) the psychic costs of moving, (2) the difference in psychic incomes associated with sending and receiving regions, and (3) uncertainty about income due to lack of information.

Levy and Wadychi (1974) examined the effect that introducing measures of intervening opportunity had on the distance coefficient in a regression analysis. Intervening opportunities between states i and j were reflected in their model by including variables representing the highest alternative population and wage, and the lowest unemployment rate within radius of the distance between i and j from state i. Their results suggest that the negative effect of distance can, at least in part, be explained by the fact that the longer the distance, generally the greater the number of opportunities encountered by a searching migrant. It is possible to approximate the influence of intervening opportunities by using provincial dummy variables, however, and that is the approach followed in this study. The provincial dummies will reflect all relatively unchanging factors particular to migration flows between any two provinces including intervening opportunities.

Others have emphasized the information effect of distance as a negative factor affecting the flow of messages about prevailing economic conditions in regions.[17] One possible way of capturing this effect is by discounting the income variables by distance measures.[18] It is not obvious, however, why distance should provide more than at best a very crude approximation to impediments to the flow of information among regions. A more appropriate way to model information flows might be to incorporate the learning process explicitly in the model by using lagged explanatory variables as in the adaptive expectations approach. The adaptive expectations model is also convenient from the point of view of estimation because it can be reduced to a form in which only current exogenous variables along with a lagged dependent variables appear on the right hand of the migration equation.[19] We will return to this issue in Chapters 5 and 6.

Even if information flows are reflected in other ways in the model, however, this still leaves a separate role for distance to capture the influence of costs associated with migration. In studies of aggregate flows, distance is often the only variable explicitly intended to reflect all of these costs. Because of the importance of distance and the potentially complex way in which it may affect migration, the manner in which it is incorporated into the model will be given fairly careful consideration in this study. In particular, because of the ambiguous nature of the different influences on migration that the distance variable is intended to reflect and its vague theoretical justification, it is very difficult to justify a most appropriate, specific functional form for that variable. It is desirable that the influence of distance be permitted as much flexibility as possible in the model. Because of their inherent flexibility, spline functions [Suits, Mason and Chan (1978)] are especially appropriate in this context and will be employed in this study. It is of interest to see whether the spline specification for distance improves the overall explanatory power of the models in comparison to more rigid specifications and whether the performance of the other variables in the models is affected. Estimates of the spline coefficients also permit a plot of the exact relationship between migration and distance. Much more will be said about these issues in later chapters.

A problem arises for interregional migration studies with respect to the most appropriate way of approximating the distance between two large geographical areas. McInnis (1969), Courchene (1970) and Vanderkamp (1971) in earlier Canadian studies settled for highway mileage between principal urban centres of a province or region. Laber and Chase (1971) used average population weighted distances between centres when there was more than one population centre in a province. This latter approach is appealing from the perspective of the average distance travelled by a 'typical' migrant in moving between provinces.[20]

There is evidence from previous studies that the negative impact of distance on Canadian migration has diminished over time, indicating improvement in the efficiency of the migration process.[21] Courchene's results using the log of distance show a slow but fairly steady decline in the distance coefficient over the period 1952 to 1967. Vanderkamp, using the inverse of distance in estimations for the period 1947 to 1966, found the distance coefficient to decline quite dramatically until 1962. The coefficient did, however, start to increase again between 1963 and 1966. Vanderkamp also used distance to deflate the income variables in his model and this might account for the discrepancy between his results and those of Courchene for the later years. An obvious question which arises is whether a declining effect of distance can be detected for more recent years. This issue is examined in Chapter 7.

## 2.5 Other Influences on Migration Flows

Vanderkamp's probability interpretation provides a possible justification for the inclusion of population variables in human capital models to represent positive influences on information flows about job vacancies and, presumably, other prevailing economic conditions. As mentioned in the preceding section, however, there may be better ways of approximating such information flows, in particular, the adaptive expectations approach mentioned earlier. Typically, the inclusion of populations is justified as a proxy for omitted and usually unspecified economic influences or, even less precisely, as normalizations to the dependent variable. There are a wide variety of possible ways of using populations to normalize the migration flow variable.[22] Haenszel (1967), Young (1975), and Vanderkamp

(1976) have discussed some of the issues associated with using populations as normalizing factors in cross-section studies. Care has to be taken because the inappropriate use of population variables in econometric models can bias the coefficients of other explanatory variables with which they may be correlated.

Generally speaking, the use of population variables in migration models sheds little light on the economic inducements to migration and is clearly a remnant of the simpler gravity model framework. For more detailed insight into the causes of migration, it is necessary that the influences which population are expected to represent be given a more precise economic interpretation. Some progress has been made along this line and a fair bit of information has been acquired from empirical research about the complexity of influences operating to determine migration flows. It has, for example, been fairly well established that social factors such as age, occupation, education and language composition of the population systematically affect propensities to migrate in Canada.[23] Much recent research in the U.S. has been directed at exploring quality of life influences on migration — for example, climate, pollution and crime rates.[24] Others have examined the complexities introduced when the family unit rather than the individual is considered, for example, the migration effect of having two income earners.[25]

Since most of these influences are unchanging or slow to change and are not the focus of inquiry in this study, their influence will be incorporated in the estimation approaches. Specifically, both least squares dummy variables and error components estimation techniques are employed to capture province-specific effects on migration. These are described in detail in Chapter 6. Evidence of the importance of such factors to migration flows, however, indicates that further research along these lines is justified, particularly in view of the possibility that increasing levels of incomes in the future may lead to a decline in the importance of economic considerations as determinants of locational choice.

One particularly notable extension to the human capital model in the Canadian context has been made by Courchene (1970). In an econometric model of interprovincial migration, Courchene examined the migration impact of three distinct measures of federal transfers to provincial governments and to individuals in different provinces. The three measures were: location oriented subsidies per worker; total federal transfers per dollar of earned income; and unemployment insurance benefits per dollar of earned income. Evidence that these exert a negative impact on migration suggest to Courchene that the transfers introduce an element of inefficiency in the migration adjustment process in Canada. Courchene's comments on the efficiency implications of his findings, at least with respect to transfers to provincial governments, have been contested by other economists and form a focal point for a debate which has been continuing for some years.[26] This qualification aside, Courchene's work was, until very recently, the only attempt to look at fiscal influences on migration.[27] Courchene, however, looked only at the impact of the grants and did not attempt to examine the direct effects of regional government taxation and expenditure policies on Canadian migration. Examination of this direct influence would seem to be a logical extension of Courchene's work and is the primary focus of this study.[28]

### 2.6.1 Subcentral Public Sector Influences on Locational Choices of Individuals

Interest in the possible effects of expenditure and taxation policies of regional governments on the locational choices of individuals did not germinate within the migration literature per se but amongst public finance theorists concerned about the efficiency aspects of such behaviour. Initial interest arose in attempts to solve efficiency problems associated with the provision of public goods.

Samuelson (1954) pointed out that the inability of consumers to reveal their preferences for public goods, or to adjust quantities consumed in accordance with their preferences, would likely preclude efficient provision of such goods. Tiebout (1956) argued that a market-like efficiency, at least for local public goods or goods which are public only for a geographical subset of the total population, could, under certain conditions, be approximated by consumers locating themselves spatially in accordance with their preferences for different combinations of the goods. A necessary condition for this to happen is that there be decentralized provisions of such goods and hence the possibility of regional variety. By 'voting with their feet', consumers would be at least partially able to solve the problems of preference revelation and nonexcludability, at least for this large category of public goods. The Tiebout hypothesis has been extended to include the effects of regional taxes on locational preference (Tullock, 1971). Naturally, the Tiebout solution is more feasible the larger the number of subcentral governments because this avoids problems analogous to those arising with discreteness in private goods consumption.

At least on the surface and for the case of large numbers of locational alternatives, the Tiebout solution appears appealing although the question of the optimality of such an adjustment arises. The efficiency characteristics of a Tiebout-like adjustment have been questioned by subsequent theorists,[29] but the decline in importance of this aspect of Tiebout's theory has been at least partly offset by its growing practical relevance to empirical work on the causes of locational choice.

We can use the framework developed by Buchanan and Goetz (1972) for a cursory look at how the subcentral public sectors might affect locational choices of individuals. If it is assumed that there is perfect knowledge, full mobility and no interregional spillovers in tax burdens or expenditure benefits, Buchanan and Goetz state that an individual would choose region X over any alternative region Y only if

$$(2.4) \qquad [MVP_x^i + (B_x^i - T_x^i)] - [MVP_y^i + (B_y^i - T_y^i)] \geqslant 0 \qquad i = 1, \ldots, n$$

where the MVP's refer to marginal private goods value or product and the bracketed terms represent the fiscal surplus or benefits ($B^i$) minus taxes ($T^i$) obtained from the relevant subcentral public sector. Equality in (2.4) would, they claim, presumably be a situation to which the migrant was indifferent.[30] It would appear that the fiscal surplus terms in equation (2.4) could lead to an allocation of individuals which was significantly different from that which would evolve if marginal productivity was the sole determinant of locational choice.

One line of development of Tiebout's original hypothesis has been concerned with the extent to which fiscal advantage of this sort would be capitalized in property values. It was originally argued by Oates (1969, 1973) that a favorable fiscal environment would lead to property prices being bid up and his econometric work found evidence of this. Subsequent research, both theoretical and empirical has taken issue both with Oates' hypothesis and the interpretation he placed on his empirical findings.[31] Epple et al. (1978) in fact claimed that no meaningful test of the Tiebout hypothesis had been or was likely to be conducted along these lines. The work subsequent to Oates has, however, emphasized the likelihood of at least partial capitalization in the long run and hence the importance of taking account of regional costs of living in comparing the attractiveness of alternative locations.

A second line of investigation of the Tiebout hypothesis has been concerned with examining the direct impact of fiscal considerations on locational choices and it is this literature which is most directly relevant to modelling Canadian migration flows. We will examine some of this literature after we take a closer look at the general nature of the potential subcentral public sector influences in Canada.

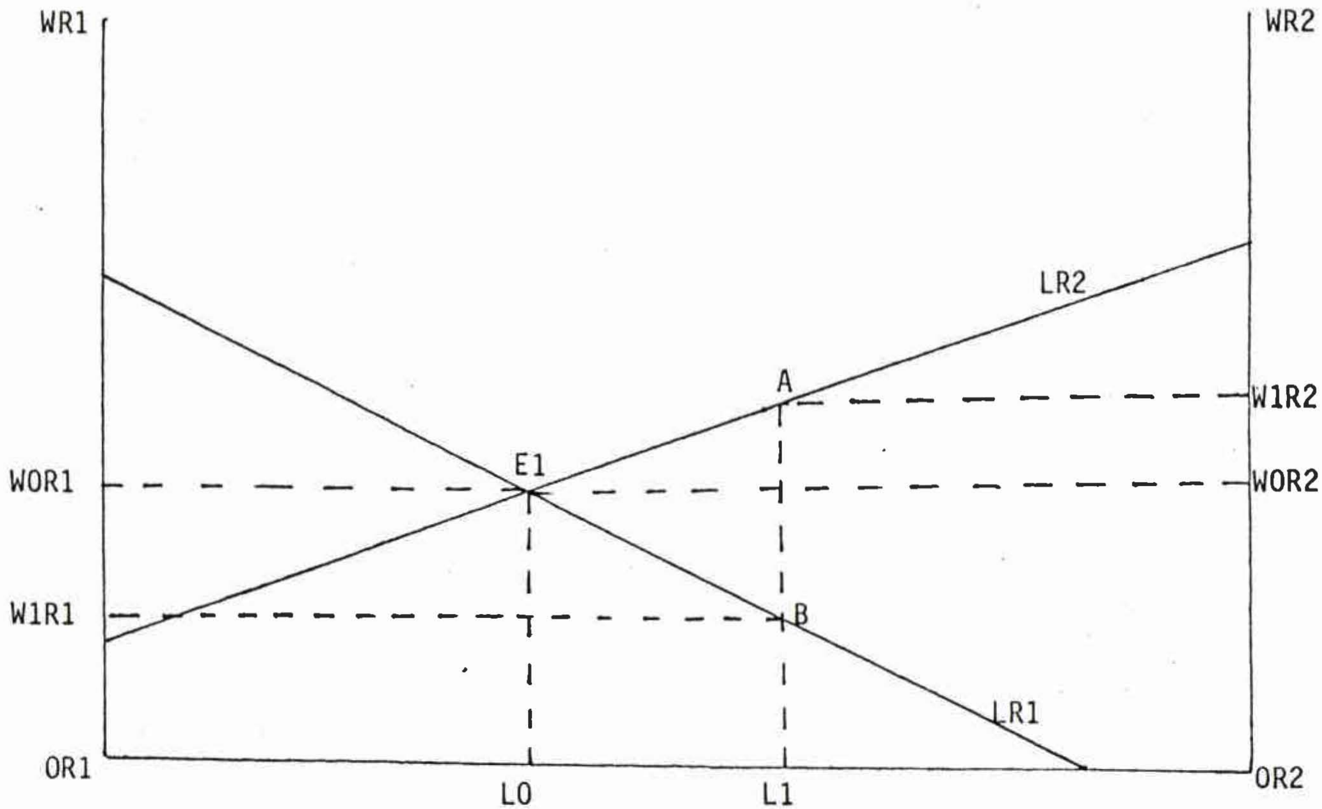
It seems unlikely that variety in the composition of subcentral public sector taxes and expenditures alone would lead to significant continuous influences on aggregate Canadian migration flows.[32] The existence of substantial disparities among regions in per capita revenue potential could, however, have such an effect. The existence of fiscal disparities among regions is an inherent problem in most federal countries but, as mentioned in Chapter 1, the issue has become particularly acute in recent years in Canada. Large differences across provinces in the ability to finance government expenditures could lead to significant continuous inducements to migration. Provinces with large tax bases would be able to provide equivalent public goods with lower tax effort (or alternatively, a higher level of public goods with equivalent or even lower tax effort) than would governments with smaller bases. Obviously, a systematic influence on migration would exist.

Various grant schemes have been proposed in the fiscal federalism literature to aid revenue deficient governments in federal states. It has been argued by some that a system of equalizing grants is required which would lead to complete equalization of per capita fiscal potential among all states or provinces.[33] Canada has implemented a partial equalization scheme.[34] Despite the existence of the equalization system, however, substantial revenue capacity disparities among provinces continue to exist.

The effect of revenue disparity and the equalization grants on population distribution as a result of induced migration can be highlighted with the aid of a diagram originating with Purvis and Flatters (1980). The vertical axes in figure (2.1) measure real wages in each of two regions (R1 and R2). The horizontal axis measures total labour force in region one if we measure from OR1 and in region two if we measure from OR2. LR1 and LR2 show the marginal products of labour in, respectively, regions one and two. If it is assumed that there are no fiscal capacity differences between regions, that there is perfect mobility of labour and that there are no intergovernmental grants, then E1 will be the equilibrium point. This will establish a common wage rate of WOR1=WOR2 in each region and will lead to OR1LO units of labour in region one and OR2LO units of labour in region two.

FIGURE 2.1

Population Distribution in Federal States



Assume now that the regions do not have equivalent potential per capita revenue capacities as a result, for example, of the existence of large natural resource royalties accruing to region one. It will be assumed for simplicity that the existence of these resource revenues does not affect the productivity of labour in region one although the relaxation of this assumption could be easily handled by shifting that region's marginal product of labour curve outward. If these resource revenues permit an increase in per capita real government expenditures (or a decrease in per capita real taxes) in region one equivalent to the distance AB in figure 2.1, then new regional wage rates, equal to W1R1 in region one and W1R2 in region two, will occur as a result of LOL1 units of labour migrating from region two to region one in response to the increased fiscal surplus possible in the latter. The new equilibrium results in a larger population in the resource rich province than would occur in the absence of the resource revenues.

Giving per capita grants of AB to region one could introduce exactly the same sort of influence on labour force allocation. The grants would increase the fiscal surplus associated with residing in the recipient region and could lead to a larger population in that region than would be the case in the absence of the grants.

The relevance of the preceding analysis to interprovincial migration for Alberta and the Atlantic Provinces for recent years should be obvious. Large oil and natural gas revenues to Alberta and high federal government grant payments to the Atlantic Provinces should permit lower taxes and/or higher government expenditures which should enhance the attractiveness of these provinces to residents and potential residents.

In Chapter 7, we will investigate in some detail the actual magnitudes of the fiscal influences on migration flows for these provinces. In Chapter 4, we will look in detail at the actual patterns and magnitudes of various measures of fiscal conditions for all provinces in Canada. The discussion in Chapter 4 will guide in the construction of fiscal influences for inclusion in all of the econometric models of Chapter 6 and 7. We turn now, however, to a brief examination of the available empirical literature for the U.S.

### 2.6.2 Evidence from U.S. Studies

In recent years, there have been a number of studies for the United States which have attempted to incorporate some aspects of subcentral public sector influences in migration models. Cebula (1979a, 1979b) has recently reviewed this literature so attention here can be limited to a brief discussion of the aspects of these studies which provide some guidance to modelling Canadian migration.

Because of institutional differences, the studies which have been undertaken for the United States provide only limited insight into appropriate ways of modelling interprovincial migration flows in Canada. For example, most of the research for the U.S. has focused on the effects of welfare payments on intermetropolitan and interstate migration flows.[35] The very great differences in average levels of welfare payments among metropolitan centres in the United States make that issue an obvious candidate for extensive study there. Only a relatively small number of studies have focused on the migration effect of more general categories of expenditures. Aside from welfare expenditures, disbursements relating to aspects of education seem to have received the most extensive investigation.[36]

Welfare, or more general categories of expenditures, usually appear as explanatory variables in econometric studies in per capita terms. No study, to my knowledge, has attempted to adjust the expenditure figures to allow for differences in the costs of providing government goods and services although this would appear to be conceptually desirable. Cebula (1979b), however, does use metropolitan cost of living indexes as explanatory variables in some of his models.

Taxes are also usually expressed in per capita terms in migration models.[37] Very few studies attempt to incorporate measures of the relative intensity of the tax burden which is imposed on residents. Liu (1977) uses a measure of the growth in the average tax rate (total tax to personal income) in a simultaneous equations model of net migration to SMSAs. Aronson and Schwartz (1973) tested a noneconometric model of fiscally induced migration among towns and borroughs in the Harrisburg, Virginia urbanized area, in which they employed a measure of the rate of local property taxation. U.S. studies which have included tax variables have focused primarily on the property tax.[38]

Ellson (1980), in a study of suburban versus central city location for fifty metropolitan centers, employed as an explanatory variable an index which measured the ratio of per capita government expenditures to per capita local taxes in the suburbs to that in the central cities. The advantage of Ellson's approach is that it incorporates, in a single measure, the attractiveness of suburban versus central city location. The disadvantage is that it does not permit examination of the migration impact of expenditures and taxes separately.

Friedman (1981) estimated a conditional logit model of locational choice in the San Francisco Bay area in which the effective property tax rate and four variables representing local public goods appeared as explanatory variables. The four variables were education expenditures per pupil, parks and recreation expenditures per capita, the number of fire stations per square mile, and the felony crime rate. The latter two were used because it was felt that they gave a more accurate indication of the quality of fire and police protection than did per capita expenditures.[39]

Although not unanimous, the empirical evidence which is emerging from U.S. studies generally supports the view that subcentral government expenditure and tax policies can have systematic influences on locational choices of individuals.

## 2.7 Concluding Comments

The purpose of this chapter has been to review the literature and issues which are of relevance to the present study. This discussion will serve as a reference point for developing our Canadian migration model and for evaluating the estimation results. Attention here has been limited to issues concerning the causes of aggregate migration flows. Examination of the most appropriate structural form for the migration model is postponed until the next chapter.

The discussion in this chapter has identified the most likely influences to Canadian migration as indicated by economic theory and existing empirical evidence. Consideration has been given to alternative ways of expressing these influences in a model of aggregate migration behaviour as well as to various issues associated with interpreting results from econometric investigations.

The possibility that fiscal influences may be affecting Canadian migration flows has been examined only very generally in this chapter. Discussion in Chapter 4 analyses the precise nature and magnitudes of these influences in much more detail.

## FOOTNOTES TO CHAPTER TWO

1. See Carroll and Bevis (1957), Dodd (1950) and Isard (1960), Chapter 11. The history of the gravity model has been reviewed by Carrothers (1956) and Olsson (1965).

2. See Isard (1960), Chapter 11.

3. See Stouffer (1940) and Levy and Wadychi (1974) on intervening opportunities.

4. See Greenwood (1975a) for a discussion of the human capital model.

5. The question of the appropriateness of expressing flows between i and j as a function only of conditions in i and j arises and we will return to this issue in Chapter 3. In general it will be argued that flows between any two regions cannot be considered in isolation from conditions prevailing in other regions.

6. Muth (1968, 1971), Perksy and Kain (1970), Olvey (1972), Greenwood (1973), Greenwood and Anderson (1974), Liu (1977) and Cebula (1977) have all estimated simultaneous equations models of migration.

7. The literature confirming the influence of income differences on migration is vast. In fact, most models of the causes of migration include measures of income as explanatory variables. McInnis (1969), Courchene (1970), Laber and Chase (1971), Vanderkamp (1971) and Grant and Vanderkamp (1976) all found evidence that income differences systematically affect migration flows in Canada.

8. See Courchene (1970) and Grant and Vanderkamp (1976).

9. For example, Vanderkamp (1971).

10. See Greenwood (1975), p. 399 and Richardson (1978), p. 111.

11. Fields (1976).

12. See, for example, Sommers and Suits (1973) and Cebula, Kohn, and Galloway (1973-74).

13. See Lowry (1966), Gallaway, Gilbert and Smith (1967), McInnis (1969), Courchene (1970), Rogers (1967) and Wadychi (1974).

14. It should be noted that unemployment rates need not be the only factors absorbing differences in incomes among provinces. In fact, as described later in this chapter, it might be expected that income differentials would be at least partly capitalized in property values. This emphasizes again the importance of incorporating cost of living indexes in interregional migration studies.

15. A high level of unemployment might also indicate reduced average opportunity costs of out-migration from a region. This would be true to the extent that it reflected reduced average expectations of having a job and hence the average expected future income stream from employment.

16. Virtually all Canadian interregional econometric migration studies include some measures of distance and the variable is always highly significant.

17. See Heide (1963), Greenwood (1970b) and Schwartz (1973).

18. Vanderkamp (1971).

19. See Johnston (1972), pp. 298-303. See also Hart (1975) and Salvatore (1977) on using this approach in the migration context.

20. See Chapter 5, Section 5.3.4.

21. Courchene (1970) and Vanderkamp (1971).

22. Among the normalizations suggested or actually used are migration divided by the sum, the product, or the square root of the product, of sending and receiving region populations. Most typically for gross migration econometric studies, sending province population is used to normalize the migration flow variable with receiving province population appearing as a separate explanatory variable.

23. For a brief overview of the evidence on the effects of these factors on Canadian migration flows, see Stone (1974). See also, Grant and Vanderkamp (1976), Chapter 2.

24. See, for example, Liu (1975), Graves (1976, 1980), and Porell (1982).

25. Mincer (1978).

26. For an introduction to the considerations relevant to this debate see Boadway (1980), especially Chapters 3 and 4, and the Economic Council of Canada (1982).

27. Several recent Canadian econometric studies conducted subsequent to and independently of the research reported in this thesis have examined aspects of this issue (Foot and Milne (1981), Winer and Gauthier (1982) and Dean (1982)). The findings of these studies will be compared briefly in Chapter 8.

28. In fact, in a footnote (p. 554), Courchene pointed out the desirability of this more direct approach but stated that it was beyond the scope of his paper.

29. See Buchanan and Wagner (1970), Buchanan and Goetz (1972), Aronson and Schwartz (1973), Flatters, Henderson and Mieszkowski (1974), Gilmer (1976), Pestieau (1977), Boadway (1981) and also Grubb (1982).

30. This would not generally be true since a given fiscal surplus term could result from many different benefit-tax combinations and there is no reason to expect migrants to be indifferent to these. In any event, fiscal surplus is not the only or necessarily the best way of characterizing or comparing the fiscal attractiveness of regions. Much more will be said about this in the next chapter.

31. See Hyman and Pasour (1973), Edel and Sclar (1974), Hamilton (1976), Meadows (1976) and Lea (1982).

32. In fact, this is a general theme emerging from the literature which has followed Oates in testing the Tiebout hypothesis by examining capitalization of fiscal advantage in property values - especially given different tastes among the population.

33. Graham (1964) has argued that per capita fiscal capacity differences among provinces will lead to violation of the principle of horizontal equity (or equal treatment of equals). In the absence of equalizing grants, this could result in labour (and capital) misallocation as described. Boadway and Flatters (1982) have examined this issue in some detail recently and have considered alternative equalization schemes which are appropriate under different concepts of horizontal equity.

34. The approach to equalization followed in Canada is described in detail in Boadway (1980) and the Economic Council of Canada (1982).

35. See Gallaway, Gilbert and Smith (1967), Sommers and Suits (1973) and Cebula, Kohn and Gallaway (1973-1974). Cebula (1974) and Cebula and Kohn (1975) classify total government expenditures into two categories - welfare and nonwelfare expenditures. Their argument is that these expenditure categories will have a different impact on migrants. Greenwood and Sweetland (1972) exclude welfare expenditures altogether. More will be said about welfare expenditures in Chapter 3.

36. See, for example, Pack (1973), Cebula (1977) and Friedman (1981).

37. For example, Cebula (1974, 1977, 1979b) and Pack (1973).

38. Cebula and Kohn (1975) used property taxes per capita while Friedman (1981) and Tsai (1982) used measures of property tax rates.

39. It will be argued in Chapter 4 that, in the present context, per capita expenditures would be more appropriate than Friedman's measures for fire and police protection.

# CHAPTER THREE
# THE MULTINOMIAL LOGIT MODEL

## 3.1 Introduction

The preceding chapter discussed the major considerations associated with identifying economic inducements to migration and of incorporating these influences in migration models. It did not, however, consider the issue of the most appropriate functional form for a migration model nor the theoretical underpinnings and implications of alternative forms. The purpose of this chapter is to discuss some of the issues associated with specifying a structural form for a migration model and to develop the multinomial logit model used in the estimation. A precise expression of the model also requires explicit definition of variables but this issue will be addressed in the next two chapters after the model framework has been developed.

## 3.2 The Migration Decision and Migration Models

The migration decision is in some respects analogous to other more conventional consumer demand choices. It is generally accepted that consumers reveal their preferences for bundles of commodities through their expenditure behaviour. Expenditure patterns are presumed to reflect the underlying utility derived from attributes of commodities by consumers, given their income constraints. Analogously, migration decisions reveal locational preferences of individuals and reflect the benefits and costs of the various alternatives available.

As discussed in Chapter 2, the attractiveness of different locations to migrants can be characterized by the economic attributes associated with them. The economic attributes in turn can be considered proxies for the utility derived from residing in each place. Income and employment prospects, distance from present location and fiscal considerations have been identified as the key economic characteristics associated with provincial locational alternatives in Canada.

Equation (2.3) of Chapter 2 and the associated discussion gave very general expression to the functional relationship between the decision to migrate and the underlying determinants affecting the decision. A more explicit and fairly common specification [see Greenwood,1975a, p. 40] for an actual single equation model of aggregate migration is

$$(3.1) \quad \frac{M_{ij}}{P_i} = \alpha_0 + \sum_{k=1}^{n} \alpha_i^k X_i^k + \sum_{k=1}^{n} \alpha_j^k X_j^k + u_{ij}$$

where $M_{ij}$ is gross migration from i to j, $P_i$ is population of i, the $X_i$'s are measures of the n attributes associated with i, the $\alpha$ are constants to be estimated and $u_{ij}$ represents nonsystematic factors which might affect migration from i to j (the stochastic error term).

Although virtually all migration models within the human capital framework purport to be based on optimizing behaviour of individuals, until recently there has often been no explicit attempt to formally justify either the functional form of models like equation (3.1) or the specific hypotheses tested, within the theoretical context of utility maximization. This situation has existed despite the fact that much of the theoretical literature concerned directly or indirectly with the geographical distribution of individuals has been developed within the framework of utility maximization. A fairly distinct gap is evident between the theoretical literature on resource allocation and much of the empirical work which has examined the factors motivating migration of individuals. More explicit recognition of migration flows as the outcome of individual utility maximizing decisions would facilitate progress in migration modelling and enhance knowledge about the underlying complexities of the migration process.

Recently several migration researchers have formulated the migration decision in a stochastic utility context.[1] Application of the framework to modelling migration is still in its infancy, however, and the theoretical implications of alternative assumptions are virtually unexplored. As a result, much of the analysis in the remainder of this chapter is adapted from literature (cited in the footnotes) which in most cases was not explicitly oriented towards the study of migration decisions.[2] Presentation here of the theoretical foundations of the resulting multinomial logit model in the context of migration is necessary in order that the full implications and advantages of the model in this setting can be appreciated. The framework will undoubtedly be extensively utilized in future empirical investigations of the determinants of migration. A major advantage of the stochastic utility framework is that, under appropriate assumptions, it results in a migration function which avoids certain conceptual limitations associated with more conventional migration models. It is appropriate to examine these problems before developing our version of the stochastic utility model and investigating its characteristics.

The dependent variable in equation (3.1) can be interpreted as an aggregate measure of the probability of migrating from the sending region to the receiving region during a particular time period - for example, a year. Given this interpretation, it would be expected that if we summed over all potential receiving regions j, including i itself, that the sum of the probabilities would total 1. That is

$$(3.2) \quad \sum_{\substack{j=1 \\ j \neq i}}^{J} \frac{M_{ij}}{P_i} + \frac{M_{ii}}{P_i} = 1 .$$

In general, the coefficients obtained from estimating an equation of the form of equation (3.1) will not give this result. It is possible to impose such a restriction but this reveals another implication of the model - namely that the staying probability is dependent on conditions in all regions. This contradicts equation (3.1) which implies that all migration probabilities are a function of conditions only in the sending and receiving regions. This problem can be illuminated by rewriting equation (3.2) as

$$(3.3) \quad \frac{M_{ii}}{P_i} = 1 - \sum_{\substack{j=1 \\ j \neq i}}^{J} \frac{M_{ij}}{P_i} .$$

Equation (3.3) implies that the staying probability is affected by all other migration probabilities associated with region i which in turn, by equation (3.1), are affected by conditions in i and each respective j. The imposition of the restriction results in an asymmetry in the treatment of staying versus migrating probabilities in the sense that the former would be affected by conditions in all regions while the latter would be affected only by conditions in the sending and receiving regions concerned.

More to the point, models of the form of equation (3.1) do not admit of any possible influence of changes in attributes of other regions on the probability of migrating between any two regions. Equation (3.1) implies that the elasticity of demand for locating in region j by residents of i, with respect to changes in an attribute of some third region l, is zero. That is

$$(3.4)\quad \frac{\partial p_{ij}}{\partial X_l^k} = 0$$

where $p_{ij} = \frac{M_{ij}}{P_i}$ is the probability of migrating from i to j. By implication, any increased migration to j as a result of, for example, improvements in economic conditions there, must come entirely from previous stayers in the other regions since none of the other migration probabilities, other than those involving region l directly, are affected by the changes. The implication of zero substitutability between migration flows is difficult to accept.

## 3.3 A Multinominal Logit Model of Locational Choice

Despite the previously mentioned similarities, the migration decision is slightly different from many other demand situations because of its 'all or nothing' nature. The question of whether and where to migrate is discrete in nature whereas many economic choice situations are concerned with marginal changes in quantity. The problem of modelling choices of individuals when there are a number of mutually exclusive, "lumpy" alternatives has been described by McFadden (1974, p.106).

> In conventional consumer analysis with a continuum of alternatives, one can often plausibly assume that all individuals in a population have a common behaviour rule, except for purely random 'optimization' errors, and that systematic variation in aggregate choice reflect common variations in individual choice at the intensive margin. By contrast, systematic variation in aggregate choice among lumpy alternatives must reflect shifts in individual choice at the extensive margin, resulting from a distribution of decision rules in the population.[3]

The stochastic utility framework recognizes the discrete nature of the migration decision. The resulting model takes the distribution of tastes for attributes of alternatives explicitly into account. Furthermore, the migration function which derives from this framework is convenient for econometric estimation using aggregate data and avoids the conceptual problems associated with more conventional migration models.

It is assumed in the stochastic utility framework that individuals derive utility from the attributes associated with alternative locational choices and that the utility function of a typical individual in a population of potential migrants, for a particular locational alternative, can be expressed as

$$(3.5) \quad U = U(X, s, \eta)$$

where $X = (x_1, \ldots, x_n)$ and the $x_i$ are vectors of measurable attributes of alternative locations, s is a vector of measurable socio-economic characteristics of the individual (for example, race, sex, age, income, etc.) and $\eta$ is an unobserved vector of nonmeasurable attributes of locational alternatives and characteristics of individuals.

The existence of the nonmeasurable vector $\eta$ imputes a stochastic nature to the utility function in (3.5) for any individual selected at random from the total population of individuals facing the same choice alternatives. The stochastic nature of the utility function can be made explicit by rewriting the utility function of (3.5) as

$$(3.6)\quad u(x,s) = V(x,s) + \eta$$

where V is the nonstochastic part of the utility function and can be considered as standing for 'representative' tastes of the population with characteristics s and $\eta$ is stochastic and reflects the component of utility specific to a particular individual with characteristics s. The non-stochastic component of utility in (3.6) represents the common utility accruing to individuals with equivalent characteristics from residing in a particular location. The stochastic component ($\eta$) is the component which leads to individuals with equivalent measurable characteristics selecting different locations.

The individual is assumed to be a deterministic utility maximizer who will choose the locational alternative which provides him with the maximum level of utility. Since the level of utility associated with any choice is not directly observable, it is necessary to express the likelihood of any choice in terms of the probability of it being chosen. Under the assumption of utility maximizing behaviour, the probability that any individual will choose locational alternative i ($p_i$) can be expressed as

$$(3.7)\quad p_i = \text{Prob}(V(x^i,s)+\eta(x^i,s)>V(x^j,s)+\eta(x^j,s) \text{ for } \underset{j\neq i}{j=1,\ldots,J})$$

$$\text{or}\quad p_i = \text{Prob}(\eta(x^j,s)-\eta(x^i,s)<V(x^i,s)-V(x^j,s) \text{ for } \underset{j\neq i}{j=1,\ldots,J}).$$

Equations (3.7) are purely descriptive and simply represent alternative ways of expressing the choice criterion and the necessary condition for the unambiguous selection of alternative i by the individual.

If we denote the cumulative joint distribution function of $[\eta(x^1,s),\ldots,\eta(x^J,s)]$ by $\psi(t_1,\ldots,t_J)$ and let $\psi_i$ denote the derivative of $\psi$ with respect to its ith argument, then (3.7) can be expressed[4] as

$$(3.8)\quad p_i = \int_{-\infty}^{+\infty} \psi_i\,(t+V_i-V_1,\ldots,t+V_i-V_J)dt$$

where $V_j = V(x^j,s)$.

We need an explicit functional form and probability distribution for the stochastic terms ($\eta_i$) of (3.7) in order to express the probability of locational choice i in terms of observable locational attributes and characteristics of individuals. The most obvious distributional assumption to make is that the $\eta$ terms are normally distributed. In the multiple choice case with J alternatives, however, the normal distribution does not result in a functional form which is computationally tractable. In fact, McFadden (1974) has shown that only if the $\eta$ terms are independently and identically Weibull distributed will a convenient functional form result. Fortunately, the resulting functional form has both plausible and desirable implications in the context of migration decisions. A random variable has a Weibull distribution if

$$(3.9)\quad \text{Prob}[\eta_i \leq \eta] = e^{-e^{-(\eta+\alpha)}}$$

where $\alpha$ is a parameter establishing the mode of the distribution and can be assumed equal to zero. Equation (3.9) is the cumulative distribution function of a Weibull distributed random variable and expresses the probability that such a variable takes on a value less than or equal to some value $\eta$. The derivative of the distribution function with respect to $\eta$ gives the following frequency function for a Weibull distributed random variable

$$(3.10)\ \psi(\eta) = e^{-(\eta+\alpha)}\exp[-e^{-(\eta+\alpha)}].$$

The Weibull distribution is very similar to the normal distribution except that it is slightly skewed with a thinner left tail and a thicker right tail than the normal. Furthermore, a Weibull distributed random variable is almost normalized by taking logs. The Weibull distribution is a natural distribution to work with in the context of utility maximization because, unlike the normal distribution, it is stable under maximization in the sense that the maximum of two independent Weibull random variables is again a Weibull distributed random variable. Furthermore, as will be demonstrated shortly, the difference of two Weibull distributed random variables has a binary logistic distribution. McFadden (1974) has shown that in the multinomial case, the Weibull is essentially the only distribution which results in a polytomous generalization of the logistic distribution. Since the resulting logistic form has desirable implications in the context of migration modelling, this is an important result. In the two alternatives case it will be shown below that

$$(3.11)\ \mathrm{Prob}[V_1+\eta_1 \geq V_2+\eta_2] = e^{V_1-\alpha_1}/(e^{V_1-\alpha_1}+e^{V_2-\alpha_2}).$$

By using the convolution formula which expresses the probability density function of two independent random variables[5] we can write[6]

(3.12) $\text{Prob}[V_1+\eta_1 \geqslant V_2+\eta_2] = \int_{-\infty}^{+\infty} \psi_1'(\eta)\psi_2(V_1-V_2+\eta)d\eta$

where $\psi_i$ is the cumulative distribution function of $\eta_i$. For the Weibull distribution, $\psi_1(\eta) = \exp[-e^{-e^{-(\eta+\alpha)}}]$ and $\psi_1'(\eta) = e^{-(\eta+\alpha)}\exp(-e^{-(\eta+\alpha_1)})$ so equation (3.12) can be written

$$
\begin{aligned}
(3.13)\ \text{Prob}[V_1+\eta_1 \geqslant V_2+\eta_2] &= p_1 \\
&= \int_{-\infty}^{+\infty} e^{-(\eta+\alpha_1)}\exp(-e^{-(\eta+\alpha_1)})\exp(-e^{-(\eta+V_1-V_2+\alpha_2)})d\eta \\
&= \int_{-\infty}^{+\infty} e^{-(\eta+\alpha_1)}\exp(-e^{-\eta}(e^{-\alpha_1}+e^{-V_1+V_2-\alpha_2}))d\eta \\
&= \frac{e^{-\alpha_1}}{[e^{-\alpha_1} + e^{-V_1+V_2-\alpha_2}]} \cdot \int_0^1 d\{\exp(-e^{-\eta}(e^{-\alpha_1}+e^{-V_1+V_2-\alpha_2}))\} \\
&= \frac{e^{-V_1-\alpha_1}}{e^{V_1-\alpha_1} + e^{V_2-\alpha_2}} .
\end{aligned}
$$

In the J variable case, this can be generalized to

$$(3.14)\qquad p_i = \frac{e^{V_i-\alpha_i}}{\sum_{j-1}^{J} e^{V_j-\alpha_j}}$$

or

$$(3.15)\qquad p_i = \frac{e^{V_i}}{\sum_{j=1}^{J} e^{V_j}}$$

if the $\alpha$'s are thought of as alternative specific effects and are absorbed into the definition of the $V_j$ terms. Equation (3.15) can be written

$$(3.16)\ p_i = \frac{1}{1+\sum_{\substack{j=1\\ j\neq i}}^{J} e^{V_j-V_i}} .$$

which has a logistic distribution. The assumption of Weibull distributed random variables for the stochastic components of the utility functions has therefore resulted in a logit model for migrational choice probabilities. The logit model specifies the probability of any particular locational choice as a function of representative tastes for attributes of the locational alternatives (x) and the characteristics of the individual (s) since $V_i = V(x,s)$.

The logit model of equation (3.15) overcomes the conceptual problems, discussed earlier in this chapter, associated with the more common specification of human capital migration models. For one thing, the probability of choosing some locational alternative in the logit model framework is clearly 1. For example, in the two-alternatives case

$$p_1+p_2 = \frac{e^{V_1}}{e^{V_1}+e^{V_2}} + \frac{e^{V_2}}{e^{V_1}+e^{V_2}} = 1.$$

Furthermore, the logit model implies that all probabilities (including the probability of staying) are affected by the attributes of all regions, in contrast with the traditional model of equation (3.1) described earlier. A change in a relevant attribute of any one region will, in the case of the logit model, potentially affect the probabilities of all choices. This is an important conceptual difference between the two models about the underlying nature of the migration process and is of direct relevance to the policy simulation analysis undertaken later in this study.

Another implication of the logit model, which is advantageous from the point of view of estimation, is that the 'odds' of choosing one location over another are independent of the presence or absence of additional alternatives. In the migration context, if we let $p_{ii}$ be the probability of staying in the sending region and $p_{ij}$ be the probability of migrating to region j, then

$$p_{ij} = \frac{e^{V_j}}{\sum_{\substack{i=1 \\ i \neq j}}^{J} e^{V_i} + e^{V_j}} \; ; \quad p_{ii} = \frac{e^{V_i}}{\sum_{\substack{j=1 \\ j \neq i}}^{J} e^{V_j} + e^{V_i}}$$

and

$$\frac{p_{ij}}{p_{ii}} = \frac{e^{V_j}}{e^{V_i}} \, . \tag{3.17}$$

Equation (3.17) reveals that the ratio of the probability of migrating from i to j to the probability of staying in i is a function only of conditions in i and j and is unaffected by conditions in other regions. So, although in the logit model the probability of any locational choice is affected by conditions in all regions, the ratio of any two probabilities is affected only by conditions in those two regions.

The logit model not only implies that conditions in all regions affect all migration and staying probabilities but also that probabilities respond to changing circumstances in a specific and predetermined manner. The implications of equations (3.15) and (3.17) are that improvements (deteriorations) in conditions in some region will lead to equi-proportionate decreases (increases) in all other probabilities, including staying probabilities. A similar conclusion holds for changes in the number of choice alternatives — the addition or deletion of any chosen alternative will affect all other choice probabilities equi-proportionately. These proportional changes would lead to the ratios of any two probabilities being unchanged as predicted in equation (3.17). The implication of traditional migration models, under similar circumstances, is that only staying probabilities would be affected since the model would not predict any changes in any migration flows except those directly involving the region concerned.

The multinomial logit model, then, implies perfect substitutability among migration flows in the sense that all probabilities of migrating into or out of a region change equi-proportionately with changing economic conditions in that region. One way of interpreting this is that there are no regional affinities in migration patterns other than those explained by variables in the model. This can be seen more clearly by considering the following generalization of the model expressed in (3.15)[7]

$$(3.18)\quad p_{i.} = \frac{e^{V_i} + \theta_i \sum_{j=1}^{J} e^{V_j}}{(1+\sum_{j=1}^{J} \theta_j) \sum_{j=I}^{J} e^{V_j}}$$

where the $\theta$ are parameters associated with the alternatives indicated by the subscripts and $\theta \geq 0$. Now, not only all choice probabilities, but the ratio of any two probabilities depend, in general, on the characteristics of all alternatives. This can be seen by dividing (3.18) by a similar expression for say $p_{ii}$. It can also be easily verified that it is still the case with (3.18) that

$$\sum_{\substack{j=1 \\ j \neq i}}^{J} p_{ij} + p_{ii} = 1.$$

Furthermore, it can be shown that the model in (3.18) is a special case of mixed probability random utility models.[8]

The $\Theta$ parameters in (3.18) can be considered as measures of the extent to which conditions in all regions affect the choice between two alternatives. Nonzero values for these would serve to alter the perfect substitutability implication of the logit model.[9] In the absence of any evidence that the $\Theta$ parameters are other than zero, the logit seems a reasonable model to work with.[10]

So far, the logit model has been described in terms of the probability of a single migrant choosing a particular location. The migration data used in this study, however, are annual data reflecting total flows between any two provinces for a particular year. For aggregate data, the dependent variables of equation (3.15) can be interpreted as the ratio of either movers ($M_{ij}$) or stayers ($M_{ii}$) to sending region population ($P_i$). That is

$$p_{ij} = \frac{M_{ij}}{P_i} \quad ; \; p_{ii} = \frac{M_{ii}}{P_i} \, .$$

This aggregative interpretation of choice probabilities leads to the ratio of movers to stayers as the dependent variable for equation (3.17).[11] Using the micro model for aggregate data is equivalent to assuming that the utility functions of individuals are the same and in particular that the s vectors for different individuals are identical — an implication that could be readily challenged. Grunfeld and Griliches (1960) pointed out many years ago, however, that aggregation errors may be more than compensated for by reductions in specification errors in the micro relation.

After the V terms are specified, (3.17) can be expressed in a form which is readily amenable to estimation by taking logs of both sides of the equation. The existence of an error term can be justified for the usual reasons such as the omission of explanatory variables. After estimation of a model of the general form of equation (3.17), it is a simple matter to work back and predict the effect of changes in choice attributes on the probability flow matrix because of the model's implication of perfect substitutability among choice alternatives and the restriction that the sum of the probabilities of staying in a region or of migrating to some other region must equal one.[12]

## 3.4 Functional Forms for the Representative Utility Functions — Some Theoretical Considerations

In order to derive equations which can be statistically estimated, it is necessary to give precise specification to the representative utility functions — the V terms of equation (3.17). This section considers the broad theoretical implications of alternative functional forms for the representative utility functions. Different functional forms have different implications for overall changes in the probability flow matrix in response to changing economic circumstances. This issue is of direct relevance to the policy issues explained later in the study. Two alternative functional forms will be considered here — utility functions linear in variables and utility functions linear in the logarithms of variables. The next two chapter will give detailed consideration to the specification of the variables appearing in the utility functions.

The assumption that the representative utility functions are linear in variables gives rise to the following form for equation (3.15)

$$(3.19)\ p_{ij} = \frac{\exp\{a_o + \sum_{k=1}^{K} a_j^k X_j^k\}}{\exp\{a_o + \sum_{k=1}^{K} a_j^k X_j^k\} + \sum_{\substack{i=1 \\ i\neq j}}^{I} \exp\{b_o + \sum_{k=1}^{K} b_i^k X_i^k\}}$$

where the $X_i$ are as yet unspecified attributes of choice alternatives and the a's and b's are constants. In a similar fashion, we could specify the probability of staying as

$$(3.20)\ p_{ii} = \frac{\exp\{b_o + \sum_{k=1}^{K} b_i^k X_i^k\}}{\exp\{b_o + \sum_{k=1}^{K} b_i^k X_i^k\} + \sum_{\substack{j=1 \\ j\neq i}}^{J} \exp\{a_o + \sum_{k=1}^{K} a_j^k X_j^k\}} .$$

Dividing $p_{ij}$ by $p_{ii}$ and taking logs of both sides would give the following equation.

$$(3.21)\ \ln\left[\frac{p_{ij}}{p_{ii}}\right] = a_o - b_o + \sum_{k=1}^{K} a_j^k X_j^k - \sum_{k=1}^{K} b_i^k X_i^k + u_{ij}$$

where $u_{ij}$ is the error term, the inclusion of which can be justified for the usual reasons, for example, the omission of explanatory variables. It can be easily shown that equation (3.19) implies that the direct elasticity of demand for alternative j with respect to a change in its $k^{th}$ attribute ($E_{jk_j}$) is

$$(3.22)\ E_{jk_j} = \frac{\partial p_{ij}}{\partial X_j^k} \cdot \frac{X_j^k}{p_{ij}} = b_j^k X_j^k (1 - p_{ij}) .$$

In words, the elasticity is proportional to the weighting of the attribute in the representative utility function, to the amount of the attribute possessed by region j, and to the probability of not migrating to region j. The first two conditions are quite clear. The last condition implies that, for aggregate probabilities, the percentage change in the probability of residents of i choosing to migrate to region j will be smaller (larger) the more (less) popular region j already is to residents of region i, other things equal. An additional implication of the simple linear specification of the representative utility functions is that there is constant marginal utility (or disutility) with respect to changes in one of the choice attributes. This latter implication is in conflict with generally accepted consumer demand theory and is somewhat difficult to accept in the present context.

Alternatively, it could be assumed that the attributes of the choice alternatives enter the representative utility functions in log-linear form, giving the following specifications for the choice probabilities, $p_{ij}$ and $p_{ii}$

$$(3.23)\quad p_{ij} = \frac{\exp\{\ln a_o + \sum_{K=1}^{K} a_j^k \ln X_j^k\}}{\exp\{\ln a_o + \sum_{k=1}^{K} a_j^k \ln X_j^k\} + \sum_{\substack{i=1 \\ i \neq j}}^{I} \exp\{\ln b_o + \sum_{k=1}^{K} b_i^k \ln X_i^k\}}$$

$$(3.24)\quad p_{ii} = \frac{\exp\{\ln b_o + \sum_{k=1}^{K} b_i^k \ \ln X_i^k\}}{\exp\{\ln b_o + \sum_{k=1}^{K} b_i^k \ \ln X_i^k\} + \sum_{\substack{j=1 \\ j\neq i}}^{J} \exp\{\ln a_o + \sum_{k=1}^{K} a_j^k \ \ln X_j^k\}}.$$

The equation to be estimated in this case becomes

$$(3.25)\quad \ln \left[\frac{p_{ij}}{p_{ii}}\right] = \ln a_o - \ln b_o + \sum_{k=1}^{K} a_j^k \ \ln X_j^k - \sum_{k=1}^{K} b_i^k \ \ln X_i^k + u_{ij}.$$

In the log-linear form of the representative utility functions, the ratio of the probabilities can be written

$$(3.26)\quad \frac{p_{ij}}{p_{ii}} = \frac{\exp\{\ln a_o + \sum_{k=1}^{K} a_j^k \ \ln X_j^k\}}{\exp\{\ln b_o + \sum_{k=1}^{K} b_i^k \ \ln X_i^k\}} = \frac{a_0 \prod_{k=1}^{K} (X_j^k)^{a_j^k}}{b_0 \prod_{k=1}^{K} (X_i^k)^{b_i^k}}.$$

The log-linear form for the representative utility functions implies that the ratio of two migration choice probabilities can be expressed in a form which is analogous to the ratio of two Cobb-Douglas utility functions. Furthermore, the log-linear specification implies diminishing marginal utility with respect to increases in attributes of choice alternatives which is an appealing implication. The coefficients in the double log version, equation (3.25), are effectively constant partial elasticities. Since many migration studies are estimated in double log form, estimates of coefficients obtained using equation (3.25) would be comparable to the published results for a sizable body of existing empirical work.

The direct elasticity of demand for alternative j with respect to a change in the $k^{th}$ attribute of that alternative can be shown here to be

$$(3.27)\quad E_{jk_j} = \frac{\partial P_{ij}}{\partial X_j^k} \cdot \frac{X_j^k}{P_{ij}} = b_j^k(1-P_{ij}).$$

With the log-linear specification of the representative utility functions, the direct elasticity of demand for alternative j by residents of region i is similar to the simple linear form, except that in the log-linear case the elasticity is not sensitive to the amount of the attribute possessed by region j.

It is also possible to derive cross-elasticities of demand for alternative j by residents of region i with respect to a change in the $k^{th}$ attribute of some third region l. In the case of the simple linear V function, this elasticity can be shown to be

$$(3.28)\quad E_{jk_l} = \frac{\partial P_{ij}}{\partial X_l^k} \cdot \frac{X_l^k}{P_{ij}} = -b_l^k X_l^k P_{il}.$$

Equation (3.28) shows that the cross-elasticity of demand for alternative j with respect to a change in the $k^{th}$ attribute of alternative l is negatively proportional to the weighting of the attribute in the representative utility function, and directly proportional to both the amount of the attribute possessed by alternative l and the proportion of the population of region i already migrating to region l.

In the log-linear specification of the representative utility function, the cross-elasticity becomes

$$(3.29)\quad E_{jk_l} = \frac{\partial P_{ij}}{\partial X_l^k} \cdot \frac{X_l^k}{P_{ij}} = -b_l^k P_{il}.$$

The cross-elasticity in this case is insensitive to the amount of the attribute possessed by alternative 1.

It can be seen that alternative specifications of the representative utility functions have different implications for the underlying nature of the migration adjustment process. In the estimation, both versions will be tested but the log-linear specification of the representative utility functions is theoretically more appealing because of its implication of diminishing marginal utility with respect to increases in choice attributes and because the coefficients in this case are more directly comparable with results obtained in other migration studies.

## 3.5 Summary and Concluding Comments

This chapter has presented the basic model framework which will be employed in the estimation. A model of aggregate migration choice was developed from the assumption of utility maximizing behaviour on the part of migrants. Utility levels of individuals were assumed to be a function of attributes of choice alternatives and were viewed as consisting of two components -- a representative component common to all individuals and a stochastic component unique to each individual. Particular assumptions about the distribution of the stochastic component resulted in a logit specification for the choice probabilities. Some of the theoretical implications of the model were examined and seen to be appealing in the context of the migration decision. The multinomial logit model has decided conceptual advantages over more conventional migration models.

## FOOTNOTES TO CHAPTER THREE

1. See Grant and Vanderkamp (1976), Schultz (1977), Fields (1979) and Friedman (1981).

2. The framework has been most widely used in empirical analyses of qualitative choice behaviour in the area of transportation mode choice modelling. [See Domenich and McFadden (1975), Stopher and Meyburg (1975) and McFadden (1977).]

3. Italicized words in the original are indicated by underlining.

4. See Domenich and McFadden (1975), p. 52.

5. A derivation and discussion of the convolution formula is given in Davenport (1970), p. 189.

6. The following derivation of the logit model is adapted from Domenich and McFadden (1975), pp. 63-65.

7. The model expressed in equation (3.18) has been named the 'Dogit Model' because it dodges the 'independence from irrelevant alternatives' rigidity of the logit model. The dogit was introduced by Gaudry and Dagenais (1979) and has been applied in the area of transportation demand [Gaudry and Wills (1978), Gaudry (1980)]. See also, Gaudry (1981).

8. McFadden (1978).

9. The $\theta$ parameters alter the direct and cross-elasticities of locational demand for the logit model which are derived later in the chapter. They may either weaken or reinforce the automatic substitution effect implicit in the logit model. [See Gaudry and Dagenais (1979).]The $\theta$ parameters may also be interpreted as measures of 'compulsive' or 'captive' behaviour. In fact, the dogit model of equation (4.18) can be expressed in such a way that the $\theta$ parameters clearly reflect a basic need for the choice alternative [Gaudry (1980), p. 269]. Gaudry has noted the similarity between this interpretation of the model and Stone's (1954) approach to consumer demand wherein part of income is used to satisfy basic desires for certain goods, independently of their prices.

10. Actual estimation of the values of the $\theta$ parameters is an obvious course for future research, particularly in light of the implication of 'compulsive' behaviour implicit in nonzero values. In the present study, 'compulsive' migration flow behaviour will be captured by the use of provincial dummy variables as will be described in Chapter 6. It should be emphasized that large flow probabilities between any two provinces ($p_{ij}$) are not necessarily indicative of 'compulsive' behaviour since the flows may be justified on the basis of the values of the variables appearing in the model. It is only migration flows which cannot be explained by variables in the model which could potentially be considered as reflecting 'compulsive' behaviour.

11. The dependent variable for the logit model using aggregate migration data restricts the migration flow measure analysed to gross rather than net migration. This is desirable however, as discussed in Chapter 5, since gross migration studies have advantages over net migration studies.

12. Specifically, in the three-region case, for example, the adding up restriction on the probabilities implies

$$p_{ij} + p_{ik} + p_{ii} = 1$$

and similarly for flows from regions j and k. The implication of perfect substitutability among choice alternatives implies that after a change in economic conditions in one region (j) the migration response must be such as to leave the ratios of any two flow probabilities into any region unchanged. Those into j, including the staying probability, will rise equi-proportionately (for example, $p_{ij}/p_{jj} = p'_{ij}/p'_{jj}$ where $p'_{ij} > p_{ij}$, $p'_{jj} > p_{jj}$). Those into all other regions, including staying probabilities, will decline equi-proportionately (for example, $p_{ji}/p_{ki} = p'_{ji}/p'_{ki}$ where $p'_{ji} < p_{ji}$, $p'_{ki} < p_{ki}$).

# CHAPTER FOUR

# POTENTIAL FISCAL INFLUENCES ON MIGRATION IN CANADA

## 4.1 Introduction

Chapter 2 provided an overview of some of the literature which is of relevance in identifying and modelling inducements to aggregate migration flows. The chapter focused primarily on the effects that economic conditions and distance can have on migration. Of particular interest was the potential influence that subcentral government fiscal policies could have on Canadian migration flows. It was pointed out that the importance of incorporating these influences in Canadian migration models has grown in recent years because of the increasing importance of federal-provincial grants, and oil and gas revenues to particular provinces. The general nature of potential influences created by these factors was briefly examined. The purpose of this chapter is to take a more detailed look at the precise form and magnitude of subcentral fiscal inducements to migration. Specification of the other variables appearing in the multinomial logit model is reserved until Chapter 5.

Separate, detailed attention to the fiscal variables in this chapter is justified for a number of reasons. First, examination of the migration impact of the fiscal influences forms the primary focus of this study so it is important that the fiscal variables be carefully developed.

Second, no existing econometric study has undertaken a detailed examination of the issue of subcentral fiscal influences on Canadian migration. As a result, there is no established and generally accepted way of modelling these influences and incorporating them in migration models. It is by no means even obvious which items should be given consideration.

In addition, as will be seen, there are a number of plausible ways of expressing the fiscal items selected to permit interprovincial comparisons. It is important that care is taken in considering the strengths and weaknesses of each alternative. This will enable evaluation of the extent to which each measure appropriately reflects actual underlying fiscal influences and hence improve confidence in the validity of the econometric results.

Finally, after construction of alternatives fiscal measures, it is useful to examine their magnitudes and patterns of distribution among provinces and to relate these to the recent migration trends discussed in Chapter 1. This will facilitate in gaining initial useful insights into the plausibility of a systematic relationship between migration and fiscal influences prior to the actual statistical investigations.

## 4.2 Delineating Subcentral Public Sector Differences in Canada

This study focusses on fiscal disparity as it exists among provinces in Canada rather than on intraprovincial fiscal disparity among municipalities. The problem of interprovincial fiscal disparity is also different from, but not unrelated to, the issue of fiscal imbalance between the provincial and federal governments. The latter problem arises because of inadequate provincial revenue sources to meet the rapidly expanding expenditure obligations of the provinces, relative to those of the federal government. As discussed in Chapters 1 and 2, recent developments have brought the problem of financial disparity among provinces to the forefront and it is in this area that the most controversial issues have emerged.

Since it is interprovincial migration flows which are being analysed, it is important that the fiscal variables chosen reflect as accurately as possible total differences in expenditures and taxes for that level of geographical demarcation. Residents of a province are affected by the fiscal activities of both provincial and local governments. Neither provincial nor local data are individually comparable among provinces, however, since different provincial governments have delegated varying powers and responsibilities to their municipalities.

In view of this, the fiscal variables used in this study are constructed from consolidated provincial-local data compiled by Statistics Canada.[1] The consolidated data reflect revenues and expenditures of combined provincial and local governments by province and have been adjusted to remove multiple accounting for a given transaction. The consolidated data most accurately portray overall fiscal realities in a province since they take into account the activities of both subcentral levels of government. The data are available for all ten provinces annually on a calendar year basis from 1962 onwards. There is, however, a publication lag of several years.

4.3 Consolidated Provincial-Local Government Expenditures

Table 4.1 shows consolidated provincial-local government expenditure data by province and by selected major expenditure category for the year ended December 31, 1977, the latest year available at the time or writing. Each expenditure item is expressed both in dollars per capita and as a percentage of total expenditures (in parentheses). The data in Table 4.1 indicate considerable variability among provinces in both the pattern and overall levels of consolidated expenditures. The two largest expenditure categories for all provinces are health and education. The difference in per capita expenditures on health between the highest and lowest expenditure provinces is $220.70. For education, the spread is $190.40. Other expenditure categories demonstrate similar variability across provinces.

Not all of the expenditure categories in Table 4.1 are relevant in establishing locational preferences of individuals so it is necessary to choose those that are appropriate for inclusion in a migration study. Selections were based on information available on the types of expenditures included in each expenditure category by the financial management system of accounts.[2]

Expenditures on health, education, social welfare and recreation and culture are obvious candidates for inclusion. On the other hand, general service expenditures and debt charges can be excluded since they do not represent a benefit to residents. To the extent that expenditures on general services and debt necessitate collection of revenues, they will be reflected in the tax measures discussed in the next section of this chapter. As expenditures only,

Table 4-1

Selected Detail On Consolidated Provincial-Local Government Expenditure by Category and By Province - Year Ended December 31, 1977*

| | Nfld | | PEI | | NS | | NB | | Que | | Ont | | Man | | Sask | | Alta | | BC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % |
| General Services | 94.7 | 4.5 | 140.1 | 6.2 | 92.8 | 4.6 | 96.0 | 4.9 | 193.3 | 7.6 | 126.9 | 5.8 | 146.0 | 6.2 | 157.6 | 6.5 | 216.1 | 7.8 | 201.3 | 8.6 |
| Protection of Persons & Property | 70.7 | 3.4 | 72.6 | 3.2 | 97.8 | 4.8 | 82.8 | 4.3 | 137.5 | 5.4 | 132.9 | 6.1 | 122.9 | 5.3 | 113.9 | 4.7 | 143.0 | 5.0 | 131.8 | 5.6 |
| Transportation & Communications | 232.2 | 11.1 | 228.5 | 10.1 | 198.6 | 9.8 | 264.1 | 13.6 | 232.2 | 9.1 | 164.1 | 7.5 | 150.7 | 6.4 | 262.6 | 10.9 | 308.5 | 11.2 | 240.6 | 10.2 |
| Health | 363.1 | 17.4 | 412.4 | 18.3 | 470.1 | 23.1 | 370.5 | 19.1 | 451.0 | 17.7 | 449.0 | 20.4 | 585.8 | 25.0 | 492.3 | 20.4 | 491.7 | 17.8 | 458.5 | 19.5 |
| Social Services | 195.8 | 9.4 | 199.9 | 8.9 | 165.4 | 8.1 | 232.0 | 11.9 | 349.6 | 13.7 | 262.2 | 11.9 | 278.3 | 11.9 | 282.0 | 11.7 | 214.5 | 7.8 | 300.1 | 12.8 |
| Education | 523.3 | 25.1 | 503.1 | 22.3 | 523.0 | 25.8 | 475.1 | 24.5 | 665.5 | 26.2 | 556.1 | 25.3 | 505.7 | 21.6 | 525.6 | 21.7 | 614.3 | 22.3 | 521.3 | 22.2 |
| Resource Conservation & Industrial Development | 132.6 | 6.4 | 371.1 | 16.5 | 108.7 | 5.4 | 102.3 | 5.3 | 87.2 | 3.4 | 55.1 | 2.5 | 102.2 | 4.4 | 195.5 | 8.1 | 279.7 | 10.1 | 85.5 | 3.6 |
| Environment | 56.3 | 2.7 | 40.7 | 1.8 | 56.1 | 2.8 | 65.2 | 3.4 | 97.9 | 3.9 | 99.1 | 4.5 | 61.7 | 2.6 | 59.1 | 2.4 | 125.7 | 4.6 | 103.1 | 4.4 |
| Recreation & Culture | 52.3 | 2.5 | 61.7 | 2.7 | 39.8 | 2.0 | 45.9 | 2.4 | 72.6 | 2.9 | 84.5 | 3.9 | 81.4 | 3.5 | 64.2 | 2.7 | 118.8 | 4.3 | 80.7 | 3.4 |
| Labour, Employment & Immigration | 1.0 | .1 | 1.5 | .1 | 1.3 | .1 | 3.1 | .2 | 6.9 | .3 | 1.5 | .1 | 9.2 | .4 | 2.8 | .1 | 1.9 | .1 | 2.2 | .1 |
| Housing | 1.6 | .1 | 16.8 | .8 | 15.2 | .8 | 4.5 | .2 | 9.2 | .4 | 22.3 | 1.0 | 2.7 | ..1 | 6.0 | .3 | 13.5 | .5 | 5.9 | .3 |
| Regional Planning & Development | 36.6 | 1.8 | 16.9 | .8 | 36.2 | 1.8 | 22.1 | 1.1 | 10.8 | .4 | 19.8 | .9 | 46.1 | 2.0 | 35.2 | 1.5 | 14.8 | .5 | 25.8 | 1.1 |
| Debt Charges | 304.1 | 14.6 | 147.0 | 6.5 | 162.6 | 8.0 | 155.8 | 8.0 | 205.8 | 8.1 | 182.6 | 8.3 | 195.9 | 8.4 | 172.8 | 7.6 | 172.4 | 6.3 | 124.1 | 5.3 |
| Other Expenditures | 21.8 | 1.1 | 40.5 | 1.8 | 63.8 | 3.1 | 23.9 | 1.2 | 25.7 | 1.0 | 40.9 | 1.9 | 51.8 | 2.2 | 49.6 | 2.1 | 45.6 | 1.7 | 68.2 | 2.9 |
| Total Expenditures | 2086.1 | 100 | 2252.8 | 100 | 2031.4 | 100 | 1943.3 | 100 | 2545.2 | 100 | 2197.0 | 100 | 2340.4 | 100 | 2419.2 | 100 | 2760.5 | 100 | 2349.1 | 100 |

Source: Constructed from data in Consolidated Government Finance 1977, Statistics Canada, 68-202, Table 6.

* The dollar figures are per capita and the percentage figures express an expenditure category as a percentage of total expenditure.

however, they are likely to be largely irrelevant to residents and potential residents.[3]

The other expenditure categories are somewhat less clear cut. Expenditures on protection of persons and property are relevant because they primarily reflect outlays on courts of law and correctional, police and fire fighting services. Transportation and communication expenditures which cover disbursements for the acquisition, construction, operation and maintenance of all transportation facilities at the provincial-local level (roads, highways and public transportation) are also of relevance. The environment category covers expenditures on water purification and supply, sewage and garbage collection and disposal as well as pollution control and so is included. The housing category is included because it represents assistance for home renovation or purchase and real property tax subsidies. The category regional planning and development is relevant because it primarily reflects community and regional planning, zoning and development expenditures. It was also decided to include labour, employment and immigration outlays because they cover expenditures on the promotion of improved working conditions and (in the case of Quebec) on the promotion of immigration and assistance to immigrants.

Other excluded expenditure categories are those for resource conservation and industrial development, research establishments and transfers to own enterprises. Expenditures within these categories do not directly alter the quality of life in a province although they will affect provincial income and employment conditions and will be reflected in variables representing these in the migration models.

In summary, the expenditure categories relevant to migrants in Canada are: Protection of Persons and Property; Transportation and

Communications; Health; Social Services; Education; Environment; Recreation and Culture; Labour, Employment and Immigration; Housing; and Regional Planning and Development. The classification system used by Statistics Canada for categorizing different types of government expenditures has changed somewhat over the years. To the extent possible, however, the guidelines outlined above were followed in selecting relevant government expenditures for each year.

The questions of how much detail on different types of expenditures should be retained in the migration models as well as how expenditures would most appropriately be expressed also justify careful consideration. The two issues are closely related.

The manner in which provinces allocate their revenues by expenditure category, whether by choice or because of biases created by federal grants, could possibly have a disparate impact on different individuals and potentially affect migration flows. Table 4.1 indicates that there are substantial differences in per capita dollar expenditures for most expenditure categories across provinces.

It was decided, however, not to attempt to examine the separate influences on migration of each expenditure category. Using individual categories of expenditures in the migration models would increase considerably the number of coefficients to be estimated and therefore the likelihood of multicollinearity. The unveiling of systematic patterns in the effect of government expenditures on migration would likely only be frustrated by attempting to garner too much detailed information on the separate effects of individual expenditure categories. Such an approach might prove more fruitful with migration micro-data where it becomes possible to classify migrants into more homogeneous subgroupings (for example, by age, sex, education). It is the overall aggregate impact of the expenditure structure on average which is the focus of analysis here.

Furthermore, there is little reason to suspect that the different expenditure categories would have different qualitative effects on migration flows. It is only the magnitude of the influences if anything which should vary across expenditure categories and these differences are not likely to be revealed in any reliable fashion with aggregate data. This is likely to be true even in the case of social welfare expenditures which have often been treated separately in U.S. studies. The partial effect of social welfare expenditures should be to induce in-migration and to reduce out-migration although they might affect different types of migrants than say education or health expenditures. Having said this, however, social welfare expenditure is the one category which will be examined separately in some model versions because of the policy implications of migration which is motivated by such outlays. More typically, all of the selected expenditure categories will be combined for the reasons given.

It could also be argued that dollar expenditures are a measure of the value of inputs, not of outputs of government services. Presumably migrants are ultimately interested in the quality of education, health care and fire protection and the levels of crime in different provinces, not the dollar expenditures on these items.[4] While this is a valid point and undoubtedly warrants separate study, controversy about the potential resource allocation effects of the existing federal structure has centered around the ability of different provinces to finance their expenditures. Of interest in this context is whether or not financial constraints for revenue deficient provinces have affected their intensity of taxation or their dollar expenditures on goods and services and whether these in turn have affected their attractiveness to individuals. From that perspective, dollar expenditures are the relevant measures.

The appropriateness of using annual expenditures on the selected categories might also be questioned since provinces are not on an equal footing with respect to the development of their social capital stock. It could be argued, for example, that Ontario might continue for some time to have the most attractive post secondary education system, even if annual expenditures are lower than for other provinces, simply because of the cumulative effect of previous large expenditures over the years. The dependent variable used in the regression model developed in the preceding chapter is the ratio of the probability of migrating from one province to another during the year to the probability of staying in the sending province. While levels of annual government expenditures (as well as other variables in the models) will affect these probabilities, the fact that some provinces retain absolute advantages because of high past expenditures, will have to be reflected in other ways in the models. Such stock effects are captured by various means in this study including the use of an adaptive expectations framework in some model versions, and estimation approaches which admit of province-specific components of migration flows. Each of these is described later in the study.

Total per capita real government expenditures on the selected expenditure categories would appear, then, to be an acceptable way of comparing differences among provinces in subcentral public sector output, for present purposes. The use of provincial populations as bases seems appropriate since we are not comparing separate expenditure categories.[5] Because average income levels differ substantially across provinces a given level of per capita expenditures may be of greater relative importance in some provinces than in others. To account for this possibility, the appropriateness of expressing aggregate government expenditures as a proportion of aggregate personal income will also be explored in the empirical investigations. Additional ways of expressing the expenditure variables will be discussed after consideration has been given to the taxation variables in the next section.

## 4.4 Consolidated Provincial-Local Government Revenues

Table 4.2 on the next page shows selected detail on the revenue components by province for the year ended December 31, 1977. As in the case of expenditures, revenues also demonstrate considerable variablity among provinces, both by category and in total. The most important tax categories are personal income taxes, consumption taxes and property and related taxes. As in the case of government expenditures, decisions have to be made about which revenue categories are appropriate for inclusion in the migration study, how much detail on individual revenue categories to retain, and how the revenue variables will be expressed in the migration models.

The first two issues can be approached jointly. Revenue collections by either level of government in a province are of interest to any resident or potential resident only if they reduce received real incomes. Revenue collections in a province may affect received real incomes either directly by reducing net nominal earnings, or indirectly by affecting the prices of

Table 4.2

Selected Detail on Consolidated Provincial-Local Government Revenue Sources
By Province, Year Ended Dec. 31, 1977*

| | Nfld | | PEI | | NS | | NB | | Que | | Ont | | Man | | Sask | | Alta | | BC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % |
| Personal Income Taxes | 228.3 | 11.4 | 178.1 | 8.5 | 249.0 | 13.4 | 229.1 | 13.0 | 603.8 | 24.8 | 341.5 | 17.1 | 312.3 | 15.0 | 315.5 | 13.3 | 311.9 | 8.5 | 377.6 | 15.9 |
| Corporation Income Taxes | 43.4 | 2.2 | 25.9 | 1.2 | 30.2 | 2.1 | 36.3 | 2.1 | 63.3 | 2.6 | 93.9 | 4.7 | 85.2 | 4.1 | 78.3 | 3.3 | 214.5 | 5.9 | 103.6 | 4.4 |
| Property and Related Taxes | 69.0 | 3.4 | 112.3 | 5.4 | 184.2 | 9.9 | 151.4 | 8.6 | 268.6 | 11.1 | 379.3 | 19.0 | 340.0 | 16.3 | 303.3 | 12.8 | 311.7 | 8.5 | 401.8 | 16.9 |
| Consumption Taxes | 375.4 | 18.7 | 306.9 | 14.7 | 276.7 | 14.9 | 267.6 | 15.2 | 358.4 | 14.7 | 333.0 | 16.7 | 304.5 | 14.6 | 305.3 | 12.9 | 65.2 | 1.8 | 398.4 | 16.8 |
| Health & Social Insurance Levies | 22.1 | 1.1 | 22.1 | 1.1 | 23.3 | 1.3 | 28.3 | 1.6 | 229.6 | 9.5 | 164.2 | 8.2 | 27.2 | 1.3 | 52.3 | 2.2 | 96.1 | 2.6 | 130.9 | 5.5 |
| Natural Resource Revenue | 31.9 | 1.6 | 2.7 | .1 | 7.9 | .4 | 13.6 | .8 | 16.3 | .7 | 11.7 | .6 | 21.0 | 1.0 | 404.2 | 17.1 | 1694.1 | 46.2 | 181.4 | 7.6 |
| Privileges Licenses & Permits | 49.5 | 2.5 | 23.6 | 1.1 | 34.5 | 1.9 | 31.3 | 1.8 | 44.3 | 1.8 | 55.4 | 2.8 | 40.5 | 2.0 | 48.6 | 2.1 | 51.2 | 1.4 | 45.2 | 1.9 |
| Sales of Goods & Services | 73.5 | 3.7 | 138.9 | 6.6 | 73.8 | 4.0 | 61.3 | 3.5 | 86.3 | 3.6 | 105.1 | 5.3 | 93.2 | 4.5 | 113.9 | 4.8 | 167.7 | 4.6 | 118.6 | 5.0 |
| Return on Investments | 139.6 | 7.0 | 147.1 | 7.0 | 170.1 | 9.1 | 115.6 | 6.6 | 138.9 | 5.7 | 147.5 | 7.4 | 190.0 | 9.5 | 286.5 | 12.1 | 342.3 | 9.3 | 233.8 | 9.8 |
| Other Revenue From Own Source | 64.6 | 3.2 | 16.4 | .8 | 22.0 | 1.2 | 28.1 | 1.6 | 94.8 | 3.9 | 75.8 | 3.8 | 72.9 | 3.5 | 85.2 | 3.6 | 84.4 | 2.3 | 54.6 | 2.3 |
| Transfers From the Federal Government | 910.6 | 45.3 | 1119.0 | 53.5 | 768.2 | 41.3 | 794.7 | 45.2 | 516.6 | 21.3 | 278.1 | 13.9 | 571.9 | 27.5 | 366.9 | 15.5 | 324.0 | 8.8 | 324.2 | 13.7 |
| Total Other Revenues | 1.25 | .1 | 0 | 0 | 10.1 | .5 | .4 | 0 | 8.2 | .3 | 9.8 | .5 | 14.3 | .7 | 7.2 | .3 | 3.2 | .1 | 4.1 | .2 |
| Total Revenue | 2009.1 | 100 | 2093.0 | 100 | 1862.3 | 100 | 1758.8 | 100 | 2431.0 | 100 | 1994.8 | 100 | 2002.7 | 100 | 2365.4 | 100 | 3668.8 | 100 | 2375.1 | 100 |

Source: Constructed from data in Consolidated Government Finance 1977, Statistics Canada, 68-202, Table 5.

* The dollar figures are per capita and the percentage figures express a revenue category as a percentage of total revenue.

goods and services sold in a province. These two channels of influence not only suggest criteria for evaluating revenue categories for inclusion in a migration model but also a convenient dichotomous classification for representing them. For the remainder of this study, revenue categories which represent a direct reduction in received nominal income of individuals will be referred to as 'personal taxes' while those which affect the cost of goods and services purchased or consumed in a province will be referred to as 'commodity taxes'.

Using the above selection criteria and information about the types of revenues included in each category by the financial management system of revenue classification, the following were considered to be of relevance to the migration decision:

> Personal Taxes: personal income taxes, and health and social insurance levies.
>
> Commodity Taxes: all property taxes, all consumption taxes, taxes on insurance premiums, privileges, licenses and permits, sales of goods and services, and remittances from own enterprises.

The selection and classification is more or less self-explanatory although a few comments may be warranted. Corporation income taxes are excluded for a number of reasons. Although differences in corporation tax rates across provinces could affect the locational decisions of corporations, and hence indirectly of employees of corporations, this effect will already be reflected in the provincial income and employment variables. Furthermore, if corporation taxes lead to higher product prices, the free flow of products among provinces will tend to distribute the burden of the tax to individuals not resident in the taxing province. Thus, provincial corporation income taxes will tend to result in higher prices for all Canadians and will be reflected in the provincial price indexes. It would not be appropriate, therefore, to assign the burden of any particular province's corporation income taxes to residents of that province.

Natural resource revenues and transfers from the federal government were omitted since neither imposes a financial burden on the residents of a province. Their influence will be felt, to the extent that they affect government expenditures on goods and services, but such effects will also be picked up in the expenditure variables. The category "remittances from own enterprises" is included however because it represents trading profits of provincial liquor boards and affects liquor prices.

Another issue associated with tax variables in a migration model concerns the appropriate base or bases to use. The use of individual tax rates for each tax as defined in the tax statutes was ruled out. This decision was reached because of the relatively large number of taxes and because substantial variation in the definitions of the bases in different provinces makes interprovincial comparisons difficult.

One possibility is to follow the procedure used for government expenditures and express total taxes in per capita terms. Although per capita taxes are used in some model versions, this measure of taxation burden is somewhat inadequate. For one thing, high per capita taxes for a province might be indicative of high tax capacity rather than high tax rates. This is particularly true in the case of the provincial personal income tax which, being based on federal income taxes, is indirectly structured so that the marginal (and hence average) tax rates increase as taxpayers move into higher income brackets.

Another possibility would be to express taxes as a percentage of aggregate provincial personal income. While the appropriateness of this measure is also explored in some of our model versions, it is only slightly preferable conceptually to the per capita measure. Although increasing incomes will reflect to some extent overall increases in the total tax base for a province, the measure still does not solve the problem created by the increasing marginal rate structure for the federal (and hence provincial) income tax. This factor will again tend to cause an artificially high measure for wealthy provinces.

Both of these measures, despite their shortcomings, however, do give an approximate, general measure of the burden of taxation in a province and the extent to which taxes reduce the attractiveness to residents and potential residents. Even for wealthy provinces, with only artificially high provincial income tax rates, the measures give an indication of the extent to which the apparent gain from locating there is reduced by tax payments.[6]

One additional shortcoming of each of these measures is that they fail to distinguish between taxes that affect received incomes ('personal taxes') and those that largely affect the cost of living ('commodity taxes'). It seems unlikely that these two categories of taxes would have the same effect on the attractiveness of a province. It would be desirable to maintain the dichotomy between the two types of taxes to separate their individual effects on migration.

For 'commodity taxes,' total gross provincial expenditure seems to be the most reasonable base for comparing the intensity of provincial tax effort and is the base used for these taxes in the econometric models. For 'personal taxes' an obvious approach is to use the actual provincial personal income tax rates. One problem with this measure, however, is that the effect of health and social insurance levies would be missed and these are very important sources of revenue for Quebec and Ontario. Another problem is that Quebec has remained outside the tax collection arrangements between the other provinces and the federal government and levies personal income taxes under its own statute with its own rate structure. It would be necessary to calculate a comparable Quebec rate for each year if provincial income tax rates were used in the migration models. Another possibility would be to express 'personal taxes' alone as a percentage of provincial personal income, but that still leaves the problems associated with the graduated federal rate structure.

Perhaps the most accurate way to reflect the impact of consolidated provincial-local 'personal taxes' in a migration model, however, is simply to deduct such taxes from the personal income variables appearing in the models. It seems reasonable that a dollar of 'personal taxes' paid would be viewed by an individual as being equivalent to a dollar reduction of earned income in the province and both should tend to have the same effect on in- and out-migration, at least on average for aggregate flows.

It can be seen that there are a number of possible ways of expressing both government expenditures and the burden of taxation at the subcentral level. Perhaps the conceptually most appropriate way of representing them in a migration model is to express relevant government expenditures in per capita terms, 'commodity taxes' as a proportion of gross provincial expenditure and to subtract 'personal taxes' from the income variable. The other possibilities discussed might also give reasonable approximations to prevailing fiscal conditions, however, and will be tested in some models.

Much of the theoretical literature in fiscal federalism, as discussed in Chapter 2, describes fiscal advantage in terms of the combined measure of fiscal residuum, or government expenditures minus taxes. Use of this measure implies that expenditures and taxes affect migrants equivalently. This seems somewhat unlikely. In addition, as mentioned in Chapter 2, it is possible for a given fiscal residuum figure to represent virtually an infinite number of different expenditure-tax combinations and there is no obvious reason why migrants should be indifferent to these alternatives. Ellson (1980) used a modification of fiscal ratio, or benefits per dollar of taxes, but this implies that equal percentage increases in benefits and taxes would leave migrants indifferent.

Despite the limitations of these two measures, their use (especially fiscal residuum) does provide a direct link to the theoretical public finance literature on fiscally induced locational choice and their performance in some versions of the migration model will be explored. Cautiously used, they also provide useful summary measures of fiscal forces which exist in a federal state, as discussed in the next section.

## 4.5 Fiscal Advantage and Migration in Canada

Having considered some of the different fiscal measures and their advantages and limitations, we can look at the precise patterns and magnitudes of fiscal influences and how they mesh with observed recent migration flows described in Chapter 1.

Table 4.3 shows some summary taxation and expenditure figures for

## Table 4.3

### Selected Consolidated Provincial-Local Government Fiscal Measures - 1977

| | Nfld | PEI | NS | NB | Que[7] | Ont | Man | Sask | Alta | BC |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Total government expenditures per capita | 2086 | 2253 | 2031 | 1943 | 2545 | 2197 | 2340 | 2419 | 2761 | 2349 |
| 2. Total revenue per capita | 2009 | 2088 | 1862 | 1759 | 2327 | 1995 | 2082 | 2365 | 3669 | 2375 |
| 3. Total own revenue per capita | 1098 | 972 | 1094 | 964 | 1810 | 1717 | 1511 | 1998 | 3345 | 2050 |
| 4. Total selected government expenditures per capita | 1532 | 1553 | 1602 | 1562 | 1992 | 1790 | 1835 | 1841 | 2045 | 1868 |
| 5. Total "personal" & "commodity" taxes per capita | 743 | 642 | 768 | 708 | 1250 | 1273 | 1024 | 1025 | 836 | 1354 |
| 6. Fiscal surplus per capita 1: row (1) - row (5) | 1343 | 1611 | 1264 | 1235 | 1295 | 924 | 1316 | 1394 | 1924 | 995 |
| 7. Government expenditure/tax ratio: row (1) ÷ row (5) | 2.81 | 3.51 | 2.65 | 2.75 | 2.04 | 1.73 | 2.29 | 2.36 | 3.30 | 1.73 |
| 8. Fiscal surplus per capita 2: row (4) - row (5) | 789 | 911 | 834 | 854 | 742 | 517 | 811 | 816 | 1209 | 514 |
| 9. Government expenditure/tax ratio 2: row (4) ÷ row (5) | 2.06 | 2.42 | 2.09 | 2.21 | 1.67 | 1.41 | 1.79 | 1.80 | 2.45 | 1.38 |
| 10. Total commodity taxes as a % of GPE | 9.76 | 9.71 | 8.16 | 7.88 | 7.91 | 7.79 | 8.32 | 7.31 | 3.35 | 8.35 |
| 11. Provincial Personal Income Tax Rates | 58.0 | 50.0 | 52.5 | 55.5 | 78.8 | 44.0 | 56.0 | 58.5 | 38.5 | 46.0 |

Sources: Constructed from data in Consoldiated Government Finance, Statistics Canada, 68-202; Provincial and Municipal Finances 1977, Canadian Tax Foundation; and, System of National Accounts, Provincial Economic Accounts: Experimental Data, Statistics Canada, 13-213.

the consolidated provincial-local sectors by province for the year ended December 31, 1977. The table gives a fairly complete picture of the fiscal realities in different provinces and the possible influences on migration coming from this source. Line 1 of Table 4.3 shows that total per capita expenditures range from a low of $1943 in New Brunswick to a high of $2760 in Alberta - a difference of over $800. Line 2 of Table 4.3 reveals that total revenue is even more widely dispersed than total expenditures. Alberta's total revenue collections of $3669 per capita in 1977 were more than twice those for New Brunswick. Line 2, however, includes transfers to the provinces from the federal government. Line 3 gives a more accurate picture of the extent of fiscal disparities among provinces as it shows revenue collections from own source. Alberta's per capita revenue collections from own source of $3345 are approximately three and one-half times larger than those for New Brunswick. The difference between the expenditure and revenue figures for Alberta are largely explained by the huge surplus - now totalling over $11 billion - which that province has been accumulating in its Heritage Trust Fund. The existence of this huge fund is almost certain to permit continued high government expenditures and low taxes for Albertans in future years and should offset to a significant extent any drop off in natural resource or other levies.

The first three rows of Table 4.3 give only a very limited picture of potential inducements to migration because they include the expenditure and revenue categories which were considered not to be of relevance to residents of a province. Lines 4 and 5 respectively show selected government expenditures per capita and total 'personal' plus 'commodity' taxes per capita. It can be seen from line 5 that residents of British Columbia pay per capita provincial-local taxes of $1354 - more than double those paid by residents of Prince Edward Island. Quebec and Ontario residents pay approximately equal taxes per capita of $1250 and $1273, respectively. Alberta residents pay significantly lower provincial-local taxes per capita than any other Canadians with the exception of the residents of the four Atlantic Provinces. Alberta taxes are low, of course, because of the large resource revenues accruing to the province. The reason for the low taxes in the Atlantic Provinces is less obvious. Tax collections may be low either because tax rates are low or because tax bases are small but there is evidence to suggest tax collections are low in the Atlantic Provinces primarily for the latter reason. This conclusion is supported by the two important general measures of tax rates shown in lines 10 and 11 of Table 4.3 - total commodity taxes as a percentage of gross provincial expenditure and provincial personal income tax rates as a percentage of 'Basic Federal Tax'.

The selected government expenditures per capita of line 4 follow a pattern similar to the total expenditures of line 1. Although grant payments to the poorer provinces do not bring average revenues up to the national average, they do nevertheless permit far larger expenditures on key items than would be possible from own revenue alone.

Lines 6-9 show combined measures of fiscal advantage involving both expenditures and taxes for each province. Line 6 of Table 4.3 shows one measure of fiscal surplus, total expenditures per capita minus total 'commodity' plus 'personal' taxes. Federal transfers make the surpluses for the Atlantic Provinces, Quebec and Manitoba compare quite favourably with those of most of the other provinces with the exception of Alberta. Federal-provincial grants make the major recipient provinces much more attractive places to reside than would be the case in their absence. The grants probably increased the surplus by at least $800 to $1000 per capita for the residents of the four Atlantic Provinces in 1977 - conceivably a significant inducement to potential in-migrants and, what is even more likely, a very substantial retardant to potential out-migrants.

Alberta, of course, has by far the largest fiscal surplus associated with it according to the measure used in line 6 of Table 4.3. Somewhat surprisingly, Ontario and British Columbia have the smallest fiscal surpluses of $924 and $995 per capita, respectively. The reason is that, unlike Alberta, these provinces are more dependent on taxes than resource royalties for revenue and, unlike the poorer provinces, are not large grant recipients, relative to their population sizes. As such, they are the least attractive provinces to a potential migrant according to this criterion of fiscal advantage.

This conclusion is supported by line 7 of Table 4.3 which shows total government expenditures per dollar of relevant taxes paid - line 1 divided by line 4. Residents of Prince Edward Island receive even more government services per dollar of taxes paid than do residents of Alberta. The Prince Edward Island ratio is just slightly more than double those for Ontario and British Columbia.

The patterns revealed in lines 6 and 7 are supported by the alternative measures of fiscal surplus and fiscal ratio of lines 8 and 9. Lines 8 and 9 give the most precise measures since they exclude irrelevant expenditure categories. It is interesting to note that Prince Edward Island, New Brunswick and Nova Scotia rank respectively second, third and fourth in terms of the fiscal surplus measures given in line 8. The ratio figures of line 9 show Prince Edward Island and Alberta to be almost equal by this measure. The other three Atlantic Provinces also have ratio figures greater than two. British Columbia and Ontario are again by far the least attractive provinces according to this fiscal measure.

On the basis of Table 4.3, it is possible to make some general comments about the potential influences of subcentral public sectors on interprovincial migration flows in Canada. The exact effect that fiscal factors will have on interprovincial migration, of course, will depend to some extent on the awareness of migrants and the precise manner in which their behaviour is motivated by expenditure and tax considerations. For aggregate migration flows, however, the fiscal surplus and fiscal ratio patterns give a rough summary approximation to the general migration influences in operation since they take both expenditure and taxes into account. The fact that the patterns for all four measures (lines 6 - 9) are very similar lends credence to this claim.

If this is true, and migrants consider the taxes and expenditures of subcentral governments in making decisions about moving from one province to another, then the following would be expected to result on the basis of fiscal consideration alone: (1) increased in-migration and, even more likely, reduced out-migration for provinces highly dependent on federal grants - especially the four Atlantic Provinces but to a lesser extent Quebec and Manitoba as well; (2) reduced in-migration and increased out-migration for Ontario and British Columbia because expenditures, being financed primarily by tax revenues, make them less attractive to individuals, and; (3) increased in-migration and reduced out-migration for Alberta because of large resource revenues and the resulting large public expenditures and low tax burden on residents these permit.

These expectations appear to accord remarkably well with actual observed migration patterns, summarized in Chapter 1, which have emerged in recent years and at least raise the possibility that fiscal factors might indeed be systematically affecting migration flows in Canada.

## 4.6 Summary

The purpose of this chapter was to take a fairly detailed look at the nature and magnitudes of potential subcentral fiscal influences on Canadian interprovincial migration flows. Several alternative ways of identifying and measuring these influences were examined and evaluated. Distinct patterns of potential influences emerge which appear, at least on the surface, to accord remarkably well with actual recent migration patterns. Furthermore, these influences seem to be relatively distinct from, and often at odds with, more conventional inducements to migration such as income and employment prospects. The forces emanating from the public sectors are substantially affected by the existence of natural resource revenues and federal-provincial grants.

The evidence emerging from this chapter would seem to argue for explicit incorporation of subcentral public sector influences in the multinomial logit econometric migration models. In the next chapter, all variables appearing in the models are explicitly defined and constructed.

## FOOTNOTES TO CHAPTER FOUR

1. Consolidated Government Finance, Statistics Canada, catalogue 68-202, annual.

2. The Canadian System of Government Financial Management Statistics, Statistics Canada, catalogue 68-506, occasional.

3. It is possible that both government expenditures and taxes might be indirectly of relevance to migrants to the extent that they affect income levels and employment prospects. Such indirect influences are not considered in this chapter although it should be pointed out that they will be reflected in other variables appearing in the final model versions.

4. As pointed out in Chapter 3, Friedman (1981) used proxies for the effectiveness of police and fire protection rather than dollar expenditures.

5. If we were, then bases other than population might be more appropriate -- for example, education expenditures per pupil. The equalization formula, it might be noted however, measures potential fiscal capacity differences among provinces in per capita terms in determining provincial entitlements.

6. In fact, even in a unitary state, with no regional differences in tax rates, income taxes would reduce the expected payoff from migration and hence mobility, other things equal. It should also be mentioned that government expenditures in a unitary state could also reduce mobility since, with pure public goods, individuals would receive a part of their consumption set irrespective of where they were located geographically so that the incentive to migrate would be reduced. On the other hand, government expenditures which improve the human capital of the population (for example health and education expenditures) increase the expected payoff from migrating and might exert a partially offsetting positive influence.

7. The Quebec revenue figures are adjusted, where relevant, to reflect the fact that Quebec taxpayers receive a tax abatement as compensation for provincial financing of established programs. Since Quebec levies its own personal income tax, the Quebec rate in row 11 is what the effective Quebec rate would have been if Quebec collections were expressed as a percentage of "basic federal tax" after allowing for the federal abatement.

# CHAPTER FIVE

# CONSTRUCTION AND SPECIFICATION OF VARIABLES

## 5.1 Introduction

The multinomial logit framework was developed in Chapter 3. The functional form of the migration model is represented by equation (3.17), but it is necessary to specify the exact form of the representative utility functions in that equation before estimation can proceed. The general implications of two broad specifications, linear and log-linear, were considered in Chapter 3 but a complete description of the model requires a detailed discussion of the data used, their sources and the logic and methodology employed in constructing the different variables used in the models. The analysis of Chapters 2 and 4 provide the guidelines for proceeding with this task.

## 5.2 Alternative Migration Flow Measures

The multinomial logit model developed in Chapter 3 from the stochastic utility framework results in a dependent variable which is the ratio of two aggregate flow probability measures. Adherence to that theoretical framework restricts the analysis to gross rather than net migration flows but gross flow analyses are preferable because they reveal considerably more information about the causes of migration. There is a large degree of information loss with net flow studies, and in particular, there will be a tendency for estimated coefficients for some variable to either 'wash out' or be exaggerated in net migration studies.[1.] In addition, it is always possible to calculate net flows from estimated equations on gross flows, but the converse is not true. Both theoretical and practical considerations, therefore, restrict the analysis to gross flows.

### 5.3.1 Defining and Constructing the Variables

It was argued in Chapters 2 and 4 that, assuming rational optimizing behaviour of individuals, migration flows among Canadian provinces would be motivated by measures of average earnings levels, employment prospects, government benefits and taxes, distance, differences in living costs and perhaps other more general considerations. Measures representing each of these factors will be developed for inclusion in the migration model.

### 5.3.2 The Income and Employment Variables

As discussed in Chapter 2, a large body of work has confirmed the importance of differences in income opportunities as an inducement to migration. Empirical evidence for unemployment rates is somewhat more ambivalent, but arguments were given in support of including these in the model.

The income measure chosen is personal income per capita adjusted to take account of the various factors outlined below. Consistency and accuracy require that the income variables be defined in such a way that provincial-local taxes are given proper consideration. 'Personal taxes' reduce the nominal received income of individuals and this must be appropriately reflected in the model. Such taxes are deducted from the income variables when the influence of the taxes are not represented in one of the other explanatory variables in the model.

It is important that only income which is likely to affect migration choices be included. As discussed in Chapter 2, government transfers to individuals should be included. The income measure is adjusted to "average out" short-term fluctuations in net income received from farm operations. Income from farm operations is quite volatile for some provinces (particularly Saskatchewan) in some years. The averaging is justifiable because temporary oscillations in income from farm operations are not likely to be of relevance to most migrants. A four-year moving average procedure was used to "smooth out" income from that source.

The income variables are also adjusted to remove that portion which is due to interest, dividend and investment earnings since income from those sources are not conditional upon residing in a province and hence should not affect locational choices of individuals.

Finally, the personal income variables are deflated by provincial consumer price indexes constructed to allow for differences in living costs both over time and among provinces. The methodology employed in constructing the indexes is described later in the chapter.

The resulting per capita income figures measure average real income, including transfers from all levels of government to individuals, and are defined to take account of personal tax differences across provinces.

It is possible for two provinces to have equivalent measures of real per capita income and at the same time for there to be substantial differences in the probability of an individual finding employment in each. As mentioned in Chapter 2, Ontario and British Columbia, for example, have historically had roughly equivalent per capita incomes, but unemployment has usually been much higher in the latter. To account for such differences in labour markets, the provincial unemployment rate (percentage of the labour force unemployed) is included in the representative utility functions for each province. In an attempt to capture some of the dynamic aspects of the labour market, variables for rates of growth of employment are also tested in some models.

### 5.3.3 The Fiscal Variables

The discussion in Chapter 4 indicates that there are a number of plausible ways of modelling subcentral fiscal influences. Fiscal influences are of three types: (1) government expenditure influences, (2) 'commodity tax' influences on provincial costs of living, and (3) 'personal tax' influences on received incomes.

The government expenditure influences are most often represented in the models in this study by expressing selected government expenditures in constant provincial dollars per capita. Occasionally, the expenditures are expressed as a percentage of aggregate personal income to reflect their relative importance in comparison to regional standards of living.

There are three alternative specifications used for the tax influences. The conceptually most appealing measure deducts 'personal taxes' from the income variable and expresses 'commodity taxes' as a percentage of gross provincial expenditures. The alternative specifications express total relevant taxes in constant provincial dollars per capita or as a percentage of aggregate provincial personal income.

Because, as pointed out in Chapter 4, the theoretical fiscal federalism literature almost always characterizes fiscal advantage in terms of the overall tax-expenditure package two combined measures are also tested:

(1) Fiscal surplus — total selected expenditures minus total relevant taxes per capita in constant dollars; and,

(2) Fiscal ratio — total selected expenditures per dollar of total relevant taxes.

5.3.4 Distance

The typical justification for including distance in a migration model is to reflect negative influences on the flow of messages and those costs associated with migration that vary with distance.

Distance between any two provinces in this study is defined as the population weighted average highway distance in miles between the major centres of the provinces. This measure seems a reasonable way to approximate the distance between two large geographical areas in a migration study. The use of this measure can be defended in terms of probability considerations. The population weighted average of distances between regional centers of two provinces provides an intuitively reasonable estimate of the distance which a migrant, selected at random, could expect to travel in going from one province to another. Naturally, if the migrants moving between two provinces are not distributed among centres in proportion to their populations, this measure will either understate or overstate the distance travelled by a 'typical' migrant.

Because of the complex role which is assigned to the distance variable, it is important that adequate flexibility be used in incorporating this variable in the migration model. This is particularly important since distance is unchanging and its influence has been shown by previous research to be such a major impediment to migration adjustment in Canada.

One possible way of permitting some flexibility would be to specify a piece-wise linear form for the distance variable although I am not aware of any previous migration study which has used dummy variables in this way. With this approach, the estimated intercept and/or slope coefficient would be permitted to change as distance surpassed certain specified critical levels or 'knots.' One problem with handling distance in this fashion, however, is that neither the function nor its derivatives are continuous at the interval joints. This makes it difficult to give meaningful interpretation to the distance elasticities at these points. Another problem, of course, is that rigid prespecification of the precise functional form for the piece-wise segments could give an inferior statistical fit in comparison to a less rigid specification. Since there are no obvious critical 'knots' in a multi-province migration study, a linear specification for the individual segments in piece-wise regression is particularly tenuous.

To avoid these problems in this study, a spline function specification is used for the distance variable.[2] To my knowledge, no other study has utilized the spline function in this role. The use of the spline function permits a continuous nonlinear effect of distance on migration flows without the necessity of prespecifying the precise functional form. With the spline function specification, the linear segments of piece-wise linear regression are replaced by piece-wise polynomial approximations. Any degree of polynomial can be used but the cubic is sufficient for present purposes. The function and its first and (if desired) second derivatives can be made continuous at the 'knots' by imposing appropriate restrictions. We follow the procedure developed by Suits, Mason and Chan (1978) in constructing the spline terms.

The migration model of Chapter 4, can be written in general form as

$$(5.1) \quad \ln(p_{ij}/p_{ii}) = \pi(X) + \delta(D) + u_{ij}$$

where D is distance from i to j and X is a vector of the other variables affecting migration. We can derive a spline functional form for the distance variable with 'knots' established at $D_0 = 0$, $D_1 = 1567$ and $D_2 = 3134$ miles by employing appropriate restrictions.[3] A piece-wise cubic specification defined over all three intervals is written

$$\begin{aligned}(5.2) \quad \ln(p_{ij}/p_{ii}) = {} & \pi(X) + [a_1+b_1(D-D_0) + c_1(D-D_0)^2 \\ & + d_1(D-D_0)^3]DUM_1 + [a_2+b_2(D-D_1) + c_2(D-D_1)^2 \\ & + d_2(D-D_1)^3]DUM_2 + [a_3+b_3(D-D_2) + c_3(D-D_2)^2 \\ & + d_3(D-D_2)^3]DUM_3 + u_{ij}\end{aligned}$$

where $DUM_i = 1$ if $D_{i-1} \leq D < D_i$ and 0 otherwise.

The following restrictions impose continuity on (5.2) at the 'knot' points

$$a_2 = a_1+b_1(D_1-D_0) + c_1(D_1-D_0)^2 + d_1(D_1-D_0)^3$$

$$a_3 = a_2+b_2(D_2-D_1) + c_2(D_2-D_1)^2 + d_2(D_2-D_1)^3.$$

To ensure continuity of the first derivatives of the function at the 'knots,' we impose the following constraints

$$b_2 = b_1 + 2c_1(D_1-D_0) + 3d_1(D_1-D_0)^2$$
$$b_3 = b_2 + 2c_2(D_2-D_1) + 3d_2(D_2-D_1)^2.$$

It is possible to impose additional restrictions which can ensure continuity of the second derivatives if desired. Since there is no theoretical reason for restricting the second derivatives in the present context, conventional goodness of fit measures will determine the appropriateness of imposing these additional constraints. The additional restrictions required to ensure continuity of the second derivatives at the 'knots' are

$$c_2 = c_1 + 3d_1(D_1-D_0)$$
$$c_3 = c_2 + 3d_2(D_2-D_1).$$

Since the intervals between the 'knots' are of equal size in the present case, a more convenient form results if we define two new dummy variables $DUM^*_i = 1$ if $D \geq D_i$ and 0 otherwise. In this case, substituting the restrictions into (5.2) and collecting terms with the same coefficients yields the following specification for the distance terms in equation (5.2)[4]

$$(5.3)\quad \ln(p_{ij}/p_{ii}) = \pi(X) + a_1 + b_1(D-D_0) + c_1(D-D_0)^2 + d_1(D-D_0)^3 + (d_2-d_1)(D-D_1)^3 DUM^*_1 + (d_3-d_2)(D-D_2)^3 DUM^*_2 + u_{ij}.$$

Equation (5.3) is an equation in five composite distance variables.

The coefficients for the above model can be estimated by means of standard regression techniques. If continuity of the second derivatives is not imposed then two additional squared terms in $D_1$ and $D_2$ would also appear in (5.3). All of the goodness of fit, significance tests and related statistics are unaffected by using the spline function. If more than three equal-sized intervals are desired, (5.3) can be expanded by adding additional terms

$$\sum_{i=3}^{k} (d_{i+1}-d_i)(D-D_i)^3 DUM_i^*$$

where k + 1 is the desired number of intervals. In the present application, however, three intervals are most likely sufficient although specifications using additional intervals will be tested. After estimating the coefficients of equation (5.3), it is possible to calculate all of the remaining original coefficients of equation (5.2). It is also possible to calculate distance elasticities at all distance levels, including those at which the 'knots' are established.

### 5.3.5 Provincial Cost of Living Differences

Cost of living differences among provinces could potentially alter the attractiveness of locational alternatives to migrants. As mentioned in Chapter 2, there is empirical evidence to suggest that migrants do take relative living costs into account in making migration decisions. It is desirable, then, to have indexes which reflect as accurately as possible the changing patterns of costs among provinces over the estimation period.

Since there are no provincial cost of living indexes available it was necessary to construct them from data available from Statistics Canada for regional centres. Indexes representing 100% of the items contained in the consumer bundle used by Statistics Canada are available for 15 regional cities for the entire 16-year period covered in the estimations.[5] These indexes, however, are not comparable among cities. The indexes were adjusted to permit inter-city comparability by multiplying the original series by adjustment factors derived from Statistics Canada's indexes of inter-city retail price differentials.[6] These latter indexes are comparable among provinces, and the expenditure categories covered in the index include about 78.7% of the total Consumer Price Index basket. The presumption underlying the use of these weighting factors is that cost differentials among regional cities for the omitted items follow roughly the same pattern as those items included in the inter-city indexes.

In cases where there is more than one regional centre in a province, the provincial indexes were constructed from the adjusted regional city indexes by weighting each by a factor representing its share of provincial population.[7] The resulting provincial series were then adjusted so that the 1970 average over all provinces was equal to 100. Table 5.1 shows the provincial price indexes resulting from employing the procedure outlined above.

The price indexes in Table 5.1 reflect the influence of all provincial-local 'commodity taxes' imposed at various stages in the production and sale of goods and services included in the consumer basket.[8] Since measures representing the burden of 'commodity taxes' appear as separate explanatory variables in all of the migration models, use of these

Table 5.1

Provincial Consumer Price Indexes - 1970 Combined Provincial Average = 100

| | Nfld | PEI | NS | NB | Que | Ont | Man | Sask | Alta | BC |
|---|---|---|---|---|---|---|---|---|---|---|
| 1961 | 85.0 | 79.0 | 84.5 | 81.9 | 81.0 | 78.5 | 74.9 | 81.3 | 74.4 | 79.9 |
| 1962 | 85.6 | 80.0 | 85.6 | 82.6 | 81.1 | 79.2 | 75.9 | 82.7 | 75.2 | 80.0 |
| 1963 | 87.3 | 81.9 | 87.6 | 83.9 | 83.2 | 80.5 | 76.6 | 83.3 | 76.1 | 81.4 |
| 1964 | 88.2 | 82.2 | 87.9 | 84.7 | 84.5 | 81.8 | 77.7 | 84.1 | 76.5 | 81.9 |
| 1965 | 89.6 | 83.7 | 89.5 | 86.0 | 86.2 | 83.8 | 79.4 | 85.5 | 77.6 | 83.4 |
| 1966 | 91.7 | 85.7 | 91.6 | 88.3 | 88.8 | 87.4 | 81.8 | 88.0 | 80.2 | 86.4 |
| 1967 | 94.2 | 87.7 | 93.7 | 91.0 | 92.3 | 90.0 | 84.8 | 90.4 | 83.3 | 88.5 |
| 1968 | 98.4 | 91.2 | 97.4 | 94.3 | 95.5 | 93.4 | 88.4 | 94.0 | 86.9 | 91.7 |
| 1969 | 101.3 | 95.4 | 101.9 | 98.2 | 98.5 | 97.1 | 92.1 | 97.2 | 90.5 | 94.8 |
| 1970 | 103.3 | 99.3 | 106.1 | 101.2 | 100.5 | 99.6 | 95.1 | 99.2 | 93.2 | 98.0 |
| 1971 | 104.9 | 100.8 | 107.7 | 102.6 | 102.3 | 101.2 | 96.2 | 100.2 | 95.5 | 101.1 |
| 1972 | 110.1 | 104.5 | 111.7 | 107.2 | 106.2 | 105.3 | 99.8 | 104.2 | 99.2 | 105.2 |
| 1973 | 119.2 | 111.8 | 119.5 | 115.1 | 113.3 | 112.6 | 106.1 | 110.2 | 105.6 | 111.2 |
| 1974 | 134.5 | 122.6 | 131.0 | 126.9 | 125.9 | 124.4 | 117.4 | 120.6 | 117.0 | 125.2 |
| 1975 | 149.9 | 135.0 | 144.3 | 141.7 | 139.6 | 137.6 | 132.0 | 134.1 | 129.7 | 139.1 |
| 1976 | 161.6 | 146.3 | 156.4 | 151.9 | 149.0 | 147.6 | 143.4 | 145.1 | 140.1 | 152.5 |
| 1977 | 173.8 | 158.1 | 163.4 | 163.5 | 161.5 | 159.0 | 154.1 | 157.5 | 152.8 | 163.4 |
| 1978 | 187.8 | 170.8 | 173.7 | 176.6 | 175.0 | 172.5 | 167.2 | 169.9 | 166.5 | 176.0 |

Source: Constructed from regional city data in Consumer Prices and Price Indexes, Statistics Canada, 62-010 indexes would involve double counting of the effects of the taxes. To avoid this double counting, it is necessary to modify the indexes of Table 5.1 to remove the effect of the 'commodity taxes.' In effect, what is desired is a set of indexes which are constructed net of the 'commodity taxes' so that the effects of the taxes can be isolated in the migration models. No previous study, to my knowledge has attempted to do this.

The procedure followed in modifying the provincial price indexes in order to achieve this result is described in detail below. Briefly, the approach is as follows. First, the constructed provincial consumer price indexes of Table 5.1 are specified to be a function of provincial 'commodity taxes' and a number of other variables. Next the coefficients estimates are obtained for the variables in the resulting equation. Finally, the estimated coefficient for the tax variable is used to adjust the indexes of Table 5.1 to generate a set of provincial consumer price indexes which have the effect of the taxes removed.

To begin, we can express the relationship between the provincial consumer price indexes of Table 5.1 for province i in year t ($CPIU_{it}$), as

$$(5.4)\quad CPIU_{it} = CPIA_{it}\ (1 + tax_{it}).$$

In 5.4 $CPIA_{it}$ is the consumer price index after removing the influence of relevant taxes and $tax_{it}$ is the average rate of taxation on items in the consumer basket in province i in year t. $CPIU_{it}$ is observable, $tax_{it}$ can be approximated in some suitable and convenient fashion, but $CPIA_{it}$ cannot be directly observed and must be estimated. We take as a proxy for $tax_{it}$, total provincial-local 'commodity taxes' (TCT) of province i in year t divided by provincial consumer expenditures (CONE) for province i in year t

(5.5) $tax_{it} = (TCT_{it}/CONE_{it})^{\alpha}$

where $\alpha$ is a parameter.[9]

$CPIA_{it}$ reflects the retail prices of all goods and services included in the consumer basket and it would be desirable to express it as a function of a number of variables which reflect its complexity in sufficient detail. As a proxy for all manufactured goods included in the consumer basket we use the national Industry Selling Price Index for Manufacturing (NISPI).[10] NISPI is a base weighted price index designed to measure movement in the prices of products sold by Canadian establishments. Prices used in the index exclude all sales taxes and excise duties on domestically produced tobacco products, liquor (except for industrial use) and beer.

To reflect the influence of imports on the provincial price indexes, we use the Canadian import price deflator[11] (IPD) which reflects changes in the Canadian dollar price of all imports coming into the country.

To represent the influence of agricultural product prices on the provincial price indexes, we use the national Index Numbers of Farm Prices[12] (NASPI) which is based as closely as possible on the prices actually received by Canadian farmers at the farm level.

The postulated general functional form for CPIA, then, can be expressed as

(5.6) $CPIA_{it} = f[NISPI_t, IPD_t, NASPI_t]$.

A few comments about relationship (5.6) are appropriate before proceeding. First, there is potential overlap in the influences reflected in some of the explanatory variables which necessitates caution in interpreting their estimated coefficients. Changes in IPD, for example, will be reflected directly in the consumer price indexes through higher prices of finished goods and services imported into Canada for consumption and also indirectly through higher prices of primary and unfinished products subjected to further processing in Canada. The effect of changes in IPD on the latter will also be reflected in the prices of Canadian manufactured goods as indicated by NISPI.

In a somewhat analogous fashion, changes in Canadian agricultural prices, as reflected by changes in NASPI, also have a dual influence on provincial price indexes. There will be a direct effect by way of changed consumer prices for fresh fruits and vegetables and an indirect effect operating through changed costs in food processing industries. This latter influence will also be reflected in NISPI since food and beverage industries are one major industry group covered by the index.

Because of data limitations, the influence of a number of categories of goods and services included in calculating the provincial consumer price indexes are neglected in the general functional form represented by equation (5.6). To some extent the influence of the omitted factors are accounted for by the least squares dummy variables (LSDV) and generalized least squares (GLS) estimating procedures employed.

Postulating a multiplicative functional form for equation (5.6) and using (5.5), it is possible to rewrite (5.4) as

$$(5.7)\quad CPIU_{it} = \alpha_o NISPI_t^{\alpha 1}.IPD_t^{\alpha 2}.NASPI_t^{\alpha 3}.(1 + tax_{it})^{\alpha 4}.e^{u_{it}}$$

where $u_{it}$ is a stochastic error term. Taking logs of equation (5.7) gives the following equation for estimation

$$(5.8)\quad \ln(CPIU_{it}) = \tilde{\alpha}_0 + \alpha_1 \ln(NISPI_t) + \alpha_2 \ln(IPD_t) + \alpha_3 \ln(NASPI_t) + \alpha_4 \ln(1 + tax_{it}) + u_{it}.$$

Observations on $CPIU_{it}$ and $tax_{it}$ vary by province and year so the data set effectively represents a pooling of cross-section and time-series data. Since, as mentioned, there are likely to be factors affecting CPIU in addition to those formally modelled in equation (5.7), it is desirable to account for this possibility in the estimation approaches. Two different procedures for handling pooled data are used to estimate equation (5.8). First, the equation is estimated with least squares dummy variables (LSDV) in which nonrandom province-specific effects are represented by a set of nine provincial 0,1 dummy variables. In this approach, $D_i$ = 1 for all years if the observation is for province i, and 0 otherwise. The index i = 2,3,...,10 represents sequentially the nine Canadian provinces (P.E.I., N.S., N.B.,...,B.C.) moving from east to west and excluding Newfoundland (the references province). Since there is a constant term in the equation, one dummy variable must be dropped. This is necessary so that the dummy variables will not sum to unity for each observation, making it impossible to invert the moment matrix in the least-squares estimation procedure. The choice of Newfoundland is arbitrary.

The second estimation approach makes use of the error components model in which the error term in (5.8) is postulated to consist of two additive terms, one reflecting random province-specific effects and a second which varies by province and year — $u_{it} = v_i + \varepsilon_{it}$. This specification of the error term, together with the conventional assumptions about the stochastic properties of the individual components, permits the development of a model which can be estimated by generalized least squares methods.[13]

Table 5.2 shows the results obtained from both the LSDV and GLS procedures. OLS estimates obtained without the provincial dummies are also presented for comparative purposes.

The results obtained using LSDV and GLS are very similar. All of the variables are very highly significant with both procedures, including the provincial dummy variables with the LSDV approach. Since all variables are in logs (except the dummies) the estimated coefficients can in effect be interpreted as elasticities. The coefficient for NISPI has the expected positive sign, as does the variable representing the 'commodity' tax burden (1 + tax). The coefficient for the latter implies that a one percent increase in that variable would increase the consumer price index of the province concerned by about 1.4 percent. The magnitude of the coefficient for the fiscal variable suggests that provincial costs of living, as measured by the constructed consumer price indexes, are quite responsive to changes in the 'commodity' tax burden. The greater than unitary elasticity undoubtedly reflects the fact that the most highly taxed items are heavily weighted in the consumer price indexes. The conclusion one can draw is that increasing fiscal disparity among provinces in the future is likely to be a significant cause of interprovincial price differentials.

The estimated coefficients of the other variables require some explanation. IPD, the Canadian dollar price of imports, and NASPI, the

Table 5.2

Equations Estimated by Alternative Methods to Determine the Effect of Selected Taxes and Other Variables on Provincial Consumer Price Indexes - Dependent Variable ln $(CPIU_{it})$.

| | LSDV | GLS | OLS | | LSDV | GLS | OLS |
|---|---|---|---|---|---|---|---|
| NISPI | 1.81 (13.22) | 1.82 (13.28) | 2.12 (6.05) | D5 | -.83 (13.17) | | |
| NASPI | -.19 (9.56) | -.19 (9.60) | -.22 (4.27) | D6 | -.93 (15.42) | | |
| IPD | -.76 (6.18) | -.77 (6.24) | -1.03 (4.27) | D7 | -.14 (23.41) | | |
| $1 + tax_{it}$ | 1.37 (12.21) | 1.36 (12.17) | .74 (4.02) | D8 | -.12 (16.53) | | |
| Constant | .56 (17.86) | .13 (14.04) | .50 (5.97) | D9 | -.11 (19.77) | | |
| D2 | -.84 (14.98) | | | D10 | -.10 (16.08) | | |
| D3 | -.25 (4.38) | | | $\bar{R}^2$ | .9949 | | .9627 |
| D4 | -.61 (10.55) | | | | | | |

* 160 observations: 10 provinces for 16 years (1962-77).

* The Di i = 2,3,...10, are dummy variables for nine provinces from east to west and excluding Newfoundland.

* All variables are in natural logarithms except provincial dummies.

* Numbers in parentheses are absolute values of t statistics.

national agricultural selling price index, have negative signs when it might be expected that increases in them would have a positive influence on provincial consumer price indexes. As mentioned earlier, the effect of an increase in IPD on provincial price indexes can be broken down into two effects — a direct effect and an indirect effect operating through NISPI.

$$\frac{\partial \ln(CPIU_{it})}{\partial \ln(IPD_t)} = \alpha_1 \frac{\partial \ln(NISPI_t)}{\partial \ln(IPD_t)} + \alpha_2 .$$

The total effect will be positive so long as

$$\frac{\partial \ln(NISPI_t)}{\partial \ln(IPD_t)} > -\frac{\alpha_2}{\alpha_1} .$$

Given the GLS estimation results, the overall effect of IPD will be positive, even with a negative coefficient, so long as the elasticity of NISPI with respect to an increase in IPD is greater than $-\frac{.77}{1.82} = .42$.

A similar interpretation can be applied in the case of NASPI. An increase in the price of Canadian agricultural products will have a direct effect on provincial consumer price indexes by raising the prices of fresh fruits and vegetables purchased directly by consumers. It will also be reflected in higher processed food products and hence will increase NISPI. The overall effect will be positive in this case so long as

$$\frac{\partial \ln(NISPI_t)}{\partial \ln(NASPI_t)} > -\frac{3}{1} > \frac{-.19}{1.82} > .10$$

The negative coefficients for IPD and NASPI, then, can be viewed as modifying adjustments reflecting a greater response elasticity of NISPI than of CPIU with respect to changes in either IPD or NASPI, respectively.

Using the GLS estimation results for the coefficient of the fiscal variable, it is possible to adjust the original price indexes of Table 5.1 to generate a set purged of the influence of all provincial-local 'commodity taxes.' The resulting provincial price indexes are shown in Table 5.3. The indexes in Table 5.3 are in effect time-wise and cross-sectionally comparable indexes of what consumer prices would be if provincial and local governments did not impose 'commodity taxes.' It is these indexes which are used as deflators of nominal dollar values in the migration models.[14]

5.3.6 Flows of Messages Among Provinces

It was pointed out in Chapter 2 that perhaps the most plausible justification for the inclusion of receiving-region population variables in migration models is to reflect the intensity of the flow of messages about economic opportunities to residents in other regions. This interpretation of the effect of the population variable is consistent with the traditional gravity model framework. In an attempt to account for information flows, receiving-province population is used as a separate explanatory variable in many of the models. The sending-province population variable is omitted since residents presumably have complete information about prevailing local conditions. In the next chapter, models with population in them are referred to as 'gravity models.'

As described in Chapter 2, use of the population variable is undoubtedly not the most appropriate way of modelling flows of information about economic opportunities, at least from the perspective of the potential migrant. Economic messages may be of a positive or negative

Table 5.3

Provincial Consumer Price Indexes Adjusted To Remove The Effects of Consolidated Provincial-Local 'Commodity Taxes'*

| | Nfld | PEI | NS | NB | Que | Ont | Man | Sask | Alta | BC |
|---|---|---|---|---|---|---|---|---|---|---|
| 1962 | 77.1 | 70.7 | 74.3 | 71.7 | 70.4 | 68.4 | 67.3 | 68.3 | 66.1 | 68.4 |
| 1963 | 78.4 | 71.8 | 76.1 | 72.8 | 72.0 | 69.4 | 67.5 | 68.7 | 67.0 | 69.2 |
| 1964 | 78.4 | 71.9 | 76.4 | 73.4 | 72.4 | 70.4 | 68.4 | 69.8 | 67.9 | 69.7 |
| 1965 | 79.5 | 73.0 | 77.7 | 74.6 | 75.4 | 71.8 | 68.6 | 70.9 | 68.2 | 70.3 |
| 1966 | 80.7 | 75.0 | 80.1 | 75.3 | 74.9 | 74.2 | 71.4 | 73.0 | 71.2 | 73.2 |
| 1967 | 82.6 | 76.7 | 81.3 | 78.2 | 76.8 | 76.1 | 72.7 | 74.7 | 73.8 | 74.9 |
| 1968 | 84.7 | 77.7 | 84.1 | 80.7 | 79.4 | 78.2 | 74.5 | 76.8 | 76.3 | 77.6 |
| 1969 | 87.5 | 80.4 | 85.2 | 82.1 | 81.4 | 80.9 | 77.1 | 78.9 | 79.1 | 79.8 |
| 1970 | 89.7 | 84.2 | 88.4 | 84.5 | 81.5 | 82.6 | 79.4 | 79.1 | 80.8 | 81.7 |
| 1971 | 90.9 | 83.9 | 89.7 | 86.1 | 83.8 | 84.4 | 80.9 | 80.2 | 82.8 | 83.8 |
| 1972 | 94.6 | 87.0 | 92.7 | 89.5 | 86.0 | 87.9 | 83.2 | 84.2 | 86.1 | 87.5 |
| 1973 | 102.2 | 93.0 | 99.9 | 96.2 | 93.7 | 93.7 | 88.7 | 89.7 | 92.3 | 92.7 |
| 1974 | 114.8 | 104.7 | 111.1 | 107.1 | 104.9 | 104.2 | 98.2 | 100.0 | 104.6 | 104.5 |
| 1975 | 127.2 | 115.7 | 123.1 | 120.7 | 116.6 | 117.2 | 109.8 | 111.6 | 116.5 | 113.5 |
| 1976 | 137.1 | 126.0 | 133.1 | 130.3 | 124.4 | 123.9 | 118.6 | 120.7 | 126.4 | 123.6 |
| 1977 | 146.9 | 134.9 | 138.4 | 139.7 | 133.6 | 132.0 | 127.2 | 127.2 | 136.1 | 132.3 |

* Obtained using GLS equation reported in Table 5.2

nature. Population variables, being stocks, reflect the culmination of all past migration flows. As such, they are relatively insensitive to changes in the pattern of messages. What is needed is a measure which reflects the quality, not only the quantity, of message flows. The lagged migration variable is used as an alternative to population to reflect changes in information flows. Various assumptions about expectations formation on anticipated economic conditions will lead to a lagged dependent variable as an explanatory variable[15] so these models will be referred to as 'expectations models.' This could still conceivably leave a role for population as a proxy for omitted economic influences and this possibility will be explored in the econometric work although this argument for including population is not particularly convincing.

## 5.4 Specification of the Complete Model

With all of the variables constructed and defined, it is now possible to specify the alternative model forms tested empirically. To simplify matters, however, we will focus here on only one of the model specifications. The other models differ only with respect to a few of the variables, particularly the fiscal variables, and the relevant changes will be noted in the next chapter. In the specification below, 'personal taxes' appear as a deduction from the income variable while 'commodity taxes' and government expenditures appear as separate explanatory variables. Based on the discussion to this point, we express $V_j$ — the representative utility which a 'typical' individual in province i would expect to derive from migrating to province j — to be a linear-in-logs function of the following form[16]

$$(5.9)\quad V_{j(t)} = a_0 + a_1 Y_{j(t-1)} + a_2 GE_{j(t-1)} + a_3 t^{(1)}_{j(t-1)} + a_4 U_{j(t-1)} + a_5 POP_{j(t-2)} + a_6 DIST_{ij}.$$

The utility function associated with continued residence in i is expressed in a similar fashion except that the distance and population variables are omitted

$$(5.10)\quad V_{i(t)} = b_0 + b_1 Y_{i(t-1)} + b_2 GE_{i(t-1)} + b_3 t^{(1)}_{i(t-1)} + b_4 U_{i(t-1)}.$$

Substituting equations (5.9) and (5.10) into equation (3.17) of Chapter 3 and taking logs of both sides give the following equation for estimation.

$$(5.11)\quad \ln(p_{ij}/p_{ii}) = (a_0-b_0) + a_1 Y_{j(t-1)} + a_2 GE_{j(t-1)} + a_3 t^{(1)}_{j(t-1)} + a_4 U_{j(t-1)} + a_5 POP_{j(t-2)} + a_6 DIST_{ij} - b_1 Y_{i(t-1)} - b_2 GE_{i(t-1)} - b_3 t^{(1)}_{i(t-1)} - b_4 U_{i(t-1)} + u_{ij(t)}.$$

It is convenient here to summarize the coefficient signs for the different variables which economic theory most convincingly suggests should be expected to result from estimating equation (5.11): $Y_j(+)$, $GE_j(+)$, $t_j^{(1)}(-)$, $U_j(-)$, $POP_j(+)$, $DIST_{ij}(-)$, $Y_i(-)$, $GE_i(-)$, $t_i^{(1)}(+)$, $U_i(+)$. These expectations are more or less self-explanatory in light of the discussion to this point and require no further comment.

## 5.5 Summary

This chapter has been concerned with defining and developing the variables which appear in the models estimated in the next two chapters and with specifying one version of the complete model. Particular care was taken in developing the spline function specification for the distance variable and in constructing the provincial consumer price indexes used as deflators in the models.

# FOOTNOTES TO CHAPTER FIVE

1. For a discussion of this point see Greenwood (1975), pp. 108-109.

2. For discussions and applications of spline functions, see, Poirier (1973), Wold (1974), Barth, Kraft and Kraft (1976) and, Suits, Mason and Chan (1978).

3. These 'knots' separate the total distance of 4,700 miles into three equal-sized segments. The sensitivity of the regression results to the selection of alternative 'knots' is also tested in the empirical investigations.

4. See, Suits, Mason and Chan (1978), p. 134.

5. Consumer Prices and Price Indexes, Statistics Canada, catalogue 62-010, quarterly, Table 9.

6. Consumer Prices and Price Indexes, Statistics Canada, catalogue 62-010, quarterly, Table 19.

7. The use of population weighted regional centre price indexes to reflect average provincial costs of living in an aggregate migration study is analogous to using population weighted distances between major centres to represent distances between provinces and can be justified on the same grounds. Migrants moving between provinces will be distributed among centres in the receiving province approximately in proportion to the populations of the centres. As such, the constructed provincial price index will give an intuitively acceptable indication of the average expected cost of living to a 'typical' in-migrant to the province. A similar argument justifies the use of the weighting procedure in constructing price indexes for sending provinces. To the extent that migrants are not distributed among provincial centres in proportion to their populations, the constructed provincial consumer price indexes may be somewhat biased. This is most likely to be a relevant consideration for flows between provinces with major regional centres in close proximity to provincial borders (for example, Ottawa-Hull).

8. These include all sales, excise and other taxes applicable to individual commodities.

9. Gross provincial expenditure was also used as a base for the tax variable in some model versions and performed equally as well as consumer expenditures. The latter being more narrowly defined is conceptually preferable, however, since it gives a closer approximation to the relevant subset of goods which the selected taxes affect. Data for both provincial consumer expenditure and gross provincial expenditure were taken from Provincial Economic Accounts, Statistics Canada, catalogue 13-213, annual.

10. From Industry Selling Price Indexes: Manufacturing, Statistics Canada, catalogue 62-543, occasional, and Industry Price Indexes, Statistics Canada, catalogue 62-011, monthly.

11. From National Income and Expenditure Accounts, Statistics Canada, catalogue 13-001, quarterly, Table 21.

12. From Index Numbers of Farm Prices of Agricultural Products, Statistics Canada, catalogue 62-003, monthly.

13. The error components model and the procedure for estimating it are described in more detail in the next chapter.

14. Other models of provincial consumer price determination were postulated and estimated (for example, using the foreign exchange rate rather than IPD) and the alternative models and estimation results are available upon request. In every case, the coefficient for the tax rate variable was of the expected positive sign and was always highly significant. It is encouraging to note that the magnitude of the estimated coefficients for the tax variable varied within a very narrow band with the alternative specifications. Despite this, some caution is justified, since the indexes in Table 5.3 are used as deflators for all nominal dollar variables in the migration models. Estimation results for the latter would potentially be affected by the values of the constructed price indexes and hence by the magnitude of the effect of the tax influences on the price indexes. To allow for this possibility, price indexes were constructed using the range of values for the estimated tax variable coefficients and were tested in the migration models. The estimation results for the migration model were not affected in any significant way by the use of the alternative price indexes.

15. The Koyck transformation on lagged explanatory variables as well as both the 'adaptive expectations' and 'partial adjustment' models result in a one period lagged dependent variable as a right-hand variable in the model along with current period exogenous variables. (See Johnston (1972), pp. 298-303.)

16. The variables are fully defined in the appendix at the end of Chapter 6. For convenience, the distance spline terms are not written out in equations (5.9) to (5.11). The model presented here is a version of the 'gravity model' since population rather than a lagged dependent variable is used to represent information flows. Models in which the variables are specified in simple linear forms are also estimated. The explanatory variables are lagged to reflect the fact that it would be expected that migrants would react to changes in economic circumstances only after some time delay. Note that the population variables is lagged two time periods. More will be said about the appropriate lags for the explanatory variables in the next chapter.

# CHAPTER SIX

# INTERPROVINCIAL MIGRATION IN CANADA:

# EMPIRICAL RESULTS

## 6.1 Introduction

Alternative versions of the utility model of migrational choice developed in the preceding chapters are tested on Canadian interprovincial migration data in this chapter. The intent is to identify as closely as possible the underlying economic inducements to migration flows among the Canadian Provinces.

Before presenting and analysing the estimation results, however, it is appropriate to give some consideration to the variety of possible approaches afforded by the Statistics Canada migration data set analysed in this study, as well as to complications associated with econometric estimation with such data. These issues are taken up in sections 6.2 and 6.3. The discussion in those sections also provides a brief introduction to some of the issues examined in Chapter 7.

In section 6.4, estimation results obtained using different versions of the model with the entire migration data set are reported. A primary focus of the analysis in section 6.4 is the subcentral government fiscal inducements to Canadian interprovincial migration flows. Because the migration data set is relatively new and unexplored in the available published literature, however, interest in the estimation results extends beyond examination of that single issue.

Section 6.5 presents a brief summary of the findings reported in the chapter and highlights conclusions which seem justified in view of the evidence presented.

## 6.2 Alternative Migration Flows

The migration data set analysed gives annual interprovincial migration flows for children and adults for the eighteen-year period beginning June 1, 1961, and ending May 31, 1979. The estimation period, however, is constrained by the consolidated provincial-local government fiscal data which was available only for the sixteen-year period from January 1, 1962 to December 31, 1977 at the time of the estimation. The estimation was thus limited to the sixteen-year period beginning June 1, 1962 and ending May 31, 1978.

The discrepancy between the migration year and the calendar year on which the explanatory variables are based does not necessitate adjustment of the data. In fact, we would expect migrants to react to changes in regional economic conditions only after some time delay. The difference between the calendar year and the migration year is approximately half a year and provides a convenient time lag during which migrants could reasonably be expected to begin reacting to information available on alternative provincial economic circumstances. The population variable is measured twelve months prior to the end of a given migration year.

Migration observations for each year are represented by a 10 by 10 migration flow matrix and the entire data set analysed in this study consists of sixteen such matrices. Restricting attention to gross flows, it is possible to focus on either in-migration or out-migration. For pooled observations for all provinces, of course, there is no distinction between these since they are simply alternative ways of cataloguing the same event. Using the pooled data set, there are 90 migration flow observations per year for each of sixteen years for a combined total of 1440 observations.

When the focus is on individual provinces, however, the alternative measures highlight different flows, each of which could provide useful information on inducements to migration. When the flow is measured from one particular province to each of the other nine, the estimated coefficients isolate the effect of the explanatory variables on the mobility of the existing population within the sending-province. When the flow is measured to one particular province from each of the other nine, the coefficients emphasize the effect of the explanatory variables on the residents of the other provinces in choosing the isolated province as a locational choice.

There is no general theoretical reason for preferring either in or out flows but there are some policy issues associated with subsets of provinces which are more appropriately analysed in terms of one flow measure than the other — for example, the effects of federal-provincial grants on out-migration from highly grant-dependent provinces. There is justification, therefore, for testing at least some versions of the model on data for at least some subsets of provinces and for preferring one flow measure over the other when addressing particular questions. In any event, there will be 144 flow observations for each separate province — nine in or out flows per year for each of sixteen years.

In addition to focussing on at least some subsets of provinces separately, there is also justification for testing some versions of the model for each year. With information on the temporal pattern of the coefficients, it is possible to evaluate any changes in the efficiency of the migration process over the estimation period. It is also possible to examine any changes in the pattern of individual influences over time. There are 90 interprovincial migration flow observations for each year.

Examination of migration flows for individual years as well as for subsets of provinces is reserved until Chapter 7. That chapter presents a rather detailed analysis of some specific issues associated with these and other topics associated with migration in Canada. The estimation in this chapter is concerned with the entire pooled data set for all 10 provinces and for all 16 years.

## 6.3 Estimation Approaches

The advantage of using the entire data set consisting of migration flows for all 10 provinces and all 16 years is that it enables us to extract information about the overall causes and efficiency of Canadian interprovincial migration. Using interprovincial migration flows for different years, however, complicates the estimation procedure. The migration flows are for different geographical units (provinces) and, when the observations are extended to different years, represent a pooling of cross-section and time-series data. A common suspicion with pooled data is that the intercept terms in the regressions may vary for different cross-sectional units and/or for different years.[1] In the present context, this would translate into distinct migration propensities for residents of all different provinces in a year or for those of the same province over time. In the case of migration, it seems more reasonable to suspect differences among provinces as a result of, for example, different social characteristics of the provincial population. The case of Quebec comes most readily to mind.[2]

There are a number of possible ways of dealing with this problem. One possibility is to use least squares dummy variables (LSDV) in which 0,1 dummies are used to represent nonrandom provincial effects. In the present setting, there would be 9 sending and 9 receiving-province dummy variables One province would be dropped in each case to avoid the dummy variable trap described in Chapter 5.

One problem with using dummy variables in least squares estimation, however, is that the dummies may eliminate a large part of the variation among the dependent and explanatory variables if the between-province variation is large. Effectively they may explain too much in the sense that they may explain systematic differences which are in reality due to the other explanatory variables. It is also difficult to give a meaningful interpretation to the dummy variables and their use results in an unnecessarily large reduction in degrees of freedom.

Another way to deal with the problem, currently popular among proponents of variance components models, is to treat the provincial effects as random instead of nonrandom, as in LSDV.[3] In this approach, the regression disturbance is assumed to consist of two components: $u_{it} = v_i + \varepsilon_{it}$. The first component ($v_i$) is province-specific while the second component ($\varepsilon_{it}$) varies by province and year.[4] The assumption of random province effects can be rationalized by arguing that inability to theoretically explain these effects formally within the model reflects additional ignorance which should be incorporated in the residual.

Variance components models are appealing in the context of pooled migration flow data because, unlike the LSDV procedure, they enable us to extract information about the regression parameters from the between-province variation. Instead of estimating coefficients for n provincial dummies, we estimate only two parameters — the mean and variance of the distribution of the $v_i$'s. The usual assumptions are made about the stochastic properties of each of the two components of the error term.[5] The existence of the $v_i$ term, however, produces a correlation among residuals for a given provincial cross-section unit although the residuals are independent for different provinces.

There are various ways of estimating a variance components model of this sort. The approach followed in the present case is a two-step Generalized Least Squares (GLS) method.[6]

Both the LSDV and GLS estimating procedures described above are used in this chapter. The two alternatives provide a check on the reliability of the estimated coefficients. In the LSDV approach, Newfoundland is arbitrarily selected as the reference province for which the sending and receiving dummy variables are dropped. Unfortunately, because one of the steps in the GLS approach requires calculation of variable deviations from regional means, it is not possible to estimate separate coefficients for the distance terms using that procedure. Since the estimated distance between any two provinces is constant through time, the category mean is always equal to each annual value. Taking deviations from regional means for either simple distance, or any of the constructed distance variables in the spline specification, always results in an entire column of zeros for those variables, making it impossible to invert the product moment matrix.

Because of this problem, the distance variables are excluded in the GLS regressions. The effect of the unchanging distance is lumped in with all other region specific effects in this case. The effect of omitting the distance variables on the coefficient estimates for the other variables is likely to be relatively minor. The primary loss from the omission is that it makes it impossible to isolate the individual effect of distance on migration. For an estimate of this, it is necessary to resort to the LSDV framework.

An additional problem created by the omission of the distance variables in the GLS estimation is that it is not possible to forecast or predict individual province migration flows using the estimated GLS coefficients. Although the effect of distance will be incorporated indirectly in the GLS coefficient estimates, in order to predict flows for specific provinces it is necessary to separately identify all of the relevant characteristics of the sending and-receiving-provinces, including the distance between them. For example, suppose an equation estimated from the pooled migration data by the GLS approach was used to predict outflows from one province to each of two other provinces, one further away than the other. If all nondistance variables were equivalent for the two receiving-provinces in the year considered, the model would predict equal flows to each, although a larger flow should go to the closer province. Despite this practical shortcoming, the GLS estimations are theoretically appealing in the context of pooled data and enhance confidence in the reliability of the coefficient estimates for the economic variables.

Results obtained from estimated alternative versions of the migration model with both procedures are reported and analysed in the next two sections. Generally speaking, the results are highly supportive of the utility model of migration behaviour developed in this study. The appropriateness of both the structural form of the model as well as of the general hypothesized influences to migration flows hold up through a wide array of specific model versions. The similar results from the two alternative estimation procedures add additional support to the models. Of particular interest is the preponderance of evidence confirming the systematic effect of subcentral public sector influences on Canadian interprovincial migration.

### 6.4.1 Estimation Results for the Gravity Model

Tables 6.1 to 6.6 report results obtained with the 'gravity model' version of the basic model in which receiving-province population appears as a separate explanatory variable.[7] It was described earlier how the inclusion of population can be justified within the gravity model framework to reflect information flows about economic opportunities such as employment or other labour market conditions.

Table 6.1 shows the results obtained from estimating the basic model specified in equation (5.11). In that model, sending- and receiving-region consolidated government expenditures and total consolidated 'commodity taxes' appear as separate explanatory variables while all the 'personal taxes' appear as deductions from the income variables. Distance appears in the model in the spline function form with both the first and

Table 6.1*

Determinants of Interprovincial Migration in Canada, 1963-78**

Gravity Model 1*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(1)}$ | -.8557 | -.7707 | $DIST^{(2)}$ | .1925E-05 | | DS8 | -.1711 | | DR9 | -.6638 | |
| | (4.2017) | (4.9647) | | (9.5181) | | | (1.8398) | | | (2.2365) | |
| $Y_j^{(1)}$ | 1.0945 | .9385 | $DIST^{(3)}$ | -.4100E-09 | | DS9 | .6695 | | DR10 | -.0756 | |
| | (5.4039) | (6.6852) | | (7.4809) | | | (5.9180) | | | (.2086) | |
| $U_i$ | .0452 | .0583 | $DIST^{(4)}$ | .4213E-09 | | DS10 | -.8780 | | Constant | -12.3290 | -1.5301 |
| | (.8291) | (1.4572) | | (5.3958) | | | (8.1668) | | | (8.1155) | (4.2960) |
| $U_j$ | -.2499 | -.2476 | $DIST^{(5)}$ | -.1095E-09 | | DR2 | -.5029 | | $\bar{R}^2$ | .9470 | |
| | (4.6341) | (6.2053) | | (1.4115) | | | (1.4669) | | | | |
| $Pop_j$ | 1.2654 | .8377 | DS2 | -.0600 | | DR3 | -.1303 | | SEE | .3357 | 1.3655 |
| | (5.5765) | (8.5563) | | (1.2169) | | | (1.0761) | | | | |
| $t_i^{(1)}$ | .2048 | .1758 | DS3 | .2021 | | DR4 | -.2583 | | F | 804.73 | |
| | (2.3514) | (2.7540) | | (3.5241) | | | (3.3444) | | | | |
| $t_j^{(1)}$ | -.3858 | -.3960 | DS4 | -.0344 | | DR5 | -2.8159 | | DW | .7430 | |
| | (4.4538) | (6.1887) | | (.6633) | | | (4.8616) | | | | |
| $GE_i$ | -.0624 | -.0415 | DS5 | -1.3549 | | DR6 | (-1.7637) | | | | |
| | (.5520) | (.4967) | | (17.5720) | | | (2.7259) | | | | |
| $GE_j$ | -.1019 | .0726 | DS6 | .0352 | | DR7 | -.7663 | | | | |
| | (.8976) | (.8691) | | (.3121) | | | (3.8891) | | | | |
| $DIST^{(1)}$ | -.0367 | | DS7 | .4525 | | DR8 | -1.2902) | | | | |
| | (16.8090) | | | (4.6035) | | | (7.1186) | | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** 'Commodity Taxes' are expressed as a proportion of gross provincial expenditures and 'personal taxes' are deducted from the income variables.

Table 6.2*

Determinants of Interprovincial Migration in Canada, 1963-78**
Gravity Model 2*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(1)}$ | -.8855 | -.6875 | $DIST^{(2)}$ | .1925E-05 | | DS7 | .4965 | | DR7 | -.7287 | |
| | (4.1740) | (4.8955) | | (9.5154) | | | (4.6866) | | | (3.7762) | |
| $Y_j^{(1)}$ | 1.0268 | .8848 | $DIST^{(3)}$ | -.4100E-09 | | DS8 | -.1309 | | DR8 | -1.2547 | |
| | (5.4814) | (6.9809) | | (7.4788) | | | (1.3338) | | | (7.0703) | |
| $U_i$ | .0491 | .0511 | $DIST^{(4)}$ | .4213E-09 | | DS9 | .7232 | | DR9 | .6270 | |
| | (.9218) | (1.3057) | | (5.3943) | | | (6.1110) | | | (2.1174) | |
| $U_j$ | -.2432 | -.2362 | $DIST^{(5)}$ | -.1095 | | DS10 | .9311 | | DR10 | .3947E-02 | |
| | (4.8176) | (6.2645) | | (1.4111) | | | (7.9905) | | | (.0111) | |
| $Pop_j$ | 1.1987 | .8283 | DS2 | -.0598 | | DR2 | .4107 | | Constant | -11.4610 | -3.2072 |
| | (5.3623) | (8.5581) | | (1.2269) | | | (1.2133) | | | (8.1842) | (14.6973) |
| $t_i^{(1)}$ | .2069 | .1815 | DS3 | .2114 | | DR3 | -.0886 | | $\bar{R}^2$ | .9470 | |
| | (2.3828) | (2.8602) | | (3.6104) | | | (.7706) | | | | |
| $t_j^{(1)}$ | -.4223 | -.4157 | DS4 | -.0235 | | DR4 | -.2379 | | SEE | .3369 | 1.3455 |
| | (5.2106) | (6.9429) | | (.4426) | | | (3.2033) | | | | |
| $GE_i$ | -.1137 | -.0923 | DS5 | -1.3078 | | DR5 | -2.6747 | | F | 830.16 | |
| | (1.3044) | (1.5583) | | (15.3080) | | | (4.6916) | | | | |
| $DIST^{(1)}$ | -.3662E-02 | | DS6 | .0967 | | DR6 | -1.6070 | | DW | .7431 | |
| | (16.8040) | | | (.7837) | | | (2.5248) | | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** 'Commodity Taxes' are expressed as a proportion of gross provincial expenditures and 'personal taxes' are deducted from the income variables.

Table 6.3*

Determinants of Interprovincial Migration in Canada, 1963-78**

Gravity Model 3*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(2)}$ | -.9059 | -.6536 | $DIST^{(3)}$ | -.4100E-09 | | DS9 | .5226 | | DR10 | -.0106 | |
| | (3.9233) | (4.1168 | | (7.4237) | | | (4.9908) | | | (.0301) | |
| $Y_j^{(2)}$ | 1.1119 | -.8170 | $DIST^{(4)}$ | .4213E-09 | | DS10 | .7146 | | Constant | -12.7800 | -3.3355 |
| | (5.0122) | (5.4081) | | (5.3546) | | | (5.6732) | | | (9.0339) | (15.6765) |
| $U_i$ | .0688 | .0803 | $DIST^{(5)}$ | -.1095E-05 | | DR2 | .5843 | | $\bar{R}^2$ | .9462 | |
| | (1.3002) | (2.0438) | | (1.4007) | | | (1.6751) | | | | |
| $U_j$ | -.2806 | -.2855 | DS2 | -.0697 | | DR3 | -.1122 | | SEE | .3383 | 1.3595 |
| | (5.5952) | (7.6230) | | (1.4328) | | | (.9877) | | | | |
| $Pop_j$ | 1.3321 | .8819 | DS3 | .1452 | | DR4 | -.2330 | | F | 817.31 | |
| | (5.8409) | (8.8835) | | (2.2136) | | | (3.1728) | | | | |
| $t_i^{(3)}$ | .2810 | .2306 | DS4 | -.0866 | | DR5 | -2.8411 | | DW | .7427 | |
| | (2.2849) | (2.5079) | | (1.4470) | | | (4.9615) | | | | |
| $t_j^{(3)}$ | -.2862 | -.1399 | DS5 | -1.4855 | | DR6 | -1.7428 | | | | |
| | (2.5926) | (1.6835) | | (15.0030) | | | (2.7231) | | | | |
| $GE_i$ | -.1747 | -.1840 | DS6 | -.1293 | | DR7 | -.6624 | | | | |
| | (1.6335) | (2.3091) | | (.9814) | | | (3.4900) | | | | |
| $DIST^{(1)}$ | -.3552E-02 | | DS7 | .3290 | | DR8 | -1.2127 | | | | |
| | (16.6810) | | | (2.9095) | | | (6.4903) | | | | |
| $DIST^{(2)}$ | .1925E-05 | | DS8 | -.2799 | | DR9 | -.4807 | | | | |
| | (9.4453) | | | (2.5529) | | | (1.6238) | | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** Real total relevant taxes are expressed per capita and the income variables include 'personal taxes.'

Table 6.4*

Determinants of Interprovincial Migration in Canada, 1963-78**
Gravity Model 4*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(2)}$ | -.6453 | -.4869 | $DIST^{(3)}$ | -.4100E-09 | | DS9 | .5485 | | DR10 | -.0385 | |
| | (3.0074) | (3.2814) | | (7.4332) | | | (5.2373) | | | (.1088) | |
| $Y_j^{(2)}$ | .8654 | .7452 | $DIST^{(4)}$ | .4213E-09 | | DS10 | .7383 | | Constant | -12.7820 | -3.4333 |
| | (4.8327) | (5.9181) | | (5.3614) | | | (6.1252) | | | (9.3240) | (16.6821) |
| $U_i$ | .0488 | .0681 | $DIST^{(5)}$ | -.1095E-09 | | DR2 | .5831 | | $\bar{R}^2$ | .9463 | |
| | (.9085) | (1.5580) | | (1.4025) | | | (1.6902) | | | | |
| $U_j$ | -.2638 | -.2666 | DS2 | -.0585 | | DR3 | -.1333 | | SEE | .3379 | 1.3797 |
| | (5.2106) | (7.0824) | | (1.2216) | | | (1.1708) | | | | |
| $Pop_j$ | 1.3400 | .9026 | DS3 | .1553 | | DR4 | -.2455 | | F | 819.52 | |
| | (5.9178) | (9.1125) | | (2.5180) | | | (3.3539) | | | | |
| $t_i^{(2)}$ | .3422 | .3143 | DS4 | -.0831 | | DR5 | -2.8808 | | DW | .7439 | |
| | (2.8862) | (3.5698) | | (1.4611) | | | (5.0455) | | | | |
| $t_j^{(2)}$ | -.3175 | -.2849 | DS5 | -1.4790 | | DR6 | -1.7977 | | | | |
| | (2.9477) | (3.5781) | | (15.7760) | | | (2.8164) | | | | |
| $GE_i$ | -.1939 | -.1672 | DS6 | -.1099 | | DR7 | -.6885 | | | | |
| | (1.9135) | (2.2314) | | (.8660) | | | (3.6239) | | | | |
| $DIST^{(1)}$ | -.3662E-02 | | DS7 | .3376 | | DR8 | -1.2229 | | | | |
| | (16.7020) | | | (3.0721) | | | (7.0002) | | | | |
| $DIST^{(2)}$ | .1925E-05 | | DS8 | -.2882 | | DR9 | -.5183 | | | | |
| | (9.4573) | | | (3.6993) | | | (1.7541) | | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** Total relevant taxes are expressed as a proportion of aggregate provincial personal income and the income variables include 'personal taxes.'

Table 6.5*

Determinants of Interprovincial Migration in Canada, 1963-78**
Gravity Model 5*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(2)}$ | -.5943 | -.4660 | $DIST^{(5)}$ | -.1095E-09 | | DR2 | .3501 | | $\bar{R}2$ | .9459 | |
| | (2.8663) | (3.2408) | | (1.3969) | | | (1.0326) | | | | |
| $Y_j^{(2)}$ | .7473 | .6561 | DS2 | -.0485 | | DR3 | -.0914 | | SEE | .3392 | 1.2903 |
| | (4.2261) | (5.2461) | | (1.0123) | | | (.8037) | | | | |
| $U_i$ | .0928 | .0996 | DS3 | .1935 | | DR4 | -.2482 | | F | 868.628 | |
| | (1.7950) | (2.5901) | | (3.3600) | | | (3.3877) | | | | |
| $U_j$ | -.2958 | -.2948 | DS4 | -.0352 | | DR5 | -2.5779 | | DW | .7483 | |
| | (5.9113) | (7.8872) | | (.6708) | | | (4.5486) | | | | |
| $Pop_j$ | 1.1936 | .8323 | DS5 | -1.3977 | | DR6 | -1.4253 | | | | |
| | (5.3492) | (8.8392) | | (16.5030) | | | (2.2555) | | | | |
| $FS_i$ | -.1359 | -.1159 | DS6 | -.0548 | | DR7 | -.6083 | | | | |
| | (1.7480) | (2.0102) | | (.4509) | | | (3.2107) | | | | |
| $DIST^{(1)}$ | -.3662E-02 | | DS7 | .3852 | | DR8 | -1.2018 | | | | |
| | (16.6350) | | | (3.6659) | | | (6.8615) | | | | |
| $DIST^{(2)}$ | .1925E-05 | | DS8 | -.1908 | | DR9 | -.3006 | | | | |
| | (9.4197) | | | (1.9422) | | | (1.0374) | | | | |
| $DIST^{(3)}$ | -.4100E-09 | | DS9 | .5140 | | DR10 | .1428 | | | | |
| | (7.4036) | | | (5.9131) | | | (.4054) | | | | |
| $DIST^{(4)}$ | .4213E-09 | | DS10 | .7929 | | Constant | -11.8130 | -3.2856 | | | |
| | (5.3401) | | | (6.8951) | | | (9.1439) | (17.2455) | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** Fiscal surplus model (total relevant expenditures minus total relevant taxes in real per capita terms). The income variables include 'personal taxes.'

Table 6.6*

Determinants of Interprovincial Migration in Canada, 1963-78**

Gravity Model 6*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(2)}$ | -.7799 | -.6289 | $DIST^{(5)}$ | -.1095E-09 | | DR2 | .3460 | | $\bar{R}2$ | .9460 | |
| | (4.1848) | (5.1311) | | (1.3983) | | | (1.0262) | | | | |
| $Y_j^{(2)}$ | .7456 | .6616 | DS2 | -.0676 | | DR3 | -.0897 | | SEE | .3389 | 1.2903 |
| | (4.3064) | (5.3842) | | (1.4022) | | | (.7825) | | | | |
| $U_i$ | .0746 | .0824 | DS3 | .1392 | | DR4 | -.2459 | | F | 870.369 | |
| | (1.4118) | (2.0974) | | (2.1188) | | | (3.3985) | | | | |
| $U_j$ | -.2890 | -.2889 | DS4 | -.0873 | | DR5 | -2.5705 | | DW | .7478 | |
| | (5.7875) | (7.7409) | | (1.4603) | | | (4.5753) | | | | |
| $Pop_j$ | 1.1918 | .8352 | DS5 | -1.4897 | | DR6 | -1.4138 | | | | |
| | (5.3741) | (8.8784) | | (15.0540) | | | (2.2603) | | | | |
| $FR_i$ | -.2380 | -.2139 | DS6 | -.1407 | | DR7 | -.6005 | | | | |
| | (2.3953) | (2.9037) | | (1.0675) | | | (3.2295) | | | | |
| $DIST^{(1)}$ | -.3662E-01 | | DS7 | .3170 | | DR8 | -1.1919 | | | | |
| | (16.6510) | | | (2.8095) | | | (6.9375) | | | | |
| $DIST^{(2)}$ | .1925E-05 | | DS8 | -.2761 | | DR9 | -.2915 | | | | |
| | (9.4287) | | | (2.5147) | | | (1.0208) | | | | |
| $DIST^{(3)}$ | -.4100E-09 | | DS9 | .5132 | | DR10 | .1490 | | | | |
| | (7.4106) | | | (4.9719) | | | (.4283) | | | | |
| $DIST^{(4)}$ | .4213E-09 | | DS10 | .7035 | | Constant | -11.0280 | -3.1358 | | | |
| | (5.3452) | | | (5.5782) | | | (10.1810) | (21.2349) | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** Fiscal ratio model (total relevant expenditures divided by total relevant taxes). The income variables include 'personal taxes.'

second derivatives of the piece-wise polynomial segments restricted to be equal at the 'knots.'

Among the economic variables (i.e., excluding the distance and dummy variables) eight of the nine coefficients are of the hypothesized sign in the sense that they are consistent with commonly held a priori expectations. Among these eight, the t ratios indicate that six are significantly different from zero at at least the 5% level of significance in a two-tailed test. A majority of the t ratios for the sending- and receiving-province dummy variables are significant at the 10% level, or higher, providing evidence of the existence of structural differences among provinces in migration flow patterns and hence the appropriateness of the LSDV and GLS estimation approaches.[8] Dummy variables for individual years were also tested, in separate regressions not reported, but proved to be statistically insignificant.

Four of the five spline function terms for the distance variable have coefficients which are significant at least at the 10% level. Because of the complexity of the spline function specification, it is difficult to readily ascribe any intuitive meaning to the estimated coefficients for the spline function terms. Examination of this issue is reserved until Chapter 7 when the effect of distance on migration is explored in more detail. All of the subsequent estimation results reported in this chapter, however, employ the cubic spline specification for distance with both the first and second derivatives restricted to be equal at the 'knot' points. This specification consistently performed better, in terms of level of statistical significance of the individual spline terms and overall F than the version in which the second derivatives were not restricted.

We will examine the estimation results for each category of variables for the alternative gravity model specifications of the basic model. All of the results reported in the tables are for the double-log specification of the model. Simple linear versions of the model were also tested and the general results were very similar to those obtained with the log-linear version. The log-linear version, however, consistently performed slightly better in terms of overall explanatory power of the models so attention is limited to those models here.

Some care has to be taken in interpreting the variable coefficients in the logit model and in comparing them with coefficient estimates in previous studies. In a double-log specification, the estimated coefficients are effectively constant partial elasticities between the dependent and each separate explanatory variable. In the present model, however, the dependent variable is the ratio of the probability of migrating from i to j to the probability of staying in i. To get the direct- and cross-elasticities of the original migration probabilities (the $p_{ij}$'s) with respect to each explanatory variable, strictly speaking it is necessary to modify the estimated coefficients by using the elasticity formulae of Chapter 4. The adjustments would be very small in the case of direct elasticities, however,[9] so the estimated coefficients can be compared with previous elasticity estimates with very little loss of accuracy.

## 6.4.2 The Income Coefficients

The estimated coefficients for the income variables in all versions of the 'gravity' model tested were highly significant and of the hypothesized signs. Two different definitions of average income were tested — one including consolidated provincial-local 'personal taxes' and the other excluding the taxes. The different definitions for the income variables were used to accommodate the effects of the 'personal taxes' in alternative ways in the migration models. In Tables 6.1 and 6.2, 'personal taxes' appear in the model as a deduction from the income variables while in Tables 6.3 to 6.6 'personal taxes' appear as explanatory variables in one form or another in the migration models and in these cases the income variables are defined gross of the taxes.

The "correctness" of the signs of the income coefficients and their high levels of statistical significance hold up through both LSDV and GLS estimation. This strongly supports the precise income definitions used in this study and in particular the alternative ways of consistently handling the 'personal taxes.' The income elasticity for the receiving province is generally somewhat larger than that for the sending province.

As discussed in Chapter 2, predominance in the size of the receiving-region coefficient for the income variable is consistent with results obtained in a large number of previous migration studies by other researchers, both for other countries and for Canada. It is worth noting, however, that there is a much smaller absolute difference in size between the sending- and receiving-province coefficients reported here than has often been found to be the case in previous studies mentioned in Chapter 2. In fact, in some versions of the model, the estimated income coefficients were almost identical in absolute size (see for example, Table 6.6).[10] The receiving-province elasticities are generally fairly close to 1 with most versions of the gravity model and this is substantially lower than those typically found by Courchene (1974) and Grant and Vanderkamp (1976). The sending-province elasticities also appear to be generally somewhat lower than these researchers found.

With the model specifications used in this study, there appears to be much closer symmetry in the 'push-pull' effects of sending and receiving province income variables respectively. Consistent accommodation of the subcentral fiscal variables in the models seems to reveal a much higher degree of efficiency, at least in this respect, than was indicated in previous research.

### 6.4.3 The Unemployment Variables

The high degree of symmetry between sending-and receiving-provinces does not appear to hold for the unemployment rate variables. The estimation results reveal that receiving- province unemployment rates consistently exert a much larger absolute influence on gross flows between two provinces than do sending-province unemployment rates. In addition, the level of statistical significance of the coefficients was consistently higher for the receiving-province variable than for that of the sending-province. In fact, the coefficients for the sending-province unemployment rates are not statistically different from zero in many specifications although the level of statistical significance was generally higher in the GLS estimations. In light of the discussion in Chapter 2, model versions were also tested which included the national rate of unemployment in addition to the provincial rates. The coefficient for the national variable was statistically insignificant, however, and its inclusion did not improve either the performance of the provincial variables or the overall explanatory power of the models. For all model versions tested, however, including those reported in the tables, the estimated coefficients for sending-and-receiving province unemployment rates always had the expected positive and negative signs respectively. In all cases, the receiving-province unemployment rate coefficient was significant at least at the 1% level of significance. These consistent results contradict the highly ambiguous results often reported for unemployment rate variables in the migration literature.

It seems safe to conclude on the basis of these consistent findings that labour market conditions, as measured by average unemployment rates, do have a directional impact on aggregate interprovincial migration flows which is consistent with the most generally accepted economic theory.[11] Further, the evidence strongly supports the contention that unemployment conditions in receiving-provinces exert a substantially greater influence than do those in the sending-province.

The results for the income and unemployment variables when considered jointly suggest that personal transfer payments to individuals may hinder the migration adjustment process. The relatively high sensitivity of out-migration to average sending-province income levels together with the relatively low sensitivity to sending- province unemployment rates lends credence to arguments that unemployment insurance, social welfare payments and other transfers to individuals have retarded migration flows. By increasing the incomes of the unemployed, such transfers appear to reduce the response of migration to employment conditions in the host province.

### 6.4.4 The Fiscal Variables

The results reported in the tables confirm the systematic influence of subcentral fiscal activity on Canadian interprovincial migration flows. We will consider first the results for models in which taxes and expenditures appear as separate explanatory variables and then those obtained using combined expenditure, tax measures.

#### The Tax Variables

As mentioned previously, in the specifications reported in Tables 6.1 and 6.2, 'personal taxes' are deducted from the income variables. 'Commodity taxes' in those specifications are expressed per dollar of gross provincial expenditures and appear as separate explanatory variables. The very highly significant coefficients on the income variables, as discussed earlier,strongly support the treatment of 'personal taxes' as a deduction from income. Higher rates of 'personal' taxation in a province reduce received earnings and have a very marked effect on the attractiveness of the province to both existing and potential residents.

The 'commodity tax' rate variables in the gravity model versions estimated were always of the hypothesized signs with out- (in-) migration always responding positively (negatively) to the intensity of 'commodity' taxation. In addition, the estimated coefficients were virtually always highly significant statistically. As postulated, the burden of 'commodity taxes' imposed by a province, and/or its municipalities, appears to have a marked effect on the attractiveness of the province. As was the case for the unemployment rate variables, and to a lesser extent for the income variables, the 'commodity tax' burden seems to have a stronger deterrent effect on potential in-migration than on inducing existing residents to move. The intensity of 'commodity taxation' in a province would affect its attractiveneses by affecting the cost of living in the province.

Models with several other specifications for the tax variables were also estimated. Table 6.3, for example, shows the estimation results obtained using total taxes ('personal' plus 'commodity') per capita. One possible shortcoming of the per capita variable, mentioned in Chapter 4, is that this measure does not distinguish between high taxes resulting from high tax capacity in wealthy provinces and high taxes resulting from high intensity of taxation. Despite this potential shortcoming, however, the measure performs very well. The estimated coefficients are of the hypothesized signs and are highly significant in all cases with the exception of the GLS estimate for the receiving-province tax variable. Even that coefficient is significant at the 10% level, however. In this model version, the income variables are defined net of consolidated provincial-local 'personal taxes' to avoid double counting of the effects of these taxes. The income variables have coefficients with absolute values quite close to 1, continue to have the hypothesized signs, and are both highly significant.

Table 6.4 shows the estimation results obtained using another specification for the tax variables. In this model version, total taxes are expressed per dollar of aggregate provincial personal income -- giving a rough measure of the intensity of overall taxation. This model specification also performs very well with all of the tax coefficients of the hypothesized signs and highly significant for both estimation approaches. The sending-and-receiving province coefficient estimates for the tax variables are very close in absolute size for both approaches. The income variables in this model version continue to have the hypothesized signs and are highly significant for both the LSDV and GLS estimation.

The estimation results reported in Tables 6.1 to 6.4 indicate that there are a number of possible ways in which the influence of taxes can be incorporated in the migration model as long as the income variables are consistently defined.[12] There is really very little basis on which to choose among the alternative ways of handling taxes in terms of the estimation results since the $R^2$'s adjusted for degrees of freedom are almost identical in each of the three cases. The version reported in Table 6.2 has a conceptual advantage, however, as discussed earlier in the study.

<u>The Expenditure Variables</u>

While the results provide compelling evidence that taxes have a direct impact on the pattern of migration flows, the evidence for any effect of government expenditures is less clear cut. In Table 6.1, neither of the government expenditure variables has a coefficient significantly different from 0 at the 10% level for either the LSDV or GLS equations. In addition, the receiving-province variable has a counter-intuitive negative sign. A version of the model in which government expenditures were expressed per dollar of aggregate provincial personal income was also estimated in an attempt to make some allowance for the relative sizes of government expenditures in terms of average incomes in the province. This did not lead to any improvement in the estimation results for the expenditure coefficients, however.[13]

The poor performance of the expenditure variables in Table 6.1 is not necessarily conclusive evidence that provincial-local government expenditures do not affect migration flows among provinces. The simple correlation coefficient between government expenditures in the sending-and receiving-provinces for the entire sixteen-year period is .88. This high degree of correlation suggests that provinces have attempted to keep their essential expenditures within reach of those in the leading expenditure provinces, at least until recent years. The revenue deficient provinces have more readily opted for increased taxation than reduced expenditures as the fiscal gap between them and the revenue affluent provinces has widened, both absolutely and relatively, over the years. In addition, it might be expected that government expenditures per capita would likely have relatively less influence on potential in-migrants to a province and that their primary influence would be on potential out-migrants. It seems reasonable to postulate that potential migrants would have relatively little knowledge about levels of government expenditures in different provinces although knowledge about intensity of taxation (both 'personal' and 'commodity') would be more widely known. On the other hand, existing residents would have more direct knowledge about levels of government expenditures in their own province and their migration decisions might be affected by these, at least at the margin. In support of this, in all of the estimations conducted, the sending-province government expenditure variable had the expected negative sign, while the sign of the receiving-province variable tended to change quite frequently in alternative model specifications.

With these considerations in mind, all of the equations reported subsequent to Table 6.1 were estimated excluding the receiving-province government expenditure variable. In most cases, the sending-province government expenditure variable becomes significant at least at the 10% level when the receiving province variable is omitted. In addition, the overall fit of the equations as measured by $R^2$ adjusted for degrees of freedom was never affected by the omission. All of this evidence suggests that government expenditures per capita in the sending-province have a negative influence on the outward mobility of resident populations and so do affect the flow of migrants between provinces in the manner suggested by economic theory. On the other hand, expenditures in the receiving provinces appear to have exerted no discernible influence on flows between provinces, at least for the expenditure variations which have been experienced among provinces over the estimation period. It seems quite possible, or even likely, that increasing dispersion among provinces in government expenditure levels, as a result of growing fiscal disparity, could serve to deter in-migration to revenue poor provinces in the future.

Fiscal Surplus and Fiscal Ratio Models

Table 4.3 of Chapter 4 revealed that specific patterns of potential public sector influences on interprovincial migration in Canada emerge if we compare fiscal surpluses (expenditures per capita minus taxes per capita) or fiscal ratios (expenditures divided by taxes) among provinces. These measures suggest possible ways of expressing the influence of expenditures and taxes jointly in migration models. It was also pointed out that much of the theoretical literature in the area of fiscal federalism typically expresses potential subcentral public sector biases to resource allocation in these terms.

With these considerations in mind, models were tested which incorporated fiscal surplus or fiscal ratio variables in the models. In the initial versions both sending-and receiving-province fiscal surplus or fiscal ratio variables were included, but the coefficients for the receiving province variables were always statistically insignificant and typically of the 'wrong' sign. Further tests were conducted omitting the receiving-province variables and tables 6.5 and 6.6 report results obtained with, respectively, the fiscal surplus and fiscal ratio models.

Both measures appear to perform very well. The other economic variables in the models retain their 'correct' signs, and their level of statistical significance is very high. The level of statistical significance for the unemployment rate variable in the sending province is generally higher in these specifications and in fact fails to be significant at least at the 10% or higher level only for the LSDV estimate in the fiscal ratio model.

The fiscal surplus and fiscal ratio terms are always significant at the 10% level or higher and in the case of the fiscal ratio variable, the level of significance is at least the 2% level for both the LSDV and the GLS estimates. The LSDV and GLS coefficient estimates are very similar for both variables. There is little basis on which to choose between the two specifications on the basis of the estimation results; however for the reasons given in Chapter 4, both are conceptually inferior ways of expressing fiscal influences on migration.

## 6.5 The Impact of Cost of Living Differences on Migration

Chapter 5 described the methodology employed in modifying the provincial consumer price indexes so that they would be net of the effect of provincial-local 'commodity taxes.' A number of alternative models were specified and estimated to capture the effects of 'commodity taxes' on the constructed provincial consumer price indexes. Estimation results obtained with these alternative model specifications, under the two different estimation approaches, yielded tax burden coefficients ranging from 1.36 to 1.7. The equation finally selected for removing the 'commodity taxes' from the provincial price indexes was chosen on the basis of general theoretical considerations and overall performance of the equations.

Despite the relatively reassuring consistency in the estimated coefficients for the tax burden variable under the alternative model specifications, some caution is due. As mentioned in Chapter 5, the constructed provincial price indexes are used as deflators for all nominal dollar variables appearing in the migration model. The final indexes used, however, are obviously sensitive to the magnitude of the tax burden coefficient used to adjust the original provincial price series of Table 5.1. The provincial price indexes affect the values of all of the variables which they deflate in the migration models and hence could potentially affect the entire set of estimation results.

To ensure against the possibility of purely chance results from the choice of one particular tax burden coefficient, a number of net-of-tax price indexes were constructed using a range of different coefficients for the tax burden variable. Each of these resulting index series was then used as a deflator for the nominal dollar variables in several of the migration models. Although not reported here, the general results reported earlier held up and on no occasion were any of the previous findings affected in any significant way.

## 6.6 The Population Variable, Information Flows and Autocorrelation

In all of the models estimated in the gravity model framework, the coefficient for the receiving-province population variable was highly significant and of the hypothesized positive sign. The coefficient for the population variable is generally slightly larger than unity in the LSDV estimations and generally slightly smaller than unity in the GLS results. A coefficient of approximately unit value is somewhat interesting because it suggests that there are no agglomeration effects of population on migration. In fact, the GLS coefficient estimates suggest an even more modest effect of receiving-province population growth.

The gravity model justification for the inclusion of the receiving-provinces population variable is that it serves as a proxy for flows of messages from regions about economic conditions. Using population in this role, however, does not permit differentiation in the types of messages being sent nor does it provide much flexibility in a dynamic world in which the nature of the messages is changing constantly.

A more flexible approach to modelling information flows between provinces is provided by the 'expectations' model described earlier which results in a one period lagged dependent variable as an explanatory variable. Migration flows are slow to change in the 'expectations' framework simply because perceptions of altered economic circumstances are slow to change. The 'expectations' model provides a more sensitive approach to incorporating the learning process within migration models. The model is additionally useful because, with an estimate of the coefficient for the lagged dependent variable, it becomes possible to calculate both short- and long-run elasticities of migration response to changes in explanatory variables when examining, for example, the effects of alternative government policies.

It should also be pointed out that the Durbin-Watson statistics reported for the gravity models in Tables 6.1 to 6.6 are well below the critical lower bound at the 1% level and strongly suggest the presence of serial correlation in the residuals. Strictly speaking, in the context of pooled cross-sections and time-series data, none of the tests for autocorrelation based on theoretical distributions such as the von Neumann or Durbin-Watson statistics are applicable. In the present case, however, the suspicion arises that the low value for the Durbin-Watson statistic is not irrelevant.[14] As supporting evidence a simple $\chi^2$ test and a Wald-Wolfowitz runs test (a powerful test for autocorrelation) both led to the rejection of the null hypothesis of the absence of first order autocorrelation in the disturbance terms.[15]

The existence of positive serial correlation in the residuals in the present context seems quite plausible. It is reasonable to expect that if there are extended lags in the formation of migrants' perceptions about economic realities, a temporary high level of income in one period, for example, would lead to high levels of in-migration to the province for a number of subsequent periods. The use of receiving-province population would only very inadequately reflect this dynamic aspect of the migration process particularly when the regional pattern of economic conditions is experiencing significant change. The population variable has been most typically used in migration studies, however.

## 6.7 Estimation Results for the Expectations Model

Tables 6.7 to 6.11 show the LSDV and GLS estimation results obtained with various versions of the 'expectations' model in which the one-period lagged dependent variable appears as one of the explanatory variables. Various versions of the model were also estimated with both the lagged dependent variable and the receiving-province population variable appearing together as explanatory variables. In every case, the population variable became statistically insignificant while the sign and high level of significance of the lagged dependent variable were not affected. The overall fit of the equation as measured by $\overline{R}^2$ was also not improved by the inclusion of the receiving-province population variable in the 'expectations' models.

From the estimation results, it can also be seen that the 'expectations' models give consistently superior estimation results to the gravity models. The $\overline{R}^2$ is always higher with the latter. Furthermore, the general nature of the influence of the economic variables, as indicated by the signs of the estimated coefficients and their level of statistical significance, is not upset by the substitution.

It is also of interest that indication of the presence of autocorrelation as measured by the Durbin-Watson statistic disappears in all of the 'expectations' versions estimated. This evidence is supported by a repeat of the $\chi^2$ and the Wald-Wolfowitz runs tests, neither of which lead to rejection of the null hypothesis of the absence of first order autocorrelation in the residuals.

All of these results strongly indicate that the population variable

Table 6.7*

Determinants of Interprovincial Migration in Canada, 1963-78**
Expectations Model 1*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(1)}$ | -.2011 | -.3061 | $DIST^{(2)}$ | .5231E-06 | | DS7 | .1576 | | DR7 | -.1525 | |
| | (1.4804) | (2.5082) | | (3.5156) | | | (2.3528) | | | (2.3441) | |
| $Y_j^{(1)}$ | .4656 | .5959 | $DIST^{(3)}$ | -.1065E-06 | | DS8 | -.3637E-02 | | DR8 | -.3230 | |
| | (3.7611) | (5.3973) | | (2.6720) | | | (.0561) | | | (5.1567) | |
| $U_i$ | .0619 | .0569 | $DIST^{(4)}$ | -.9932E-10 | | DS9 | .2709 | | DR9 | .0149 | |
| | (1.6502) | (1.6361) | | (1.7651) | | | (3.6389) | | | (.1889) | |
| $U_j$ | -.1518 | -.1713 | $DIST^{(5)}$ | -.5634E-11 | | DS10 | .2517 | | DR10 | .3708 | |
| | (4.1803) | (5.0667) | | (.1018) | | | (3.4914) | | | (4.5834) | |
| $\frac{P_{ij}}{P_{ii}}t-1$ | .7044 | .5452 | DS2 | -.0332 | | DR2 | -.4094 | | Constant | -2.0591 | -1.0495 |
| | (37.7570) | (25.0672) | | (.9582) | | | (9.4218) | | | (3.5973) | (6.9140) |
| $t_i^{(1)}$ | .0779 | .0991 | DS3 | .0487 | | DR3 | .0579 | | $\bar{R}^2$ | .9731 | |
| | (1.2760) | (1.7490) | | (1.2154) | | | (1.5073) | | | | |
| $t_j^{(1)}$ | -.2474 | -.3029 | DS4 | -.0152 | | DR4 | -.0316 | | SEE | .2392 | .7182 |
| | (4.2870) | (5.6274) | | (.4160) | | | (.8999) | | | | |
| $GE_i$ | -.1039 | -.0960 | DS5 | -.4124 | | DR5 | -.0496 | | F | 1680.75 | |
| | (1.8378) | (1.8244) | | (6.9317) | | | (.9462) | | | | |
| $DIST^{(1)}$ | -.1038E-02 | | DS6 | .0366 | | DR6 | .2984 | | DW | 2.3106 | |
| | (6.1011) | | | (.4838) | | | (3.5445) | | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** 'Commodity Taxes' are expressed as a proportion of gross provincial expenditures and 'personal taxes' are deducted from the income variables.

Table 6.8*

Determinants of Interprovincial Migration in Canada, 1963-78**
Expectations Model 2*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(2)}$ | -.1515 | -.2850 | $DIST^{(2)}$ | 5.1149E-07 | | DS7 | -.2061 | | DR7 | -6.5663 | |
| | (.9990) | (2.0548) | | (3.4229) | | | (2.6573) | | | (.9640) | |
| $Y_j^{(2)}$ | .4092 | .6118 | $DIST^{(3)}$ | -1.0398E-10 | | DS8 | -.3298 | | DR8 | -.2604 | |
| | (2.7574) | (4.4967) | | (2.5976) | | | (4.3379) | | | (3.8335) | |
| $U_i$ | -.0818 | .0695 | $DIST^{(4)}$ | 9.6649E-11 | | DS9 | -.2391 | | DR9 | .1919 | |
| | (2.1901) | (2.0033) | | (2.9245) | | | (3.3644) | | | (2.6297) | |
| $U_j$ | .1879 | -.2039 | $DIST^{(5)}$ | -4.7775E-12 | | DS10 | -.3663 | | DR10 | .4757 | |
| | (5.2667) | (6.1028) | | (.0860) | | | (4.1890) | | | (5.5595) | |
| $\frac{P_{ij}}{P_{ii}}$ t-1 | .7103 | .5614 | DS2 | .8127 | | DR2 | -.4120 | | Constant | -6.1091 | -1.1265 |
| | (38.0550) | (25.7537) | | (19.3824) | | | (.4571) | | | (6.3215) | (7.9157) |
| $t_i^{(3)}$ | .1505 | .1741 | DS3 | -.1785 | | DR3 | 7.0449E-02 | | $\bar{R}^2$ | .9729 | |
| | (1.7274) | (2.1470) | | (3.8306) | | | (1.7498) | | | | |
| $t_j^{(3)}$ | .1260 | .1741 | DS4 | -.1514 | | DR4 | -1.7179 | | SEE | .2403 | .7266 |
| | (1.6460) | (2.1470) | | 3.5968) | | | (.4552) | | | | |
| $GE_i$ | -.1790 | -.1852 | DS5 | -1.1599 | | DR5 | 3.0016 | | F | 1665.10 | |
| | (2.3596) | (2.6400) | | (16.7925) | | | (.4999) | | | | |
| $DIST^{(1)}$ | -1.0156E-03 | | DS6 | -.7634 | | DR6 | .4138 | | DW | 2.3120 | |
| | (5.9509) | | | (8.5166) | | | (4.6763) | | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** Real total relevant taxes are expressed per capita and the income variables include 'personal taxes.'

Table 6.9*

Determinants of Interprovincial Migration in Canada, 1963-78**

Expectations Model 3*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(2)}$ | -.0015 | -.1168 | $DIST^{(2)}$ | 5.1212E-07 | | DS7 | -.2122 | | DR7 | -.0746 | |
| | (.0100) | (.9200) | | (3.4325) | | | (2.8195) | | | (1.1076) | |
| $Y_j^{(2)}$ | .3111 | .5150 | $DIST^{(3)}$ | -1.0412E-10 | | DS8 | .3489 | | DR8 | -.2591 | |
| | (2.5512) | (4.7160) | | (2.6051) | | | (4.7153) | | | (3.8647) | |
| $U_i$ | .0670 | .0548 | $DIST^{(4)}$ | 9.6794 | | DS9 | -.2259 | | DR9 | .1759 | |
| | (1.7729) | (1.5628) | | (2.6051) | | | (3.1873) | | | (2.4041) | |
| $U_j$ | -.1775 | -.1928 | $DIST^{(5)}$ | -4.8242 | | DS10 | -.3663 | | DR10 | .4594 | |
| | (4.9368) | (5.7288) | | (.8660) | | | (4.3863) | | | (5.4848) | |
| $\frac{P_{ij}}{P_{ii}}t-1$ | .7100 | .5661 | DS2 | .8162 | | DR2 | .4182 | | Constant | -6.0721 | 1.1318 |
| | (38.1403) | (25.7943) | | (19.7454) | | | (9.7099) | | | (5.0641) | (8.2319) |
| $t_i^{(2)}$ | .2212 | .2429 | DS3 | -.1798 | | DR3 | .0638 | | $\bar{R}^2$ | .9730 | |
| | (2.6401) | (3.1022) | | (4.1009) | | | (1.6300) | | | | |
| $t_j^{(2)}$ | -.1582 | -.1714 | DS4 | .1568 | | DR4 | -.0201 | | SEE | .2399 | .7247 |
| | (2.1056) | (2.4248) | | (3.9227) | | | (.5495) | | | | |
| $GE_i$ | -.2018 | -.2004 | DS5 | -1.1705 | | DR5 | .0235 | | F | 1670.46 | |
| | (2.8167) | (3.0170) | | (17.9555) | | | (.4046) | | | | |
| $DIST^{(1)}$ | -1.0168E-03 | | DS6 | -7.658 | | DR6 | .3996 | | DW | 2.3139 | |
| | (5.9672) | | | (8.9015) | | | (4.5884) | | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** Total relevant taxes are expressed as a proportion of aggregate provincial personal income and the income variables include 'personal taxes.'

Table 6.10*

Determinants of Interprovincial Migration in Canada, 1963-78**
Expectations Model 4*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(2)}$ | -.8498E-02 | | $DIST^{(4)}$ | .9596E-10 | | DS9 | .1725 | | DR9 | .1756 | |
| | (.0617) | | | (1.6948) | | | (2.4751) | | | (2.3963) | |
| $Y_j^{(2)}$ | .3115 | | $DIST^{(5)}$ | -.4548E-11 | | DS10 | .1667 | | DR10 | .4129 | |
| | (2.5735) | | | (.0817) | | | (2.1780) | | | (4.9728) | |
| $U_i$ | .0832 | | DS2 | -.0343 | | DR2 | -.4269 | | Constant | -2.3699 | 1.1216 |
| | (2.2812) | | | (1.0239) | | | (9.9460) | | | (5.0662) | (8.7689) |
| $U_j$ | -.1865 | | DS3 | .0292 | | DR3 | .0451 | | $\bar{R}^2$ | .9728 | |
| | (5.2368) | | | (.7260) | | | (1.1660) | | | | |
| $\frac{P_{ij}}{P_{ii}}t-1$ | .7118 | | DS4 | -.0274 | | DR4 | -.0443 | | SEE | .2401 | .7174 |
| | (38.0490) | | | (.7459) | | | (1.2503) | | | | |
| $FS_i$ | -.1484 | | DS5 | (.4519) | | DR5 | -.0251 | | F | 1773.450 | |
| | (2.7163) | | | (7.0972) | | | (.4533) | | | | |
| $DIST^{(1)}$ | -.1010E-02 | | DS6 | -.0445 | | DR6 | .3566 | | DW | 2.3012 | |
| | (5.9061) | | | (.5487) | | | (4.1125) | | | | |
| $DIST^{(2)}$ | .5085E-06 | | DS7 | .0913 | | DR7 | -.1058 | | | | |
| | (3.3965) | | | (1.2873) | | | (1.5807) | | | | |
| $DIST^{(3)}$ | -.1033E-09 | | DS8 | -.0379 | | DR8 | -.3084 | | | | |
| | (2.5765) | | | (.5612) | | | (4.7912) | | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** Fiscal surplus model (total relevant expenditures minus total relevant taxes in real per capita terms). The income variables include 'personal taxes.'

Table 6.11*

Determinants of Interprovincial Migration in Canada, 1963-78**
Expectations Model 5*** - Dependent Variable ln $(P_{ij}/P_{ii})$

| | LSDV | GLS | | LSDV | GLS | | LSDV | GLS | | LSDV | GLS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_i^{(2)}$ | -.2110 | -.3306 | $DIST^{(4)}$ | .9652E-10 | | DS9 | .1836 | | DR9 | .1927 | |
| | (1.8061) | (3.1920) | | (1.7056) | | | (2.6951) | | | (2.6875) | |
| $Y_j^{(2)}$ | .2942 | .4427 | $DIST^{(5)}$ | -.4729E-11 | | DS10 | .1042 | | DR10 | .4285 | |
| | (2.4707) | (4.1533) | | (.0849) | | | (1.2237) | | | (2.2518) | |
| $U_i$ | .0718 | .0725 | DS2 | -.0516 | | DR2 | -.4289 | | Constant | -1.4769 | -.9015 |
| | (1.9253) | (2.0906) | | (1.5207) | | | (9.9937) | | | (6.1018) | (11.8771) |
| $U_j$ | -.1796 | -.2046 | DS3 | -.9617E-02 | | DR3 | .0515 | | $\bar{R}^2$ | .9728 | |
| | (5.0522) | (6.1487) | | (.2082) | | | (1.3438) | | | | |
| $\frac{P_{ij}}{P_{ii}}t-1$ | .7105 | .5606 | DS4 | -.6743E-01 | | DR4 | .0398 | | SEE | .2406 | .7256 |
| | (38.0250) | (25.7115) | | (1.6035) | | | (1.1323) | | | | |
| $FR_i$ | -.2093 | -.2003 | DS5 | -.5229 | | DR5 | -.0150 | | F | 1775.400 | |
| | (2.9825) | (3.0919) | | (7.0857) | | | (.2758) | | | | |
| $DIST^{(1)}$ | -.1015E-02 | | DS6 | -.1027 | | DR6 | .3756 | | DW | 2.3028 | |
| | (5.9366) | | | (1.1520) | | | (4.4207) | | | | |
| $DIST^{(2)}$ | .5109E-06 | | DS7 | .0479 | | DR7 | -.0905 | | | | |
| | (3.4147) | | | (.6241) | | | (1.3817) | | | | |
| $DIST^{(3)}$ | -.1039E-09 | | DS8 | -.1002 | | DR8 | -.2928 | | | | |
| | (2.9512) | | | (1.3132) | | | (4.6403) | | | | |

* All variables in natural logs except composite distance variables and provincial dummies for the LSDV procedure. Numbers in brackets below coefficients are absolute values of t statistics.

** 1440 observations.

*** Fiscal surplus model (total relevant expenditures divided by total relevant taxes). The income variables include 'personal taxes.'

does in fact serve largely as an inferior way of modelling information flows and that it contributes no additional useful information in the 'expectations' framework.

There are a number of interesting points to notice about the estimation results for the 'expectations' versions of the model. One thing to note is that the absolute magnitudes of the estimated coefficients drop substantially in comparison to those for the 'gravity model' versions reported previously. Since migrants' decisions in any year, in the 'expectations' versions of the model, are affected by economic opportunities in all previous years, the response to economic conditions in the immediately preceding period is naturally lessened. Long-run elasticities, which can be calculated with these models,are of course much larger than the short-run elasticities given by the coefficient estimates.

All of the economic variables maintain their 'correct' signs in the 'expectations' models. The level of statistical significance of the coefficient for the sending province income variable is in some cases lower in the 'expectations' versions and in fact in a number of instances is statistically insignificant. The other variables in the models generally fare very well. Of particular interest are the fiscal variables which are always of the expected signs and generally highly significant.

In the model versions reported in Tables 6.7, 6.8 and 6.9 the sending-province government expenditure variable is always significant at the 10% level or higher and in Tables 6.8 and 6.9, the variable is significant at the 1% level in both the LSDV and GLS estimates. The tax variables in Tables 6.7, 6.8 and 6.9 also perform very well. In Table 6.7, consolidated 'personal taxes' appear as a deduction from the income variables while 'commodity taxes' are expressed as a percentage of gross provincial expenditures. In Tables 6.8 and 6.9 total taxes ('personal' plus 'commodity') are expressed per capita and per dollar of provincial personal income, respectively. In both cases and with both estimating approaches, the sending-and receiving-province variables are highly significant.

Tables 6.10 and 6.11 report results obtained from estimating, respectively, the fiscal surplus and fiscal ratio versions of the 'expectations' model. For both of the estimation approaches, each of the fiscal surplus and fiscal ratio variables are significant at the 1% level of significance. Both of the versions perform equally well in terms of goodness of fit as measured by $R^2$ adjusted for degrees of freedom.

## 6.8 Summary and Concluding Comments

In this chapter, the estimation results obtained with the multinomial logit model using the total pooled migration data set were presented and discussed. Two estimation procedures, appropriate in the context of pooled cross-section, time-series data were used. The estimation results were highly supportive of the migration model developed. Of particular interest is the preponderance of evidence which suggests that taxes and expenditures of provincial and municipal governments (and most especially taxes) exert identifiable influences on Canadian interprovincial migration flows. The effects of subcentral government activity on migration are apparent in the estimation results for a large number of models which express the fiscal influences in a variety of plausible ways. The evidence quite unambiguously supports the contention that the decentralized Canadian fiscal structure affects the geographical distribution of the Canadian population. Very real and systematic influences on migration arise because of wide disparities in potential revenue capacities amongst provinces and because of large revenue transfers from the federal to the provincial governments.

In the next chapter, various specific questions associated with Canadian migration will be addressed. In addition, certain policy issues will be examined, using results from some of the models reported in this chapter.

# APPENDIX TO CHAPTER SIX

## Definition of Variables Used in the Regressions

$DIST^{(i)}$ . . . distance spline function terms (see Chapter 5), i=1,...5.

$DR_j$ . . . dummy variable with value 1 if a migrant receiving province is province j and value 0 otherwise. j=2, 3,..., 10 and represent the nine provinces from east to west (P.E.I., N.S., ..., B.C.), excluding Newfoundland.

$DS_i$ . . . dummy variable with value 1 if a migrant sending province is province i and value 0 otherwise. i=2, 3, ..., 10 and represent the nine provinces from east to west (P.E.I., N.S., ..., B.C.), excluding Newfoundland.

$FR_i$ . . . natural log of fiscal ratio (relevant government expenditures divided by total relevant taxes) in province i (see Chapter 4).

$FS_i$ . . . natural log of fiscal surplus (relevant government expenditures minus total relevant taxes per capita) in province i in constant provincial dollars (see Chapter 4).

$GE_i$ . . . natural log of per capita consolidated provincial-local government expenditures likely to be of relevance to migrants (see Chapter 4), in constant provincial dollars.

$POP_j$ . . . natural log of the population of the receiving province in thousands.

$p_{ij}$ . . . probability of migrating from province i to j - ratio of migrants to population in i.

$p_{ii}$ . . . probability of staying in province i - ratio of stayers to population in i.

$t_i^{(1)}$ . . . natural log of total consolidated provincial-local government 'commodity taxes' (see Chapter 4) in province i, expressed as a percentage of gross provincial expenditure for the province.

$t_i^{(2)}$ . . . natural log of total consolidated provincial-local government 'personal' plus 'commodity taxes' (see Chapter 4) in province i, expressed as a percentage of aggregate provincial personal income.

$t_i^{(3)}$ . . . natural log of total consolidated provincial-local government 'personal' plus 'commodity taxes' (see Chapter 4) in province i per capita expressed in constant provincial dollars.

$U_i$ . . . natural log of the unemployment rate (percentage of the labour force unemployed) in province i.

$Y_i^{(1)}$ . . . natural log of adjusted (see chapter 5) provincial income in province i, minus consolidated provincial-local 'personal taxes', per capita and in constant provincial dollars.

$Y_i^{(2)}$ . . . same as $Y_i^{(1)}$ but with consolidated provincial-local 'personal taxes' not deducted.

# FOOTNOTES TO CHAPTER SIX

1. This is a well-known problem associated with estimating with pooled data. For a discussion of this issue see Johnston (1972), pp. 192-207 and Maddala (1977), chapter 14. It is also possible that the slope coefficients may differ as well as the intercepts but that issue is not considered here. The next chapter reports estimation results for separate years and subsets of provinces and it is possible to examine such structural differences with those results.

2. The possibility that the intercepts might vary by year was tested with the use of annual dummy variables but all of the coefficients for the dummies were statistically insignificant. More is said about this later.

3. See Balestra and Nerlove (1966), Wallace and Hussain (1969), Henderson (1971), Maddala (1971), and Nerlove (1971a, 1971b). Maddala and Mount (1972) have considered various ways of estimating variance components models.

4. A third component which is year-specific and province-invariant could also be added to the error term. This third term is omitted, however, because as mentioned in footnote 2, the coefficients for annual dummy variables were statistically insignificant in preliminary LSDV estimations.

5. Namely:

$$E(v_i) = 0 \qquad E(\varepsilon_{it}) = 0$$

$$\begin{aligned} cov(v_i, v_j) &= \sigma_v^2 && \text{for } i=j \\ &= 0 && \text{otherwise} \end{aligned}$$

$$\begin{aligned} cov(\varepsilon_{i,t}, \varepsilon_{j,s}) &= \sigma_\varepsilon^2 && \text{if } i=j,\ t=s \\ &= 0 && \text{otherwise} \end{aligned}$$

$$cov(v_i, \varepsilon_{jt}) = 0 \qquad \text{for all } i, j, t$$

6. The approach is suggested by Nerlove (1967). The first round involves OLS estimation applied to deviations from provincial means for all variables. From this we obtain $s^2$, the sum of squared residuals, and $b_k$, the slope estimates. An estimate of the intra-province correlation coefficient ($\Theta$) is given by

$$\hat{\Theta} = \hat{\sigma}^2/(\hat{\sigma}_\varepsilon^2 + s^2/NT)$$

where $\hat{\sigma}_\varepsilon^2$ is calculated using the $b_k$ and the following equation

$$\hat{\sigma}_\varepsilon^2 = \frac{1}{N}\sum_{i=1}^{n} [(\bar{y}_i - \bar{\bar{y}}) - \sum_k b_k\ (\bar{x}_i(k) - \bar{\bar{x}}\ (k))]^2$$

and where $y$ is the dependent variable, $x_k$ is the $k^{th}$ independent variable, $T$ is the number of time periods, $N$ is the number of provincial flow categories (90 in this case), a single bar represents a provincial mean, and a double bar indicates a grand mean. With $\Theta$ estimated GLS can be applied in the second round by using $\Theta$ to form weights to transform the variables as follows

$$y^*_{it} = (y_{it} - y_i)/(\sqrt{1 - \hat{\Theta}}) + \bar{y}_i/(\sqrt{1 - \Theta + T\hat{\Theta}})$$

and similarly for the x variables. Alan Friedan, Virginia Polytechnic Institute and State University, developed the computer program for estimating this model.

7. Although the subscripts are omitted for convenience, all of the economic variables in Tables 6.1 to 6.11 are lagged by approximately one-half year, as described earlier in the chapter. All variables are defined in the appendix at the end of the chapter.

8. It is interesting to note that the dummy variables for Quebec (DS5 and DR5) have coefficients which are very strongly negative (and very highly significant) for obvious linguistic/cultural reasons.

9. For calculation of average direct elasticities for all provinces over the sixteen year period, estimated coefficients would be multiplied by $(1 - p_{ij})$ where average $p_{ij}$ for Canada is roughly 2% in any given year.

10. Tests for equality of sending and receiving province coefficient estimates were conducted for each variable in all model versions estimated and in most cases the hypothesis of equality was rejected.

11. Estimation was also conducted for models which included variables for the rate of growth of employment in sending and receiving provinces in an attempt to capture some of the dynamic aspects of provincial labour markets. The coefficient estimates for these variables were always statistically insignificant. The overall explanatory power of models with these variables was always substantially inferior to models with provincial unemployment rates. When both sets of variables appeared together in some model versions, the rate of employment growth variables did not improve the overall explanatory power of the models.

12. Statutory provincial personal income tax rates (defined as a percentage of 'basic federal tax') were also tested in some model versions but they consistently performed much worse than the other approaches to incorporating 'personal tax' effects. Figures for Quebec provincial income tax rates had to be estimated since the province levies its own income taxes. For further discussion of the limitations associated with using the statutory provincial income tax rates see Chapter 4.

13. In view of the discussion in Chapters 2 and 4, models were also estimated in which social welfare expenditures were specified separately from the other expenditure categories. This did not lead to any improvement in the estimation results.

14. The migration data matrix is constructed such that observations are arranged chronologically from one province to another province for each of the sixteen years. Hence, it is only every seventeenth observation (i.e., when the receiving province changes) that would be inappropriate to use in calculating the Durbin-Watson and von Neumann statistics from the residuals.

15. The Wald-Wolfowitz runs test is described in Draper and Smith (1966), pp. 95-97. Typically the test is used to detect the presence of "too few runs" (or sign changes) in the residuals so that only negative values of the test statistic are of relevance. Because of the large sample size in the present application, the normal approximation to the test statistic is applicable. The null hypothesis that the arrangement of signs is random (i.e., the absence of positive autocorrelation) is strongly rejected. The probability value is less than .005.

# CHAPTER SEVEN

# INTERPROVINCIAL MIGRATION: FURTHER EMPIRICAL INVESTIGATIONS

## 7.1 Introduction

In Chapter 6, the empirical results obtained from estimating different versions of the logit model using the total migration data set were reported and discussed. By using the entire data set, it was possible to investigate various issues associated with overall inducements to Canadian interprovincial migration over the estimation period.

Although the use of pooled data permits us to examine the overall causes of Canadian interprovincial migration flows, such aggregation obscures potentially interesting information about changes in the temporal pattern of inducements as well as any differences across provinces. Sections 7.3 and 7.4 of this chapter will deal with aspects of each of these issues in turn. Section 7.4 also examines some topical policy issues centering around migration in Canada. Section 7.2 presents a closer examination of the effect that distance has on migration, as revealed by the spline function specification for that variable. Section 7.5 contains concluding comments for the chapter.

## 7.2 The Effect of Distance on Migration Flows

In Chapter 5, the spline functional form for the distance variable was developed. At that time, the justification for and advantages of the flexible functional form were also discussed. The primary advantage of the spline specification is that it obviates the necessity of rigidly prespecifying the nature of the functional relationship between migration and distance. This is of particular importance in a country the size of Canada where distance has been shown by previous research to exert a very strong negative effect on migration flows. As pointed out in Chapter 2, this powerful influence is difficult to rationalize and is evidence that the distance variable is capturing very complex forces which are not easily identified or more explicitly modelled. In addition, the continuity restrictions of the spline function permit calculation of elasticities and derivatives throughout the entire range of the function—a distinct advantage over the use of discrete distance dummy variables which create discontinuities at the jump points. Information on the precise magnitudes of such measures and the exact nature of the relationship between distance and migration would provide valuable insights into this important hindrance to efficient migration adjustment.

In Chapter 6, the estimation results reported were obtained using the spline functional form for which both the first and second derivatives of the piece-wise polynomial terms were restricted to be equal at the 'knots'. Models were also tested without the restriction on the second derivatives (since continuity of the first derivatives is all that is required for the calculation of elasticities) but the estimation results were inferior as indicated by an F test.[1]

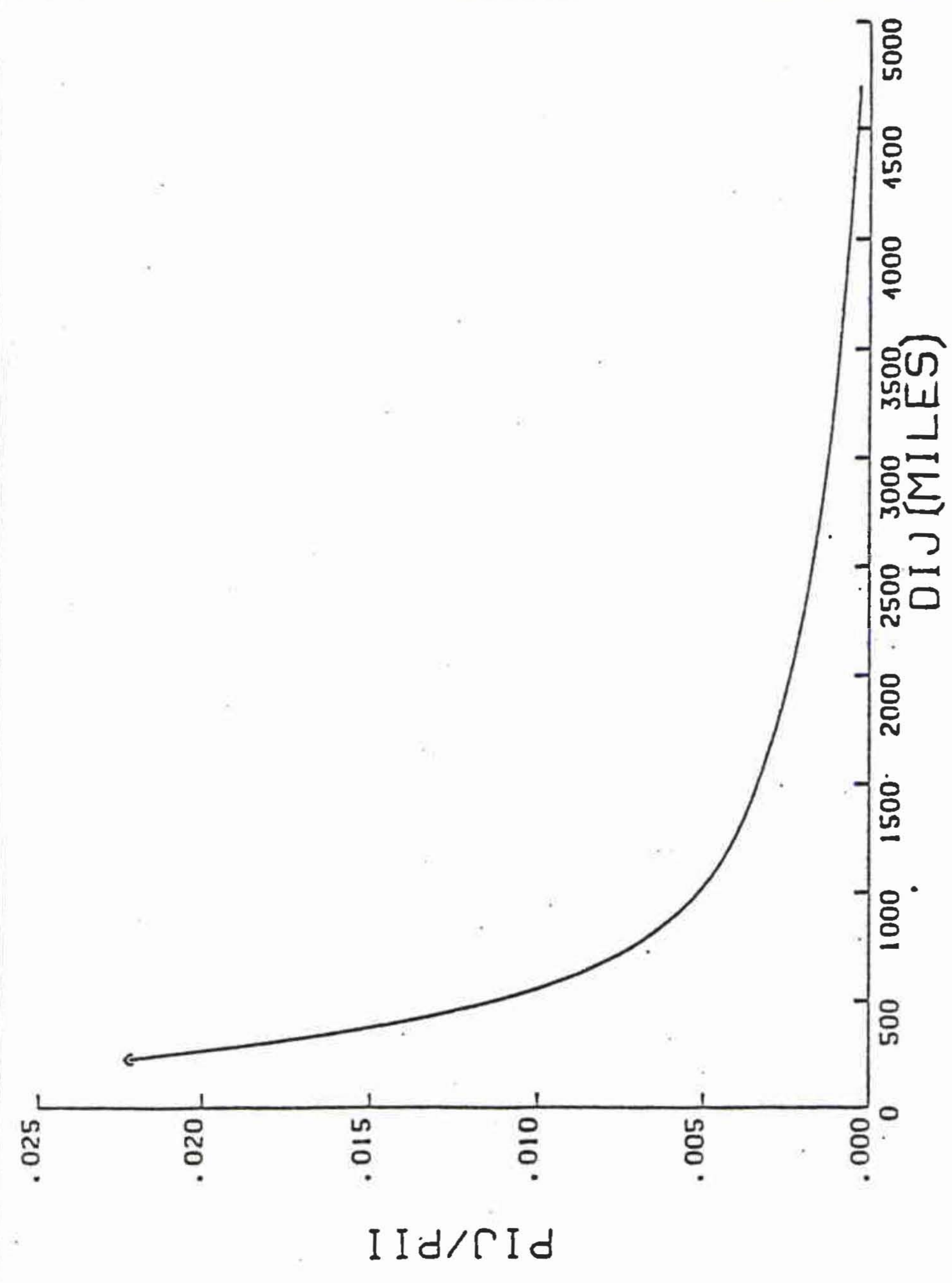
Model versions using the spline function specification for distance also consistently performed notably better, in terms of overall explanatory power, than models using other more specific functional forms such as simple distance, the log of distance and the inverse of distance. It should be emphasized, however, that the alternative specifications did not substantially affect the performance of the other variables in the models - including the levels of statistical significance of their estimated coefficients. This is an important finding since it indicates that existing anomalies in the empirical migration literature concerning the poor performance of individual variables are probably not the result of inappropriate modelling of the distance influence.

Consistently, the spline function performed very well in terms of conventional criteria. Because of the complexity of the spline function, however, it was not possible to derive any intuitive feel for the precise effect of distance on migration by simply examining the estimated spline coefficients. To establish the precise relationship, it is useful to plot the distance-migration curve using the coefficient estimates. The relationship between migration and distance is graphed in figure 7.1. The coefficients used in graphing the figure are those obtained with the gravity model version reported in Table 6.2. In graphing figure 7.1, the nondistance variables in the model were set at their mean values.

The graph of the spline in figure 7.1 shows a quite interesting and intuitively reasonable relationship between distance and migration. The flexible functional form reveals that the ratio of the probability of migrating to the probability of staying declines continuously and smoothly with increasing distance.[2]

In calculating migration-distance elasticities, the dependent variable is more appropriately expressed simply as the probability of migrating from i to j rather than as the ratio of the probability of

FIG. 7.1 DISTANCE - MIGRATION CURVE



migrating to the probability of staying in i.[3] Table 7.1 below shows the migration distance elasticities at different distance levels.

Table 7.1

Migration / Distance Elasticities — Various Distance Levels

| Distance In Miles | Elasticity of $p_{ij}$ With Respect To Distance* |
|---|---|
| 250 | - .69 |
| 500 | -1.02 |
| 1000 | -1.07 |
| 1500 | -1.04 |
| 2000 | -1.40 |
| 3000 | -2.31 |
| 4000 | -4.56 |
| 4500 | -7.13 |

*See footnote 3 for a description of the methodology used in calculating the elasticities.

The probability of migrating is, for very low distance levels, quite inelastic with respect to changes in distance. For distances between 500 and 2000 miles there is very close to unitary elasticity. Beyond 2000 miles, the migration-distance elasticity increases steadily with increasing distance and in fact becomes highly elastic at large distances.[4] Although the elasticities clearly indicate the growing relative impediment to migration exerted by increasing distance, because of the shape of the distance-migration curve, the elasticity measures may be somewhat misleading. Migration falls off very sharply with distance up to about 1000 miles after which additional distance makes very little difference. This is obscured by elasticity calculations since as $p_{ij} \longrightarrow 0$, a small absolute change becomes a very large relative change. Calculations of the first derivative of $p_{ij}$ with respect to distance confirms the impression conveyed by Figure 7.1. At the 250-mile level, for example, $dp_{ij}/dDIST$ is -.621E-03 while at 4500 miles it is -.390E-05 — a clear indication of the declining absolute influence of increasing distance on migration.

While the spline function clearly shows the precise relationship between distance and migration over the entire estimation period, an additional question arises with respect to any changes in this relationship over time. Examination of this issue is reserved for the next section.

## 7.3 The Temporal Pattern of Migration Influences

The estimation results reported in the last chapter for the total pooled data set conceal useful information about the changing patterns of inducements to migration over time. To examine the temporal pattern of the causes of migration, versions of the multinomial logit model were estimated for each year separately. For individual years, only ordinary least squares estimations were performed. OLS conserves degrees of freedom in comparison to LSDV estimations and is appropriate when the data are not pooled across provinces for different years.

An additional change from the preceding chapter is that the simple log of distance is used rather than the spline function specification for that variable. This facilitates examination of the changing influence of distance on migration over time and also conserves degrees of freedom for the more limited data set (90 observations per year).

Although model versions tested with the entire pooled data set and using the log of distance did not perform as well in terms of their overall explanatory power as those using the spline function, the simpler specification nevertheless always performed well. The distance coefficient was always highly significant statistically and always of the expected negative sign. Perhaps even more important, the coefficients for the other explanatory variables in the models and their levels of significance were not substantially affected by the alternative specifications for the distance variable. For these reasons, use of the simple log of distance should be an acceptable substitute for the spline function here. Both 'gravity' and 'expectation' model versions were tested and both performed very well in the estimations. The overall explanatory power of the model was greater for the 'expectations' version, however, so only estimation results for it are reported here. The patterns of coefficient signs and levels of statistical significance were very similar for both versions.

Table 7.2 on the next page reports results obtained from estimating one version of the 'expectations' model for each of the sixteen years separately. The variables are in natural logarithmic form. The unemployment rate, income and tax variables are entered as logarithms of ratios. The ratio specification consistently performed better in the estimations than specifications for which sending- and receiving-province variables were entered separately. Reducing the number of coefficients to be estimated also conserves degrees of freedom and facilitates examination of changes in the pattern of influences over time.

The lagged dependent and distance variables both continued to perform very well for the annual estimations. Coefficients for these variables were always of the expected signs (positive and negative respectively) and always very highly significant. There is evidence that

Table 7.2

Inducements to Interprovincial Migration by Year - 1963-78

Dependent Variable ln (pij/pii)*

| Year | Ui/Uj | $Yi^{(1)}/Yj^{(1)}$ | GEi | $ti^{(1)}/tj^{(1)}$ | DISTij | $(pij/pii)_{t-1}$ | Constant | $\bar{R}^2$ | F |
|---|---|---|---|---|---|---|---|---|---|
| | .2099 | -1.3905 | 1.2544 | .6379 | -.3943 | .6439 | -10.6930 | | |
| 1963 | (1.9233) | (4.9071) | (4.0005) | (2.5825) | (4.8573) | (13.2850) | (6.2785) | .8933 | 125.2020 |
| | .0490 | -.9379 | -.1885 | .4256 | -.2539 | .8153 | 3.2468 | | |
| 1964 | (.3756) | (3.1968) | (.5227) | (1.5604) | (2.9880) | (15.1370) | (1.6773) | .8869 | 130.0020 |
| | .0111 | -1.0355 | .1401 | .3676 | -.2177 | .7996 | -5.4534 | | |
| 1965 | (.0933) | (3.7078) | (.4125) | (1.5899) | (2.7940) | (17.6040) | (2.8871) | .9062 | 144.2390 |
| | -.0993 | -1.4092 | .5279 | .8076 | -.3312 | .6937 | -6.9077 | | |
| 1966 | (.0856) | (4.4277) | (1.4364) | (3.3220) | (3.9309) | (13.5870) | (3.4663) | .8952 | 128.5580 |
| | .2437 | -1.1041 | .6686 | .1667 | -.2481 | .7705 | 8.6054 | | |
| 1967 | (2.7634) | (4.7336) | (1.6431) | (.6602) | (3.4289) | (18.2200) | (3.5014) | .9098 | 150.6010 |
| | .2912 | -1.0476 | .2735 | .0133 | -.2603 | .7565 | -6.1218 | | |
| 1968 | (3.4811) | (4.8228) | (.5689) | (.0550) | (3.7247) | (18.3370) | (2.0759) | .9144 | 159.4740 |
| | .0652 | -.9472 | -.2066 | .6633 | -.2579 | .7745 | -3.0538 | | |
| 1969 | (.5185) | (3.1738) | (.2950) | (2.1962) | (2.8640) | (13.6890) | (.7111) | .8756 | 105.4490 |
| | .2295 | -1.4682 | .4347 | .2430 | -.2282 | .7869 | 7.2915 | | |
| 1970 | (1.7018) | (4.0403) | (.8092) | (.9931) | (2.8822) | (15.4300) | (2.2095) | .9079 | 147.2820 |

Table 7.2 (Cont'd.)

| Year | Ui/Uj | $Yi^{(1)}/Yj^{(1)}$ | GEi | $ti^{(1)}/tj^{(1)}$ | DISTij | $(pij/pii)_{t-1}$ | Constant | $\bar{R}^2$ | F |
|---|---|---|---|---|---|---|---|---|---|
| | .2734 | -1.2712 | .6688 | .1415 | -.2889 | .7157 | 8.6681 | | |
| 1971 | (2.1093) | (4.0722) | (1.1742) | (.6426) | (4.0423) | (15.8730) | (2.3475) | .9046 | 147.6590 |
| | .1416 | -.8587 | .1492 | .3964 | -.2392 | .7604 | -5.5107 | | |
| 1972 | (.8932) | (2.3638) | (.1810) | (1.3717) | (2.7269) | (14.2410) | (1.0140) | .8540 | 87.7870 |
| | .3450 | -.9384 | -.4200 | -.0197 | -.2329 | .8016 | -1.6807 | | |
| 1973 | (2.6813) | (2.5706) | (.5718) | (.0842) | (3.2769) | (17.7890) | (.3431) | .9014 | 136.6320 |
| | .3183 | -1.3156 | 1.7377 | .2833 | -.2282 | .7467 | -16.5170 | | |
| 1974 | (1.7151) | (2.5501) | (2.0821) | (1.2350) | (2.8523) | (15.1970) | (2.9223) | .8689 | 99.3210 |
| | -.1361 | -1.2704 | -.6002 | .2618 | -.1701 | .7921 | -.7971 | | |
| 1975 | (.7510) | (2.2440) | (.7002) | (1.4209) | (2.0915) | (14.5120) | (.1383) | .8762 | 105.9630 |
| | -.5934 | -2.6507 | 1.3122 | .4619 | -.3319 | .6901 | -13.3080 | | |
| 1976 | (4.3873) | (6.3129) | (1.7449) | (3.0272) | (4.5347) | (14.1320) | (2.5970) | .8926 | 124.2590 |
| | -.4556 | -1.9407 | -1.1775 | .2933 | -.1527 | .7952 | 3.3210 | | |
| 1977 | (2.9924) | (4.6697) | (1.7906) | (1.8797) | (2.1651) | (16.1260) | (.7428) | .9045 | 141.4320 |
| | -1.0078 | -2.8586 | -.9332 | .7023 | -.1312 | .7657 | 1.3872 | | |
| 1978 | (6.3455) | (7.2786) | (1.9158) | (4.8372) | (2.1908) | (18.5940) | (.4086) | .9096 | 150.7580 |

* Numbers in brackets below coefficients are absolute values of t statistics.

the effect of distance has declined over the estimation period. In fact, for the 'gravity' version of this model there was a smooth and continuously declining pattern to the absolute size of the distance coefficient. Decline in the absolute size of the distance coefficient is indicative of improved efficiency and fluidity in migration adjustment and, as discussed in Chapter 2, is by and large consistent with findings of other researchers for earlier time periods.[5] It is of significance to find additional evidence here which supports earlier trends detected that indicate the impediment exerted by distance on migration is continuing to decline over time. Improvements in transportation and communication seem to be reducing the economic and noneconomic costs associated with relocating.

The coefficient for the population variable in 'gravity' versions of the model also declined continuously over the estimation period. This could be interpreted as a continual reduction in the noneconomic influences on migration or, perhaps more appropriately, as a reflection of changes in the established patterns of migration flows away from high population provinces such as Quebec and Ontario over the estimation period.

The coefficient estimates for the income ratio variable are always of the expected negative sign and always highly significant. The much larger absolute size of the coefficients in later years is evidence of increasing responsiveness of migration to differences in average provincial incomes. The very strong performance of the income variable again supports the appropriateness of deducting provincial-local 'personal taxes' when measuring expected income levels for different provinces from the perspective of potential migrants.

The variable for the ratio of unemployment rates demonstrates an interesting pattern over the period. For all but one year prior to 1974, the variable coefficient is of the expected positive sign, although it is often statistically insignificant at the 10% level. From 1974 onwards, however, the variable has a negative coefficient and, for the last three years, the coefficient is very highly significant. This was the general pattern observed for this variable for all model versions estimated. There are two possible explanations for this. One possibility for the unexpected signs in later years is that the unemployment rate variable is erroneously being ascribed some of the explanatory power which is in reality due to other factors (for example, fiscal influences). Net positive migration gains for the Atlantic Provinces over the period represent fairly sizable migration inflows to high unemployment rate regions. In particular, there were very large flows from Quebec and especially Ontario to the Atlantic Provinces over the period which may have created a purely spurious relationship between the unemployment rate variable and migration flows in models tested for the short one-year time period.

Another possible explanation arises with realization that the period 1974-78 was a period of steady and fairly rapid increase in the overall national rate of unemployment, which went from 5.4% to 8.5% over the five years. Furthermore, this increase followed a four-year period for which the rate had declined steadily. It will be recalled from the discussion in Chapter 2 that Vanderkamp (1971) argued that during periods of generally high levels of national unemployment, it would be expected that return migration would increase and new migration would decrease, for the reasons stated at that time. If unemployment rates are highly correlated with national rates, the seemingly perverse effect of the former on migration flows might be a reflection of the result Vanderkamp hypothesized would occur during a period of generally deteriorating overall employment conditions. In fact, the results obtained with models which included the national unemployment rate variable using the entire pooled data set lend some credence to this theory. The variable always had a negative coefficient indicating that, as hypothesized by Vanderkamp, migration responsiveness to differences in regional economic conditions varies directly with overall national labour market conditions. The variable coefficient, however, was not statistically significant and its inclusion did not improve the overall explanatory power of the models. Because of this it was not included in model versions reported in Chapter 6.

The coefficient estimates for the fiscal variables in Table 7.2 indicate generally less consistent influence of these factors for individual years than was found to be the case for the total pooled data set analyzed in Chapter 6.

The tax ratio variable performs most consistently and has the expected positive sign for all but one year, although the coefficient is not significantly different from zero for the majority of years. When the tax variables were expressed separately in the model, the receiving-province variable was always of the expected negative sign and always very highly significant from 1967 onwards. The sending-province variable was most often of the expected positive sign but typically statistically insignificant. These results are qualitatively consistent with those reported in Chapter 6 where, it will be recalled, the receiving-province tax variable consistently exerted a more powerful influence on migration than the sending-province variable.

The sending-province government expenditure variable generally performed very poorly in the annual estimations. The coefficient sign is more often positive than negative and typically statistically insignificant. For model versions in which both the sending- and the receiving-province government expenditure variable appeared, the receiving-province variable was also statistically insignificant and did not improve the overall explanatory power of the model. For the estimation results with the total pooled data set, it will be recalled, it was also the case that the government expenditure variables typically performed less well than the tax variables.

The relatively poorer performance of the fiscal and unemployment rate variables for the annual estimations in comparison to the results for the pooled estimations is not totally surprising. It would be expected that for the short one-year time period, the explanatory power of the weaker influences would be obscured by the powerful influence of the more dominant variables, especially the lagged dependent variable. In support of this, the fiscal variables as well as the unemployment rate variables performed much better in estimations for individual provinces over the entire sixteen-year period.

### 7.4.1 Migration Flows for the Atlantic Provinces and Alberta

In addition to migration flows for individual years, the data set also affords the opportunity for examining flows for particular provinces. For individual provinces, it is possible to examine both in- and out-migration flows and versions of the model were estimated for each of these flows for each province separately. The general conclusions of the previous chapter with respect to the overall causes of Canadian inter-provincial migration flows are supported when the focus shifts to individual provinces. In particular, the influence exerted by the fiscal variables is quite evident, though to varying degrees for most provinces.[6]

As discussed earlier in the study, much of the controversy surrounding the effect of the Canadian fiscal structure on migration centres around the impact that oil and gas resource revenues and federal-provincial grants (particularly equalization grants) are having on migration flows for, respectively, Alberta and the Atlantic Provinces. A closer examination of flows for these two regions would seem warranted because of their topical nature and because of their importance to future policy design.

### 7.4.2 Out-Migration from the Atlantic Provinces

Most of the current controversy associated with migration flows for the Atlantic Provinces centres around the possible inhibiting effect that large federal-provincial grant payments are having on out-migration. The grants permit much higher levels of government expenditures and lower tax rates than would be possible in their absence.

Table 7.3 reports OLS estimates for the 'expectations' model although the 'gravity' model performed equally as well in other estimations conducted.

The results confirm that fiscal considerations exert a significant influence on out-migration from the Atlantic Provinces. The unemployment

Table 7.3

Estimation Results for Out-Migration
from the Atlantic Provinces 1963-1978
Dependent Variable ln (pij/pii)*

| Variable** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ui/Uj | $Yi^{(1)}/Yj^{(1)}$ | GEi | $ti^{(1)}$ | $tj^{(1)}$ | DISTij | $(pij/pii)_{t-1}$ | Constant | $\bar{R}^2$ | F |
| .2545 | -1.5724 | -.17738 | 2.0784 | -.4979 | -.5058 | .6814 | -5.1293 | | |
| (4.5961) | (8.7754) | (3.6578) | (11.2170) | (4.8663) | (13.7860) | (33.7860) | (11.4130) | .8446 | 447.37 |

* There are 576 observations, nine out-migration flows for each of the four Atlantic Provinces for each of the sixteen years.

** All variables are in natural logs. Numbers in brackets below coefficients are absolute values of t statistics.

rate and income variable appear in ratio form in Table 7.3. Both variables are of the expected signs and highly significant statistically as are all of the other variables in the model, most notably the fiscal variables.

It is interesting that the push effect of higher Atlantic Province taxes is much greater than the negative effect exerted by the intensity of taxation in the receiving province. Of additional interest is the significant negative effect that provincial-local government expenditures in the Atlantic Provinces have on out-migration. That government expenditures might increase the outward mobility of residents of very poor provinces is at least a logical possibility.[7] The evidence strongly suggests, however, that higher levels of government goods and services reduce mobility by enhancing the quality of life in the region.

Using the coefficient estimates of Table 7.3 and the elasticity properties of the logit model, it is possible to make some very rough estimates of the influences on migration resulting from the increased government expenditures and reduced taxes made possible by federal-provincial grants to the Atlantic Provinces. Consider, for example, the migration impact of a 20% reduction in federal-provincial grants. Since grant revenues represent approximately 50% of total provincial-local budgetary revenues accruing to the Atlantic Provinces, this would imply that the latter would fall by about 10%. It will be assumed that the reduction in revenues is reflected proportionately in both increased taxes and reduced government expenditures and that the increases in taxes are split equally between 'personal' and 'commodity' taxes.[8] Given these assumptions, the model would predict the changes in out-migration from the Atlantic Provinces reported in Table 7.4.[9]

Table 7.4

Effect of a 20% Reduction in Federal-Provincial Grants
on Out-Migration from the Atlantic Provinces

| Receiving Province | Actual Average Annual Out-Migration from the Atlantic Provinces, 1976-78 | Predicted Annual Out-Migration with the Grant Reduction | Increased Out-Migration Due to the Grant Reduction |
|---|---|---|---|
| Quebec | 5,096 | 5,891 | 795 |
| Ontario | 21,354 | 24,683 | 3,329 |
| Manitoba | 2,135 | 2,468 | 333 |
| Saskatchewan | 1,057 | 1,222 | 165 |
| Alberta | 5,699 | 6,588 | 889 |
| British Columbia | 4,070 | 4,705 | 635 |
| | 39,411 | 45,557 | 6,146 |

The numbers in Table 7.4 provide clear evidence that the impact of federal grants is likely to be quite significant. The 20% reduction in grant receipts leads to a 15.59% increase in out-migration, apportioned across receiving provinces as shown in the last column of the table.

The numbers in Table 7.4, representing short-run effects only, are likely to be substantial underestimates of the actual long-term migration impact of the grant reduction. There would most likely be secondary effects on incomes and unemployment rates as a result of reduced economic activity in the region. Although, it is possible that increasing marginal productivity of labour due to out-migration might offset this tendency somewhat. Also, in the longer term, reduced migration in preceding periods would lead to further reductions in migration operating through the lagged dependent variable term. Because of the high uncertainty about the precise nature of the longer term adjustment, however, the long run elasticities may be quite inaccurate and are not calculated for that reason.

The precise effect on migration of the grant reduction will naturally be quite sensitive to how the receiving governments respond in cutting government expenditures and/or increasing the different types of taxes. In fact, the large migration impact of the preceding example is very much affected by the high degree of sensitivity of out-migration from the Atlantic Provinces to the intensity of 'commodity' taxation and the resulting effect this has on the cost of living. Differences in the migration response to different fiscal variables provide concrete evidence that provincial and local governments could significantly alter the attractiveness of their province to residents and potential residents simply by altering the tax-expenditure package offered.

### 7.4.3 In-Migration to Alberta

Because of the huge oil and natural gas revenues accruing to Alberta, it has been able to provide the most attractive fiscal package of all the provinces in Canada. Government expenditures are higher, and tax rates lower, in Alberta than in any other province. It has been argued (by Purvis and Flatters, 1980, for example) that fiscal considerations offer at least a partial explanation for the dramatic influx of migrants to Alberta in recent years.

Table 7.5 on the next page reports estimation results for one version of the 'expectations' model applied to in-migration data for the province. Again the model performs very well with coefficients of all variables having the expected signs and being in most cases very highly significant. The magnitudes of the coefficient estimates is remarkably similar to those for out-migration from the Atlantic Provinces. Again, it is notable that increases in intensity of 'commodity' taxation in the

Table 7.5

Estimation Results for In-Migration
to Alberta 1963-1978
Dependent Variable ln (pij/pii)*

Variable**

| $Yi^{(1)}/Yj^{(1)}$ | GEi | $ti^{(1)}$ | $tj^{(1)}$ | DISTij | $(pij/pii)_{t-1}$ | Constant | $\bar{R}^2$ | F |
|---|---|---|---|---|---|---|---|---|
| -1.3514<br>(4.2043) | -.1885<br>(1.4317) | 1.7720<br>(5.1738) | -.7495<br>(3.0619) | -.5184<br>(5.0185) | .6607<br>(8.3979 | -3.7913<br>(3.0570) | .8588 | 145.91 |

* There are 144 observations, since in-migration flows per year for each of the sixteen years.

** All variables are in natural logs. Numbers in brackets below coefficients are absolute values of t statistics.

sending province serve as a much greater inducement to migration to Alberta than do tax reductions in Alberta. Interestingly, the receiving province government expenditure variable in other models estimated was statistically insignificant and had an unexpected negative sign. Its inclusion could not be justified on the basis of an F test. As in previous estimations reported, the migration influence of government expenditures is notably weaker than the effect of taxes but it is particularly surprising to find that the relatively high levels of government expenditures in Alberta apparently have little influence on migrants.

It is possible to use the estimation results to examine the migration impact of changes in oil and gas revenues accruing to Alberta. In fact, an increase in oil and gas revenues is not really necessary to permit the Albertan government to reduce the intensity of taxation in the province. The sizable Heritage Trust Fund already permits sufficient latitude for Alberta to implement substantial reductions without additional revenues. In any event, we will examine the effect on migration of a 10% reduction in tax revenues resulting from either an increase in resource revenues or a reduction in the size or rate of accumulation of the Trust Fund. It will be assumed that both 'commodity' and 'personal' taxes are cut 10%.

Table 7.6 below shows the resulting effect on migration apportioned across sending provinces using as the status quo average migration flows for the three year period 1976-78.

Table 7.6

Effect of a 10% Reduction in Taxes on In-Migration to Alberta

| Sending Province | Actual Average Annual In-Migration to Alberta, 1976-78 | Predicted Annual In-Migration with the Tax Cut | Increased In-Migration Due to the Tax Cut |
|---|---|---|---|
| Newfoundland | 1,459 | 1,579 | 120 |
| Prince Edward Island | 430 | 465 | 35 |
| Nova Scotia | 2,544 | 2,752 | 208 |
| New Brunswick | 1,536 | 1,662 | 126 |
| Quebec | 5,822 | 6,299 | 477 |
| Ontario | 22,074 | 23,882 | 1,808 |
| Manitoba | 8,587 | 9,290 | 703 |
| Saskatchewan | 10,628 | 11,498 | 870 |
| British Columbia | 27,608 | 29,869 | 2,261 |
| Total | 80,688 | 87,296 | 6,608 |

The figures in Table 7.6 are again short-run estimates and are calculated by following the same logic outlined in footnote 9. The overall increase in in-migration as a result of the 10% tax cut is 8.19% and strongly suggests that flows to Alberta have been substantially affected by the fiscal advantage prevailing there. It could even be that this figure is significantly underestimated if the much lower taxes in Alberta have a large indirect influence on migration by way of the increased employment which they generate. Such indirect influences might also account, at least in part, for the smaller receiving province tax coefficient. In any event, it would appear that the Alberta government has more than adequate leeway for manipulating provincial taxes in such a way as to have a significant impact on migration flows to the province. This is an interesting finding with potentially important implications for the design of provincial fiscal strategies.

## 7.5 Concluding Comments

This chapter has extended the empirical investigation of the inducements to interprovincial migration begun in the previous chapter. In particular, focus of this chapter centred around three issues: a closer examination of the effect of distance on migration as revealed by the spline function specification for that variable; changes in the pattern of influences on migration over time; and the effect of oil revenues and equalization payments on, respectively, in-migration to Alberta and out-migration from the Atlantic Provinces. Perhaps the most interesting finding from a policy perspective is that resource revenues and federal-provincial grants appear to have a significant influence on migration flows for, respectively, Alberta and the Atlantic Provinces — primarily because of the effect that they have on tax rates.

# FOOTNOTES TO CHAPTER SEVEN

1. The appropriateness of using other 'knot' points (including more than three 'knots') was also tested, however the results proved quite insensitive to the 'knots' chosen.

2. The graph of the spline function for the 'expectations' model is very similar in shape to that of the 'gravity' model in figure 7.1.

3. The original equation, omitting the nondistance terms, is of the form

(A)
$$\ln\left[\frac{p_{ij}}{p_{ii}}\right] = \sigma_1 \text{ DIST} + \sigma_2 \text{ DIST}^2 + \sigma_3 \text{ DIST}^3 + \sigma_4 \text{ (DIST - 1567)}^3 D_1^* + \sigma_5 \text{ (DIST - 3134)}^3 D_2^*$$

$D_1^*$ = 0 if $<$ DIST 1567
= 1 if $\geq$ DIST 1567

$D_2^*$ = 0 if $<$ DIST 3134
= 1 if $\geq$ DIST 3134.

By differentiating (A) with respect to DIST and multiplying the entire result by DIST, we get an expression for the elasticity of $p_{ij} / p_{ii}$ with respect to DIST.

(B)
$$\varepsilon_{(p_{ij}/p_{ii}),\text{DIST}} = \frac{d \ln (p_{ij}/p_{ii})}{d \text{ DIST}} \cdot \text{DIST}$$
$$= [\alpha_1 + 2\alpha_2 \text{ DIST} + 3\alpha_3 \text{ DIST}^2 + 3\alpha_4 \text{ (DIST - 1567)}^2 D_1^* + 3\alpha_5 \text{ (DIST - 3134)}^2 D_2^*] \cdot \text{DIST}$$

Using the relationship expressed in equation 4.27 in Chapter 4, we can get the elasticity of simply $p_{ij}$ with respect to DIST. That is

(C)
$$\varepsilon_{p_{ij},\text{DIST}} = \varepsilon_{(p_{ij}/p_{ii}),\text{ DIST}} \cdot (1 - p_{ij}).$$

The overall national migration probability is used for $p_{ij}$.

4. The short-run elasticities in the case of the adaptive expectations model of Table 6.7 are

| Distance in miles | 250 | 500 | 1000 | 2000 | 3000 | 4000 |
|---|---|---|---|---|---|---|
| Elasticity | -.20 | -.29 | -.29 | -.29 | -1.75 | -6.48 |

5. See the discussion of earlier research by Courchene (1970) and Vanderkamp (1971) in Chapter 2.

6. Estimation results for individual provinces are available from the author upon request.

7. Education and health expenditures account for a very large portion of provincial expenditures. To the extent that such expenditures increase the human capital of the population, they raise the expected gains from migration and could increase the propensity to migrate.

8. Since both conditional and unconditional grants are distributed to qualifying provinces according to formulae, a fall in grant payments to the Atlantic Provinces would most likely result in a decrease in grants for at least some other provinces. This complication would introduce a further distortion to migration flows which is ignored here. It is possible to imagine, for example, a change in the equalization formula which would primarily affect revenues going to the Atlantic Provinces.

9. The figures in Table 7.4 are determined as follows: the relevant coefficient estimates are adjusted by $(1 - p_{ij})$ (see equation 3.27); they are then multiplied by the percentage changes in the fiscal variables concerned, and the results are summed to get the total change in $p_{ij}$. The predicted changes in $p_{ij}$ are then translated into absolute numbers.

# CHAPTER EIGHT

# CONCLUDING COMMENTS AND SUGGESTIONS FOR FUTURE RESEARCH

## 8.1 Introduction

The purpose of this concluding chapter is threefold: to briefly summarize the methodology and findings of the study; to relate, to the extent possible, the findings of the study to those of several recent related inquiries; and to attempt to ferret out possible fruitful venues for future research which arise as logical extensions or offshoots to the present study. The remaining three sections of the chapter address each of these issues in turn.

## 8.2 Overview of the Study

The preceding chapters have been concerned with examination of the possible effects of subcentral fiscal influences on interprovincial migration in Canada. Because fiscal considerations represent only a subset of possible influences which may affect the locational decisions of individuals, the fiscal variables have been incorporated in a more general stochastic utility model of migration choice with strong human capital/gravity model overtones. The multinomial logit model was selected because of its inherent conceptual advantages over more conventional migration models and because of its ease of estimation using aggregate data.

The migration data set used in the study provided detailed information on annual aggregate migration flows among provinces for a relatively long sixteen-year time period. The data set had been relatively unexplored in econometric investigations prior to commencement of this study.

Consolidated provincial-local data were used in constructing the provincial fiscal variables in order to give as accurate as possible a picture of overall fiscal realities prevailing in each province. Other variables appearing in the models were constructed from sources detailed at various points in the study.

The estimation results (based both on least squares with dummy variables and generalized least squares) provide an abundance of evidence supporting the importance of economic considerations in determining Canadian interprovincial migration flows. This finding is hardly novel and in fact is consistent with the findings of a fairly large body of previous research.

Of greater interest, however, is evidence in the estimations and simulation results which would seem to clearly indicate that the decentralized federal nature of the Canadian public sector has exerted distinct influences on the pattern of migration flows. The evidence lends credence to research by Tiebout (1956) and subsequent theorists who have highlighted the potentially complex factors which may affect migration flows in federal states because of decentralized taxation and provision of government goods and services. The nature of the fiscal influences in Canada is further complicated by the existence of federal-provincial grant transfers to revenue deficient provinces and large natural resource revenues in Western Provinces.

While evidence of the effects of government expenditure influences is somewhat inconclusive, the effects of provincial-local taxes are unambiguous and consistent with a priori expectations. The influence of the intensity of taxation in destination provinces in determining locational choice is particularly powerful throughout the pooled and individual province estimations. Two separate channels of influence for taxes were identified — cost of living effects and income effects. The present study is the only one I am aware of which examines the effect of 'commodity taxes' on regional costs of living or which attempts to correct regional price deflators for such effects.

Separate estimations and simulations for Alberta and the Atlantic Provinces indicate that fiscal considerations appear to be having a significant impact on in-migration to the former and out-migration from the latter. This could account for some of the recent anomalies in observed migration patterns.

Overall, the evidence suggests that subcentral fiscal influences are having a distinct influence on the pattern of Canadian migration flows. The estimation results in support of this should serve as useful input into many of the controversies and policy issues associated with interprovincial fiscal disparity and fiscal integration in Canada.

## 8.3 Other Recent Research on Fiscal Structure and Migration in Canada

Recently, three empirical studies undertaken independently of this thesis have looked at various aspects of fiscal influences on Canadian migration. The purpose of this section is to review this aspect of these studies in the light of the empirical results presented here.

Foot and Milne (1981) use Seemingly Unrelated Regression Techniques to estimate a set of equations for net migration to each province in Canada. The migration data set they use (the same set used in this study) is compiled by Statistics Canada from Family Allowance data. The explanatory variables in their model include industrial composite average real weekly wages and salaries, unemployment rates, and government policy variables. Variables for both the reference province and a composite for all other provinces were included in each equation. The government policy variable included the sum of most federal and provincial government transfer payments to persons and industries, and provincial government expenditures on final goods and services. Because the variable includes federal transfers, of course, it does not isolate the impact of provincial expenditure activity alone. The effects of taxes are also excluded, although the appropriateness of expanding the investigation to include the effects of taxes is noted in a footnote. The expenditure variables are constructed from provincial economic accounts data and ignore expenditures by local governments. Because Foot and Milne examined the causes of net, rather than gross, migration, comparability of their empirical estimates with those of this study is further reduced.

Estimation results are presented in the Foot and Milne paper for both unconstrained model versions and versions for which the within-province variable coefficients are constrained to equality with the "all-other-provinces" variable coefficients. Although estimation results vary by province, there is evidence that the government expenditures variable is of some relevance in determining migration patterns in Canada. The within-province variable is of particular significance to net migration for the Atlantic Provinces. The variable has the expected positive sign and is generally significant. The 'all-other-provinces' variable is found to have no significant influence on Maritime migration, however. Nor is there much evidence that the government policy variable exerts a substantial influence on net migration to Ontario or the Western Provinces.

The relatively poor performance of the government policy variable in the Foot and Milne study is consistent with the performance of the subcentral government expenditure variables in this study. It is notable that in the present study, the level of government expenditures in the Atlantic Provinces was found to have a significant effect on both in- and out-migration for those provinces but no significant effect on flows to and from Alberta. It is unfortunate that Foot and Milne did not examine tax effects on migration which were found in the present study to be a much more powerful and consistent influence than government expenditures.

Dean (1982), on the other hand, incorporated provincial tax variables (but not government expenditure variables) in a model of gross interprovincial migration for the years 1972-1979. The migration data set used was the same one analysed here (although Dean's time period is much shorter) and by Foot and Milne. The non-tax explanatory variables included in the study were real personal incomes per capita, unemployment rates, receiving province population, distance, and rate of growth in employment in the receiving province.

Two tax variables were used for both the sending and receiving provinces — provincial personal income tax rates (i.e. provincial personal income taxes as a percentage of Basic Federal Tax), and direct taxes payable in a province as a percentage of each province's personal income. Use of the later variable serves as partial compensation for limitations of the personal income tax rate variable noted in Chapter 5 of this study. The influence of nonpersonal (or indirect) taxes is ignored in Dean's study.

Although the data are pooled across provinces for the entire time period, only ordinary least squares estimations are performed by Dean. The income, population, distance, rate of employment growth, and receiving-province tax variables are all of the expected signs and highly significant statistically. The unemployment rate variables are statistically significant but have counterintuitive signs — this last finding is totally consistent with the annual estimations reported in Chapter 7 of this study where the unemployment ratio variable was found to have an unexpected negative sign from 1975 onwards. Possible reasons for this were given in Chapter 7 and could quite possibly explain Dean's findings since his estimation period only covers the years 1972-1979.

Both the direct tax burden and the personal tax rate variables for the sending province have perverse negative coefficients in Dean's estimations and the latter is statistically insignificant. The author says that in disaggregated estimations for outmigration conducted for each province separately (not reported in the paper), the sending province tax variables had the expected positive signs for all provinces except Quebec and Ontario. Dean attributes the poor performance of the sending province tax variables in the pooled estimations to the dominating influence of Quebec and Ontario. It is also of relevance to point out that, as in the present study, Dean found the coefficients for the tax variables to be substantially greater for the receiving province than for the sending province. This supports the contention of this study that tax considerations affect the migration decision asymetrically in that the destination effect is more powerful than the origin effect.

Dean used his estimation results to predict the migration impact of a one point reduction in provincial personal income taxes rates in, respectively, Alberta and British Columbia on migration to these provinces from other selected provinces. Dean's calculations show that, in the case of Alberta, in-migration would fall by a low of 2.56% from Quebec to a high of 5.94% from Newfoundland. The extremes for reductions of in-migration to British Columbia are 2.90% from Quebec to 14.46% from Newfoundland.

Overall, Dean's research is highly supportive of the position that tax considerations significantly affect interprovincial migration flows in Canada.

The most recent investigation of relevance to the present study is that by Winer and Gauthier (1982), recently released by the Economic Council of Canada. It is also, however, the study, of the three reviewed here, which is least related to the present one because the authors do not look directly at the effects of either subcentral taxes or government expenditures on migration. A number of related issues examined by the authors do, however, shed some light on this issue.

Winer and Gauthier examine inducements to migration using two separate migration data sets. The first set of estimations reported are essentially a reestimation of some of Courchene's (1970) equations using an extended Family Allowance migration data set — 1951-1978 versus 1952-1967 for Courchene. Their estimation results offer partial confirmation of Courchene's earlier findings. They indicate that gross provincial out-migration is negatively affected by Federal transfers to individuals (excluding unemployment insurance transfers), per capita (or per labour force member) unconditional grants to provinces, and, at least for the Atlantic Provinces, unemployment insurance payments.

In their second set of estimations, Winer and Gauthier estimate versions of a multinomial logit model using a migration data set derived from a 10% (all social insurance numbers ending in 5) longitudinal tax file supplied by Statistics Canada from federal personal income tax returns filed between 1967 and 1977. Individuals in this subset were then categorized by broad income classes for the estimations.

Estimation results reported include those for both in- and out-migration for the Atlantic Provinces, Alberta and British Columbia together, Ontario, Saskatchewan, Manitoba, and Quebec. A variety of model forms are estimated, resulting in a large quantity of statistical output.

In addition to income and employment variables, various fiscal measures appear in different model versions, including: the differences between receiving and sending provinces in per capita federal government purchases, excluding wage and defence spending; measures of the generosity (availability) of unemployment insurance benefits in sending and receiving provinces; federal transfers to individuals, less unemployment insurance payments in the sending province; difference between receiving and sending provinces in per capita unconditional grants from the federal to the provincial governments; difference between receiving and sending provinces in per capita natural resource revenues; ratio of receiving to sending-province regional price indexes; and ratio of receiving to sending-province housing price indexes. All nominal dollar values are deflated by the national consumer price index where appropriate.

Because of the large quantity of estimation results reported by Winer and Gauthier, it is possible to give only a brief overview of the main findings here. In general, their estimation results offer some support to their hypothesis that the fiscal influences considered by them significantly influenced migration decisions over the period.

The poor and middle income classes were affected to a greater extent than the rich, and fiscal considerations exerted a more consistent influence on flows out of Atlantic Canada and into Alberta and British Columbia than on other flows. Coefficient signs for unemployment generosity indices for both the origin and destination provinces were not very consistent and were often statistically insignificant. The variables did, however, perform better for low income earners and for out-migration from the Atlantic Provinces. Their results suggest unconditional grants significantly retard out-migration of low income groups from the rest of Canada to Alberta and British Columbia although there is relatively little evidence that such transfers have significantly affected out-migration from the Atlantic Provinces, a surprising finding.

There is also strong indication that natural resource revenues have played a significant role in determining recent migration flows, particularly in inducing out-migration from the Atlantic Provinces and in attracting in-migration to Alberta and British Columbia. The very poor and the rich, however, are not significantly affected by resource revenues.

Transfers to persons, other than unemployment insurance payments, retard out-migration of high income earners from the Atlantic Provinces (an unexpected finding given that such transfers do not constitute a major source of income for this group) and attract both high and low income earners to Alberta and British Columbia.

The federal government expenditure variable performed the least well of all the variables although there is evidence that it affected migration within the Atlantic Provinces and to Manitoba and Saskatchewan.

In Chapter 5, Winer and Gauthier report results of simple simulations intended to provide rough estimates of the migration impact of changes in some of their fiscal variables. Included in the simulations are the effects of changes in equalization payments and Western natural resource revenues on out-migration from the Atlantic Provinces and in-migration to Alberta and British Columbia. On the basis of their findings, especially those for low income earners, Winer and Gauthier conclude (page 70) that the evidence supports the general conclusion that ". . . fiscal structure does influence interprovincial migration decisions."

Although, as stated earlier, Winer and Gauthier do not look directly at the effects of subcentral taxes and government expenditures on migration (the focus of this study) their research makes a valuable contribution to the accumulating evidence on the general responsiveness of migration flows to various kinds of government policies.

## 8.3 Suggestions for Future Research

The diverse body of literature surveyed in this study gives an indication of the wide ranging implications of migration as an economic phenomenon in Canada. In fact, the topic is so vast and the potential for future research so varied that it is possible to give only a very cursory overview here of a few of the many possibilities for subsequent investigation.

Obviously, more detailed study of the influence of subcentral fiscal influences on migration using micro migration data is one possibility. Although interesting questions concerning aggregate flows have undoubtedly not been exhausted, additional studies are likely to yield rapidly diminishing returns. The decision to migrate is an individual or family decision. While overall inducements to migration can be extracted from data on aggregate flows, detailed information can be acquired only by analysis at a disaggregate level which more closely approximates the level at which the decision is actually made. Several recent Canadian studies referred to earlier have been micro-oriented and extensions of these by incorporating subcentral fiscal influences (including more detailed analysis of the differential effects of different types of government expenditures and taxes) would be a useful contribution.

Examination of the efficiency implications of migration induced or retarded by government expenditure, transfer and tax policies is another possibility for future research. While the research in this and other related studies accord with expectations and by and large confirm the rational nature of migration decisions, they provide relatively little insight into the implications from the perspective of efficiency of resource allocation. It is one thing to argue that fiscal considerations affect migration flows and quite another to argue that the end result is either desirable or undesirable in terms of the resulting spatial distribution of the labour force. Much of the debate about various government policies — for example the equalization system — centre around their resource allocation effects. It is interesting to note in passing that both supporters and opponents of the current equalization system most often support their positions by resort to resource allocation arguments. The importance of identifying individuals (in terms of labour force characteristics) induced to stay or move because of fiscal consideration again emphasizes the necessity of using migration micro-data.

In addition to being influenced by economic and fiscal conditions, migration may also affect the magnitudes of these variables in different regions, a fact which deserves closer attention by researchers. In- and out-migration can affect average income levels, rates of unemployment, rates of taxation and level and composition of government expenditures. In this regard, the whole relationship between regional housing prices (or more general indices of regional living costs) and migration warrants detailed study. This and other studies have incorporated the effects of regional cost of living differences on migration but the effects of migration on property values is virtually unexplored. This is in spite of the fact that it is generally accepted that at least part of a region's economic or fiscal advantage should be dissipated over time through capitalization in real property values.

Another area of inquiry that arises as a logical extension of the present study concerns examinaton of the cross-elasticities of migration response of flows between pairs of regions to changes in economic circumstances in third regions. A conceptual limitation of the logit model, as pointed out in Chapter 4, is that it implies that migration to a region, in response to improved economic circumstances (for example), will lead to equi-proportionate reductions in all other migration and staying probabilities. While preferable to the zero cross-elasticity implication of traditional models, this rigidity imposes a priori restrictions on the nature of migration response which could bias estimation results and policy simulations. The dogit model referred to in Chapter 4 provides the theoretical flexibility necessary for testing the cross-elasticity parameters but the model has not been used in migration modelling. Estimation of the dogit parameters would provide very useful information on the nature of migration adjustment.

A final general point worth mentioning is that closer integration of theory and empirical work would also result in an improvement in migration modelling. Relatively little theoretical modelling of the subtleties determining the locational choices of individuals exists within the mainstream of migration literature which is predominantly empirically oriented. Migration researchers have tended to borrow testable hypotheses from other applied fields in economics which do deal, on a theoretical level, with various aspects of population or labour force allocation. Although this is inevitable to some extent, greater attention to the formal theoretical foundations underlying econometric models could only lead to an improvement in the preciseness of the hypothesis tested.

While the preceding suggestions only scratch the surface of the possibilities for future research in the area of migration, they are indicative of the relatively broad areas which still remain unexplored or at least underexplored.

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