WEALTH ACCUMULATION AND PORTFOLIO SELECTION BEHAVIOR OF CANADIAN AND FOREIGN-BORN HOUSEHOLDS

by

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Wealth Accumulation and Portfolio Selection Behavior of Canadian and Foreign-Born Households

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ABSTRACT

Previous Canadian research in the field of the economics of immigration has been primarily devoted to an evaluation of the labor market performance of immigrants. This thesis focuses on the role of foreign-born households in Canada's asset market. An empirical analysis of accumulation and allocation of household wealth is conducted for a large sample of Canadian households *circa* 1983-84. Feldstein's extended life-cycle model is used to examine differential wealth accumulation behavior of the foreign-born *vis-a-vis* Canadian-born households. The empirical results confirm the existence of an inverted 'U' shaped wealth-age profile as predicted by the life-cycle model. However, the rate of wealth dissipation in post retirement years is very low for Canadian-born households relative to foreign-born households. In addition, public social security wealth displaced household savings for both the Canadian born and the foreign born. Furthermore, immigrants exhibit a stronger bequest motive than the Canadian born. Household portfolio analysis suggests that both groups reveal decreasing relative risk aversion. The foreign-born households have a greater propensity to hold real estate and debt than Canadian-born households. This study concludes that immigration not only affects household sector saving but also the composition of demand in the Canadian asset market.

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DEDICATION

In memory of my father

Mohammad Golam Satter

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CHAPTER 1

INTRODUCTION

1.1 Background

In recent years, saving has emerged as an important economic policy issue in Canada. This is reflected in Canada's recent preoccupation with the problem of capital formation, national debt and pension funding for an aging population.[1] In a capitalist economy there exist three sources of saving: household saving, corporate saving and public saving. In Canada these three sectors together saved 20.7 percent of GNP on average in the 1980s.[2] Among G-7 countries Canada's national saving performance ranks 4th (see Table A1.1 in Appendix). Currently, the household sector is the principal source of saving in Canada. Over the last three decades, the share of corporate saving in GNP has remained stable while the share of public saving decreased rapidly. However, over this time period the share of household saving increased significantly (see Figure 1.1). This historical trend reveals a certain degree of substitutability between public saving and household saving. In the last decade Canada's household saving rate was only below Italy and Japan among G-7 countries as demonstrated in Figure 1.2.

An alternative way to evaluate the saving performance of the household sector is to focus on the household's asset portfolio since savings result in asset accumulation. In the last two decades Canada's asset markets have gone through profound changes.[3]

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[1] A recent volume of Scandinavian Journal of Economics (vol. 94, no. 2, July 1992) is devoted to a wide range of theoretical and practical issues related to savings in OECD countries. This special volume was edited by Koskela and Paunio.

[2] The saving-income ratio was 22 percent and 23 percent in the 1960s and 1970s, respectively.

[3] The subsequent account of household sector portfolios is based on the Bank of Canada Review, July 1992, PP1-14.

Historical data indicate that the household sector responded to these changes rationally. The ratio of household net wealth to disposable income remained stable through the 1970s despite high inflationary expectations and the resulting low or even negative real interest rates in the mid-1970s. The household sector responded to this development by shifting wealth from financial assets toward real assets, especially housing, since real assets provided a hedge against inflation. The acquisition of real estate was financed primarily through borrowing. Within the portfolio of financial assets, households shifted wealth from marketable securities to deposits and annuity contracts. Despite low real interest rates in the mid-1970s, the wealth-to-income ratio remained stable through the 1970s because capital gains in real estate were offset by capital losses in financial assets. In the first half of the 1980s the household wealth-to-income ratio fluctuated widely due to the volatility of security and real estate prices. During the 1985-91 period, the household wealth-to-income ratio grew rapidly. One important source of this growth was the sharp increase in the relative value of real estate. Household debt dramatically increased in two periods: 1970-1979 and 1985-1991. In the first quarter of 1992 the debt-to-income ratio reached a record level of 78 percent. This is primarily attributed to the growth of mortgage debt rather than consumer debt.

These profound developments in household wealth accumulation and asset composition are the result of the changes in a variety of economic-demographic factors. Among economic factors, speculation in the housing market, intense competition among deposit institutions in the 1980s, capital losses in bonds in the 1970s, and the 1987 stock market crash were important. On the demographic side, the changes in the composition of households may have played a major role. As the baby boom generation matured and immigrant numbers grew, the size of the cohort currently aged between 26-45 is expanding.[4] Immigration flows in particular may change per capita wealth holdings

[4]Foot (1986) reported that recent immigrant inflows are concentrated in the baby boom generation whose birth dates range from 1947 to 1966.

primarily by three avenues: (i) bringing with them financial and human capital; (ii) changing the age composition of the population; and (iii) having a different propensity to save than their Canadian counterparts.

Although the potentially important role of immigrants in domestic saving and real estate demand has been recognized in the literature, the empirical analysis of immigrant wealth accumulation and portfolio allocation is limited.[5] Wealth accumulation and allocation of immigrants can be different from Canadians due to two fundamental reasons: (i) immigrants may have different tastes and preferences; (ii) immigrants may be different with respect to their lifetime budget constraints. Economic and demographic variables affect household choices through these two channels. There exist a priori reasons to believe that immigrants' preferences and budget constraints are indeed different from those born in Canada.

First, immigrants are not a random sample drawn from abroad. Indeed, the foreign born are doubly selected (Borjas, 1988). At the first stage, potential immigrants participate in a world wide immigration market. At the second stage, from the pool of these self-selected persons each of the immigrant-demanding countries (mainly Australia, Canada and the U.S.A.) selects immigrants based on a set of objective criteria. Indeed, the act of immigration itself may reflect that an immigrant is motivated to enlarge his or her income or market opportunities. Therefore, foreign-born households may have a

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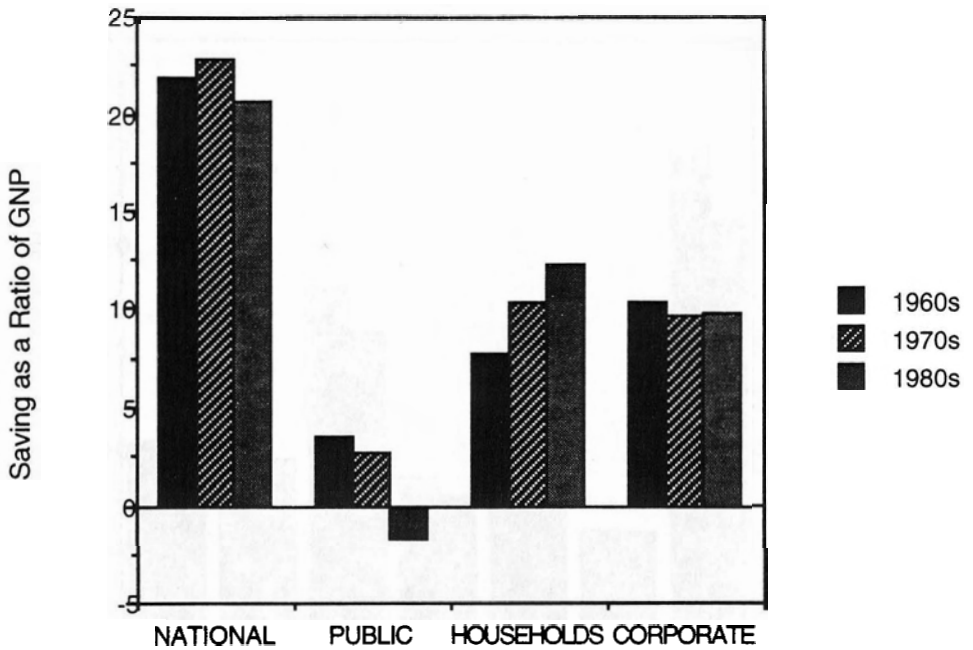
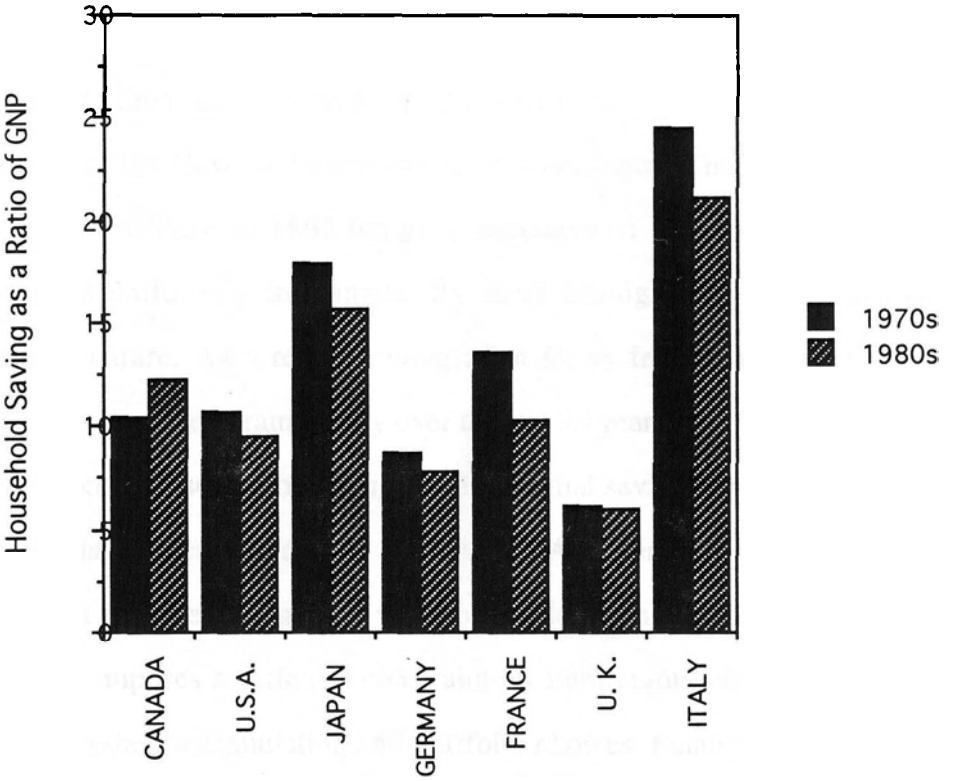
[5]In a recent article, the Bank of Canada (July 1992) acknowledges the effects of population aging on the balance sheet of the household sector but fails to recognize any possible effect of immigration on the household portfolio. Marr and McCready (1989) examined the effects of demographic variables including birth status on the pattern of consumption. DeVoretz (1989) also investigated wealth accumulation profiles of both the Canadian and foreign-born households. In Chapter 2 a review of these contributions is provided.

Figure 1.1
Gross Saving Rates in Canada



Source: Based on data derived from OECD National Accounts.

Figure 1.2
Household Saving in G-7 Countries



Source: Based on data derived from OECD National Accounts.

different set of income enhancing characteristics (education, experience, on-the-job training, occupation, language proficiency, etc.) as compared to Canadian households.[6]

Second, cross-country studies indicate a wide variation in the saving-income ratio across countries.[7] Of course, a significant part of this variation is due to country-specific economic factors. The other part may be attributed to socio-cultural differences and

[6]Chiswick and Miller (1988) and others found that although a typical recently arrived immigrant earned twenty-five percent less than a comparable Canadian-born, they catch up to the earnings of Canadian-born within 15 to 22 years of residence. Findings from other studies are reviewed in Section 2.5.

[7]For a brief discussion of recent findings see Koskela and Paunio (1992: 148-151).

differential family values.[8] Immigrant cultural values may reveal themselves as differences in time preference or utility gained from bequest or inter-vivo transfers. Thus, differential preferences may lead to differential accumulation and allocation behavior. Note also that over time immigration policy and hence immigrant selection criteria have changed to control the flow and composition of immigrants. Thus immigrant cultural values could change. Prior to 1962 the main objective of immigration policy was to maintain cultural uniformity in Canada. By 1967 immigration regulations became universalistic in nature. As a result, immigration flows from non-European cultural backgrounds have increased dramatically over the last 25 years (see Figure 1.3).

Another possible source of immigrant differential saving behavior is their limited access to Canada's federal Old Age Security (OAS) pension. Entitlement to this retirement benefit is linked to age and years of residence in Canada. Thus, the old age security program imposes a different constraint on immigrants *vis-a-vis* the Canadian born in relation to their accumulation and portfolio choices. Finally, even if immigrants are identical to the Canadian born in every respect except age, immigration inflows will affect aggregate saving in Canada according to the life-cycle hypothesis.

The above arguments provide an a priori empirical rationale to pursue this study. Previous research in the field of the economics of immigration has focused primarily on immigrants' labor market performance and given little attention to immigrant saving behavior.[9] There exists no study that evaluates the effects of public saving on private accumulation by birth status in Canada. On the other hand, main-stream literature on finance ignores the effects on the household's portfolio

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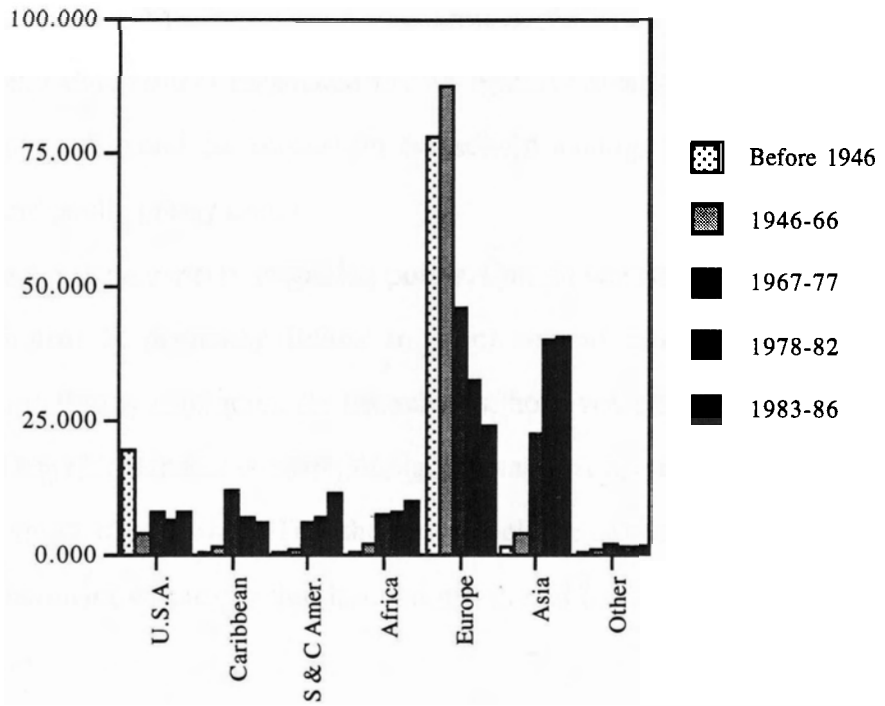
[8]Nightingale (1978) and Marr and McCready (1989) note the influence of cultural backgrounds on pattern of consumption and saving.

[9]A survey of Canadian empirical literature in the economics of immigration can be found in DeVoretz (1988).

Figure 3.1
Origin of Immigrants by Period of Arrival



allocation decision due to demographic factors by imposing strong restrictions on preference parameters. This limited analysis occurs even though we observe significant differences in household portfolio holdings by age, birth-status and other demographic characteristics[10]. The present study intends to fill these gaps in the literature.

[10]See Section 5.2.

1.2 Objective

The principal objective of this thesis is to analyze wealth accumulation and portfolio selection behavior of Canadian-born and foreign-born households in Canada. The study in general determines the impacts of economic and demographic factors on the accumulation and allocation of household wealth. Specific attention is paid to measuring social security wealth and its impact on household saving. In addition, the study addresses several public policy issues.

First, under the present immigration policy, Canada selects immigrants based on a set of criteria that is primarily linked to labor market conditions, demographic requirements and family affiliation. As households, however, immigrants do more than supply labor. They also demand consumption goods and assets, a role Canada has ignored in immigrant selection criteria.[11] This thesis will help determine whether the potential accumulation behavior of prospective immigrants should be incorporated in immigrant selection criteria.

Second, Canada's old age social security programs are based on two kinds of financing mechanisms: pay-as-you-go, or fully funded.[12] The Canada/Quebec Pension Plan (CPP/QPP) is fully funded from participant contributions over the working period of his or her life. However, other programs such as Old Age Security (OAS), Guaranteed Income Supplement (GIS), and Spouse Allowance (SPA) are based on pay-as-you-go system. Immigration may alleviate the dependency burden associated with the pay-as-you-go component of Canada's social security program.[13] This favorable outcome

[11]Under the business immigration program a certain amount of financial capital is a prerequisite for an immigration visa. However, once residing in Canada, this group can influence the asset market by demanding other types of assets.

[12]In a fully-funded system every person or every generation in the working period of life contributes to the fund which covers social security expenditures in their years of retirement. In a pay-as-you-go system a tax is collected and benefits are provided out of tax revenues in the *same* period of time.

[13]The working-age population is shrinking in Canada because the fertility rate is below the replacement rate and life expectancy is rising. The *dependency burden* will grow with the maturation of the baby-boom

depends on the age composition of immigrants, their income profiles and the degree of substitutability between public saving and the foreign born household saving. This thesis provides estimates of earning profiles and social security wealth by birth status. It is also recognized that social security wealth may be either a substitute for or complement to household fungible wealth (Feldstein, 1974, 1979).[14] If the degree of substitutability differs by birth status, immigration may alter the national saving rate via the social security channel. The study produces an estimate of this substitution effect.

Finally, as noted above, over the 1970-1990 period the household sector portfolio experienced profound changes. This could have both distributive and allocative implications. If the wealth elasticity of demand for business equities and stocks *vis-a-vis* real estate differs by birth status, immigration may lead to a reallocation of resources from business investment to residential investment. Similarly, if immigrants held a higher proportion of their portfolios in real estate *vis-à-vis* Canadians, then immigrants made capital gains and Canadians experienced capital losses from the rise in real housing prices in the 1970s and the second half of the 1980s.[15] Therefore, it is important to empirically analyze the role of immigrant *vis-a-vis* Canadian households on the demand side of asset markets. To this end this study develops and estimates a system of asset demand equations at various aggregation levels by the place of birth. This portfolio analysis will yield answers to several questions: (i) What are the demand elasticity

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generation and given the concentration of the recent immigration flow in the baby-boom age bracket. Immigration flows may alleviate the dependency burden in coming years if they belong to the age bracket preceding the baby-boom generation (see Foot, 1986).

[14]Recently, Felderer (1992) modified this theory by allowing an informal family security system (children as investment goods) as an alternative to the capital market and public social security programs. In industrialized countries like Canada, the capital market is well developed and the state performs some of the traditional family duties. Thus, this study adopts Feldstein's approach which is a special case of Felderer (1992).

[15]No conclusive evidence can be found in the recent housing demand literature about the role of immigrants. Baxter (1990) and Schwann (1990) found that immigration had a moderate effect on housing demand while the studies of Marr (1989) and Miyake (1992) imply a strong demand for housing by immigrants. This conflict can be rationalized if it is recognized that the methodology and data set vary across these studies.

coefficients of individual asset categories with respect to wealth? (ii) What are the impacts of key demographic variables on risk aversion and the consequent portfolio allocation? (iii) Does the share of nonmarketable assets such as social security wealth affect household portfolio allocation of marketable assets? (iv) Does the answer to the above three questions differ by birth status?

1.3 Methodology

To achieve the outlined objectives the following methodology has been adopted. The study proceeds by assuming that the wealth accumulation decision is strictly separable from the wealth allocation (portfolio choice) decision. Over a finite planning horizon a typical household first makes an optimal choice about consumption and earnings (i.e., labor supply and human capital acquisition). The rate of wealth accumulation is then solely dependent on the time paths of consumption and earnings according to Modigliani's pure life cycle theory. An extended version of this theory, due to Feldstein (1974, 1977), incorporates the impact of public social security wealth on household wealth accumulation. Adopting this extended life cycle theory, the study estimates wealth accumulation profiles for immigrant and Canadian households. In addition to the life-cycle motive, the wealth accumulation model incorporates the transfer motive for saving. Estimation of the wealth accumulation equation involves a two stage estimation method. At the first stage normal household earnings are predicted from the earnings equations by sex and place of birth. Unlike the previous immigrant earnings models, the present study explicitly takes into account the likelihood of differential labor market participation for the Canadian and foreign born using a probit model.

The portfolio selection problem of households has been analyzed at two different levels. First, assets have been classified into two broad categories: risky assets and riskless assets and then we estimate the demand function for risky assets by birth status

to determine whether immigrants differ from Canadians in relation to Pratt's measure of relative risk aversion. Second, estimates of a system of asset demand equations have been conducted at a disaggregated level. Apart from birth status, other demographic (age, family size) and economic variables are included in the demand system. The empirical work is based on data retrieved from Statistics Canada microdata tape: *Income (1983), Assets and Debts (1984) of Economic Families and Unattached Individuals.*

The thesis is organized in the following order. Chapter 2 reviews the literature on earnings, consumption, saving and portfolio allocation with specific emphasis on empirical studies related to life-cycle theory. The theoretical background of the wealth accumulation model is presented in Chapter 3. In Chapter 4 a model of earnings and labor force participation is provided with the relevant parameter estimates. Chapter 5 presents the method for measuring different components of household wealth and the associated descriptive properties of the data. Empirical work on wealth accumulation and portfolio selection is reported in Chapter 6 and Chapter 7 respectively. Chapter 8 provides the summary and conclusions.

CHAPTER 2

LITERATURE REVIEW

Introduction

The primary purpose of this chapter is to review both the theoretical and empirical literature on household saving and portfolio choice. The organization of this chapter is as follows. First, we present the pure life-cycle model and a brief review of major empirical findings related to this theory. Second, an extended version of the life-cycle model due to Martin Feldstein is reviewed. This model includes the effect of public social security on private saving. Third, a survey of the models of intergenerational transfer saving is presented. A summary of the recent debates between Modigliani, the leading proponent of the life-cycle motive for saving, and Kotlikoff and Summers, the leading proponents for the intergenerational transfer motive for saving, is also provided. Finally, a survey of models of household portfolio selection is provided. In each section of this chapter the relevance of the literature for empirical work is highlighted.

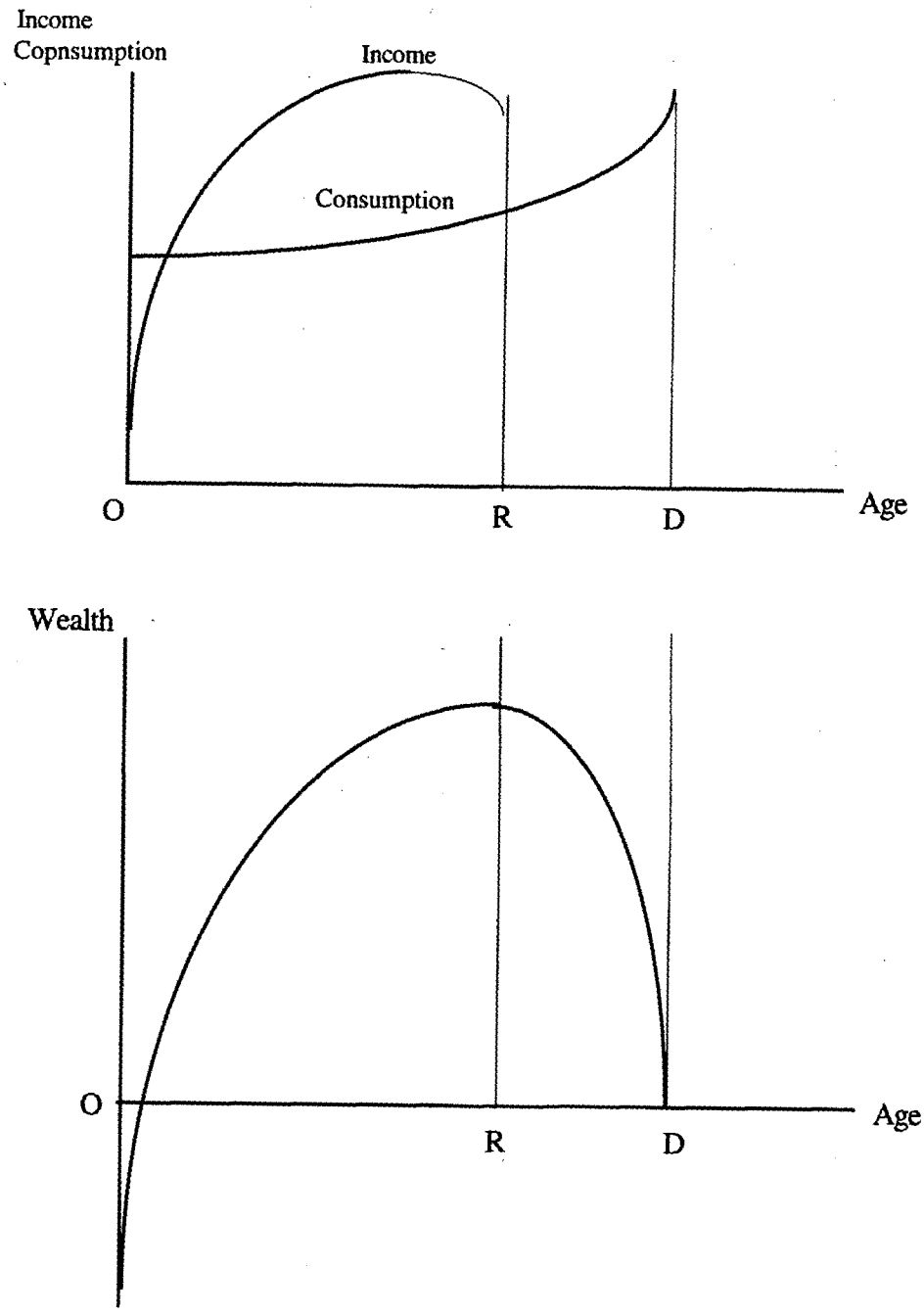
2.1 The Pure Life-Cycle Theory of Saving

The study of saving received wide attention in the early Keynesian period. Keynes (1936) outlined seven distinct motives for wealth accumulation in chapter 9 of the *General Theory of Employment, Interest and Money*. Some of these motives ('Precaution' and 'Foresight') implicitly refer to the phenomenon of life-cycle saving. The importance of this kind of saving was first explored by Harrod (1948). He recognized the existence of transitory accumulation of savings, or *hump wealth* accumulation over the individual's life cycle. Fisher (1930), on the other hand, presented the formal analysis of intertemporal allocation of consumption by utility-maximizing individuals. The famous life-cycle

model (LCM) of Modigliani (Modigliani and Brumberg, 1954; Modigliani and Ando, 1957) is an application of Fisher's optimal allocation theory to explain the existence and implications of Harrod's *hump wealth* phenomenon.

The life-cycle theory of saving presumes that households use capital markets to smooth consumption over the life cycle. This theory suggests that despite large fluctuations in disposable earnings, the level of consumption remains reasonably stable over an individual's lifetime. A typical individual's age-earning profile follows an inverted U-pattern. This income and consumption behavior together imply a hump-shaped wealth-age profile. It must be noted that the wealth accumulation profile can be hump shaped even if the earning profile does not follow an inverted U-pattern. As long as labor income ceased at retirement the wealth accumulation profile is likely to exhibit a hump shape. In Figure 2.1, we reproduce the textbook exposition of the life cycle model of saving. Panel A of Figure 2.1 illustrates the consumption and earning profiles of a typical individual with certain ages for retirement, R and death, D. If the only motive for saving is to finance consumption at retirement, the wealth-age profile follows a hump shape and reaches to age-axis at the date of death.

Figure 2.1: The Life Cycle Model



Empirical Evidence: Pure Life-Cycle Model

A large body of literature has been developed to empirically test the implications of the life-cycle theory of wealth accumulation. Here, a brief review of major studies is presented in chronological order.

Atkinson (1971) applied the life-cycle model of saving to explain the distribution of wealth in Britain. Based on the distribution derived by the Inland Revenue from estate duty returns, Atkinson reported that the top one percent of the adult population owned about one-third of the total personal wealth and the top ten percent owned approximately three-quarters of total personal wealth. The observed inequality may be due to the fact that people are at different stages of the life cycle; the top 10 percent may own more than their share because they are older and have accumulated wealth to finance consumption during retirement. If this were true, one should be more concerned about the distribution of inherited wealth rather than current wealth. Atkinson explored whether life cycle factors can explain the upper tail of the current distribution of wealth in Britain. Using Estate Duty statistics, he estimated the distribution of wealth by age and sex. His results indicated that the inequality within an age group was not significantly less than that for the population as a whole. From the observed age distribution of total wealth holdings, Atkinson concluded that the life-cycle phenomenon was not important in determining wealth-accumulation behavior in Britain.

However, Atkinson's rejection of the life-cycle model on the basis of observed wealth distribution may be misleading because it does not control for other economic-demographic factors specific to individuals. The life-cycle hypothesis can not be tested with cross-sectional data unless the key control variables (e.g., normal or permanent earnings, family composition, farm vs. non-farm family and place of residence) are taken

into account. The present study captures the influence of those control variables, in addition to age, on wealth holdings.

Mirer (1979) investigated wealth-holding patterns among aged married couples under the life-cycle framework. Using 1968 United States survey data for 2,713 married couples aged 65 to 99, Mirer showed that wealth does not decline in retirement. He used two alternative measures of household wealth: observed (unadjusted) wealth and wealth adjusted for cohort effect. The study found that unadjusted wealth increased modestly with age while adjusted wealth increased significantly with age in a sample of over-65 age cohort.[16] Adjustments for inter-cohort differences in wealth at retirement are made on the basis of the following assumptions: (i) that the relative distribution of wealth at retirement within each cohort is the same; (ii) that wealth at retirement grows at the rate g from cohort to cohort, and (iii) that the shape of the wealth-age profile at the post retirement stage is the same as that at retirement. Given these assumptions the typical age-wealth profile that will be experienced by the cohort aged 64 is expected to be (1+g)t times greater than the profile for the cohort aged 64+t in this sample. Based on his regression results Mirer concludes that precautionary, bequest, or both motives must be taken into account in addition to the life-cycle theory to explain wealth accumulation among the aged. Hence, the present study incorporates the intergenerational transfer motive in addition to the life-cycle motive of saving.

Burbidge and Robb (BR, 1985) investigated the asset accumulation behavior of major household groups in Canada (blue collar versus white collar) using 1977 survey of consumer finance data. In this study, BR estimated a net wealth equation in the form of a cubic spline function to allow considerable flexibility in the shape of the wealth-age

[16]Mirer also examined the wealth-age profiles at different percentile positions within the distribution of wealth and observes that wealth does not decline with age among the aged at all levels of wealth.

profile and to capture the nonlinear effect of predetermined variables (a vector of socio-economic characteristics) on wealth holdings. Their study suggests that an inverted U-shaped wealth-age profile exists for a 'typical' Canadian household. However, they observe that on the average, blue-collar households decumulate after retirement, while white-collar households do not. This study highlighted the fact that the life-cycle model may not be applicable for all demographic groups.[17] DeVoretz (1989) also investigated the wealth accumulation profiles of both Canadian and foreign-born households using 1984 survey of consumer finance data. He observed that the accumulation profiles of both demographic groups were consistent with the life-cycle model. The marginal impact of income on wealth was higher for immigrants than that for the Canadian born. Neither of the above two studies, however, captures the substitution possibility between household saving and public saving. If this substitution effect for one demographic group was different from the other, the above studies would not be robust to the inclusion of social security wealth.

An alternative method to explain household wealth holdings is to analyze the consumption-age profiles. The general presumption of an upward-sloping consumption-age profile and dissaving in retirement (Auerbach and Kotlikoff 1987) are not supported by two recent Canadian studies. Robb and Burbidge (1989) found that consumption-age profiles were downward-sloping late in the life cycle. Using Family Expenditures Survey data (1979, 1983, 1984), Marr and McCready (1989) also found a sharp decrease in consumer spending on all items and an increase in savings for the over-age-65 cohort.

[17]In recent years Canada has experienced a large immigrant inflow in the refugee and family class. Since immigrants in this entry category are concentrated in blue-collar jobs, one may find a correspondence between their accumulation function and BR's blue collar groups. However, it may be noted that unlike this study, the BR study ignored the substitution possibility between household saving and public saving. If this substitution effect for blue-collar households was different from that of white-collar households, the BR study would not be robust to the inclusion of social security wealth.

Their research complements the findings of earlier studies of Hamermesh (1984) and Beach, Boadway, and Bruce (1988).

Relevance for the Present Study: Pure Life-Cycle Model

Given the present state of empirical research it is not possible to draw any firm conclusion about the applicability of the life-cycle hypothesis in explaining household saving behavior. I first highlight some possible reasons for the apparent inconsistency of the pure life-cycle model with the data and then discuss the methods used in the present study to address these issues.

(1) Feldstein (1974) argued that the impact of social security wealth on the individual's simultaneous decision about retirement and personal saving must be incorporated into the pure life cycle model to explain wealth accumulation over the lifetime. An earlier empirical study found that if pension and social security wealth were taken into account, the decline in household wealth becomes pronounced in old age (King and Dicks-Mireaux, 1982).

(2) The appropriate planning horizon for individuals may not be their lifetime if they receive utility from their children's consumption. In that case the intergenerational transfer motive may become the predominant motive for saving (Kotlikoff and Summers, 1981).

(3) Given that the date of death is uncertain, a slower rate of decumulation in retirement is consistent with a pure life-cycle motive for savings (Davies, 1981).

(4) Ando and Kennickell (1985) have drawn attention to one important source of bias. They observe that aged households that are poor tend to unite with younger households and disappear from the surveyed population, which results in upward bias in the estimation of the mean wealth of the remaining independent households.

The first two points are explored in detail in the following two sections. In addition to the life-cycle motive, our empirical model captures the roles of social security and bequest motives for household wealth accumulation. Next we address the issue of uncertainty. In general, the effect of uncertainty about the date of death on saving is ambiguous. An individual who is optimistic about his or her longevity may decumulate wealth at a slower rate in retirement than an individual who is pessimistic about longevity. Thus, in the absence of any refutable prediction, it is not possible to identify what kind of accumulation behavior is consistent with the life-cycle model under uncertainty. This is one of the reasons why we observe simulation studies rather than empirical estimate of the life cycle model under uncertainty. This study is not an exception in this regard.

The last issue, which is purely empirical in nature, has been addressed in the following manner. One class of family in the present sample under the heading "other families" includes families with aged parents (or grandparents) and adult children. For these families an adult son or daughter may have been recorded as family head. Those families have been excluded from the sample to avoid possible estimation bias as noted by Ando and Kennickell.

2.2 The Extended Life-Cycle Theory

Feldstein (1974, 1977) extended the pure life-cycle model to incorporate the impact of social security wealth on private saving. He argued that social security had a dual impact: (1) it reduces personal saving because it substitutes for household wealth; and (2) it raises personal saving because it lengthens the retirement period for individuals who would otherwise work after age 65 in the absence of social security benefits. Thus, the net effect

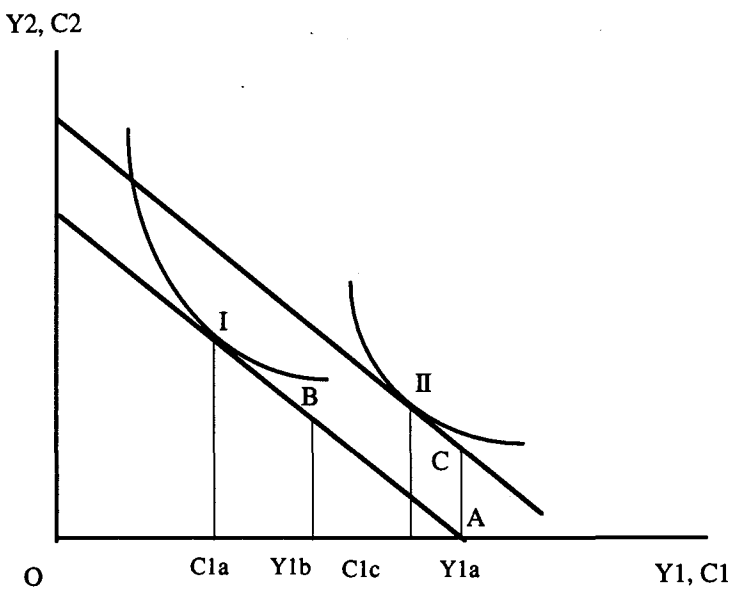
of social security wealth depends on the relative strength of the wealth replacement effect and the induced retirement effect.

Pointing to the United States old age social security system, Feldstein argued that social security policy implicitly imposes a "tax" on earnings after age 65 because the benefits are income tested. This particular feature of social security may induce individuals to retire at age 65. In Canada, the OAS pension is not means tested but other components of social security benefits are means tested. For example, the GIS is reduced by $1 for every $2 of other income and the SPA is reduced by $3 for every $4 of couple's combined monthly income from OAS. Thus, Feldstein's argument with respect to the impact of social security on retirement decision is likely to be applicable to Canada.

Figure 2.2 illustrates his basic arguments. The figure depicts two-period consumption-saving decisions for two different types of individuals. The horizontal axis measures income (Y) and consumption (C) before age 65 while the vertical axis measures those after that age. An individual who in the absence of social security would retire fully at age 65 earns Y_{1a} in period 1 and zero in period 2. He consumes C_{1a} and saves Y_{1a} - C_{1a} in period 1 to maximize his utility. Now let us introduce a fully funded social security program that reduces his income in period 1 by a payroll tax to Y1b and provides benefits equal to $(1+r)(Y_{1a} - Y_{1b})$. This implies that payroll taxes, $(Y_{1a} - Y_{1b})$ are just sufficient to provide benefits at the market interest rate, r. Thus, the individual's income position moves from A to B along the same budget line. For this individual personal savings are reduced by the amount of the tax, i.e., from $Y_{1a} - C_{1a}$ to $Y_{1b} - C_{1a}$. It also implies that public saving is a perfect substitute for private saving. This is indeed what one would expect under the pure life-cycle model. Now, consider another individual who would work beyond age 65 in the absence of social security. Point C indicates his initial income position reflecting positive earnings in both periods. In the absence of social security the individual's optimal consumption is at point II and his personal saving is Y_{1a}

- C_{1c}. If the introduction of a social security program induces the individual to retire fully at age 65, his income position will move from C to B and the consumption point will move from II to I. In this case, social security raises his personal saving from $Y_{1a} - C_{1c}$ to $Y_{1b} - C_{1a}$. But, an alternative assumption about the consumption-expansion path might yield a different effect of social security. From these two examples, it is clear that the effect of social security program on private saving is theoretically indeterminate.[18] A review of the empirical literature related to the extended life cycle theory is given below.

Figure 2.2. Social Security and Private Saving



Source: Feldstein (1974, P909)

[18]In a later paper Feldstein (1977) mathematically derived this results in a two-period model.

Empirical Evidence: Extended Life-Cycle Model

Early empirical studies of United States pension plan coverage and private savings have arrived at apparently contradictory conclusions. The cross-section studies of Katona (1964) and Cagan (1965) observed a complementary relationship between household savings and pension coverage. They interpreted this positive relationship in terms of "recognition" and "goal feasibility" effects. Pension plans remind prospective retirees about the importance of savings for old age consumption. Hence, individuals intensify their efforts to achieve a retirement saving goal.

The time series studies of Feldstein (1974) and Munnell (1974) report a substitute relationship between private savings and social security coverage. Both authors included a social security wealth (SSW) variable in the consumption (or saving) equation to determine the net displacement of savings. Feldstein's time series study indicated that a dollar increase in gross SSW raised the aggregate consumption in the United States by 2 cents which ultimately implies about 38 percent reduction in saving or investment, with a corresponding decrease in GNP by roughly 15 percent.[19] In a later cross-section study Feldstein and Pellechio (1979) also observed that social security significantly depresses private wealth accumulation. Munnell, however, reported a modest degree of substitution between private savings and SSW. Her findings were supported in a later cross-sectional study of United States private pensions (Munnell, 1976). In a recent study, Novos (1989) analyzed the robustness of the results of the Feldstein and Pellechio study (1979) using the same data set. The study found that Feldstein's results on the impact of social security were not robust either to the inclusion of alternative measures of SSW or to the inclusion of farm operators in the sample.

[19]Darby (1979), Kotlikoff (1979) and Blacer (1981) argued that Feldestein overestimated the effect of social security wealth on private saving. For a detailed discussion about this criticism see Danziger *et al.* (1981).

The study by Boyle and Murray (1979) estimated the net impact of the CPP/QPP and the OAS on Canadian household savings using aggregate time series data in a model similar to Feldstein and Munnell:[20]

$$S_t = a_1 + a_2 Y_t + a_3 W_{t-1} + a_4 CPT_t$$

where, S is household saving, Y is disposable labor income, W is private household wealth, and CPT is public pension wealth. The authors also estimated additional regression equations to test the significance of extra regressors, such as lagged income, unemployment rates, interest rates, retained earnings, unanticipated inflation, and labor force participation rates for males over 65 years of age. The first three variables take into account cyclical or transitory factors affecting savings; together with Y they represent permanent income. Retained earnings and unanticipated inflation are expected to have a negative effect on savings if households suffer from money illusion and consider corporate savings as a close substitute for regular savings. An increase in the interest rate is expected to decrease current consumption if the relative price effect (increase in the price of current consumption relative to future consumption) outweighs the income effect favoring consumption in all periods. The labor force participation variable is introduced as a partial check for the retirement effect. Their results indicate that public pension plans and old age security have no statistically significant effect on household sector savings. The results can be explained theoretically either in terms of the offsetting influence of wealth replacement and induced retirement effect (Feldstein, 1974) or with Barro's model (1974). In Barro's model households adjust bequests to offset any intergenerational transfers brought about by social security programs thus eliminating the impact on overall household savings. Boyle and Murray prefer the latter interpretation. In their opinion,

[20]Feldstein estimated the Ando-Modigliani consumption function augmented with a SSW variable, while Munnell estimated the corresponding savings function.

Feldstein's line of reasoning is not convincing, since the Canada Pension Plan component of the CPT variable in reality contained strong disincentives over the sample range due to the benefits offered to prospective retirees in the years following its introduction.

King and Dicks-Mireaux (KDM, 1982) examined the wealth-age profile and investigated its dependence on the provision for social security and private pensions using Canadian cross-sectional data extracted from the 1977 survey of consumer finances. Their main contribution is an estimation of a wealth-age relationship after controlling for differences in permanent income across families. The KDM study provided empirical support for: (i) an inverted U-shaped wealth-age profile, and (ii) the hypothesis that social security and private pension benefits reduce household saving, ceteris paribus. They concluded that the life-cycle model is applicable to households with net wealth greater than or equal to $2,500. However, the rate at which net worth declines after retirement is very low. They rationalize these findings in terms of uncertainty over the longevity of life.

Other recent studies also observe a decline in wealth after wealth reaches its peak in the age bracket 60-65, or after retirement.[21] The rate of decline depends on the measure of saving and wealth employed. If pension and social security wealth are taken into account, the decline in wealth becomes more pronounced in old age.

Relevance for the Present Study: Extended-Life Cycle Model

This study empirically determines the effect of social security on private saving for Canadian and foreign-born households separately. As illustrated in Figure 2.2, two

[21]This group includes: Diamond and Hausman, 1985; Ando and Kennickell, 1985, Hubbard, 1986 and Hurd, 1986.

individuals with different retirement plans may react differently with respect to social security, even if both individuals face a fully funded social security program. Even if we disregard Feldstein's induced retirement effect, the effect of the Canadian social security program on household saving may not be the one predicted under the pure life-cycle model for several reasons. First, old age income security programs in Canada provide a *real annuity* and it has no close substitute in the private annuity market. Social security wealth is nonmarketable and hence, individuals cannot use it as collateral. Second, the Canadian social security program is not fully funded. To date the majority of Canadians have received an increment in lifetime wealth from the social security system. This is an outcome of high real benefit levels and inadequate taxation in preretirement years. Perhaps, no age-cohort in Canada has fully paid its tax share for its social security benefits since the introduction of old age security pension in 1952, Guaranteed Income Supplement in 1967 and Spouse Allowance in 1975. Hence, the current social security system is likely to change individuals' intertemporal budget constraints. This increment in lifetime resources increases consumption and saving at every age in a life-cycle framework. Third, in an overlapping generation framework social security wealth may cause offsetting changes in private intergenerational transfers, which may lead to a reduction in the 'wealth replacement effect' of social security.[22]

The above arguments illustrate that the ultimate effect of a social security program on private net worth is theoretically indeterminate not only because of the induced retirement effect (Figure 2.2) but also due to its annuity characteristics and possible effect on bequest saving. As Feldstein (1974) wrote:

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[22]Parents recognize that any increment in their lifetime wealth, due to the intergenerational transfer mechanism built into the social security program, is to be financed by future generations of tax payers. Such an increase in social security benefits may induce parents to raise bequest saving to offset potential social security security liabilities of their children (Barro, 1974).

> As is often the case, a theoretical analysis can illuminate the ways in which a public policy affects individual behavior, but it cannot yield an estimate of the magnitude of the effect nor even an unambiguous conclusion about its sign. For this we must turn to an empirical investigation.

This study follows the course of Feldstein and choose not to impose any a priori restrictions on the effect of social security on household saving by birth status. Instead, the effects are to be determined empirically using microdata.

2.3 Models of Intergenerational Transfer Savings

In the savings literature there exist four alternative explanations for the intergenerational transfer motive for savings. This section briefly presents these models and reviews a representative sample of empirical literature related to each class of models.

Altruistic Model of Bequest

This model presumes that parents receive utility from the utility or well-being of their children. Barro (1974) presents a formal model of altruistic bequests. This group of models predicts that intergenerational transfers induced by the government are fully neutral because parents internalize the effects of such government actions on future generations by changing their planned bequests.[23]

Barro argues that households adjust bequests rather than consumption to offset any intergenerational transfers brought about by social security programs. If intergenerational transfers were operative, each dollar of lifetime increment in wealth (LIW) from the social security program would exactly displace a dollar of private transfer made in the form of bequests or inter-vivo gifts, since parents perceive LIW as a liability

[23]The neutrality results may not hold under certain circumstances. Suppose an altruistic parent intends to transfer wealth from his children to himself to maximize his utility. If the parent is unable to induce his children to transfer wealth, government intergenerational transfer programs will have real effects.

on their children. If the parents are initially in equilibrium regarding their relative position vis-a-vis their children in the absence of social security programs, they would increase bequests and other transfers to offset the tax that has been imposed upon their children. Consequently, Barro concluded that aggregate consumption would not be increased by a social security program, but bequests and other transfers would rise instead.[24]

Nonaltruistic Model of Bequests

This model assumes that parents leave a bequest because they receive utility directly from the level of bequests regardless of the economic well-being of their children. Parents' bequest decisions are made by comparing the appropriately discounted marginal utility derived from the bequest with that of their consumption. The optimal level of bequest is independent of the potential utility children receive from bequeathed wealth. Yaari (1966) and Blinder (1973) have made significant contributions in advancing a nonaltruistic model of intergenerational transfers.

A Family Annuity Model of Bequests

This model argues that parents and children establish an incomplete annuity market (Kotlikoff and Spivak, 1981). They enter into a mutually beneficial risk-sharing arrangement. Parents insure themselves against longevity risk by promising to transfer wealth to children upon their death in return for an old age annuity. In particular, if their children show a diminishing absolute risk aversion, parents will receive the highest annuity from the child with the largest earnings. As a quid pro quo parents will bequeath the largest amount of their wealth to that child.

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[24]See Kurz (1984) and David and Menchik (1985) for empirical tests of this hypothesis. None of these studies use Canadian data.

Exchange-Bequest Hypothesis

Since the seminal work of Bernheim, Schleifer and Summers (1985), the exchange-bequest model has received both theoretical attention and empirical support (Cox, 1987 and Lord, 1992). This class of models assumes that a potential bequest is used by a testator to control and manipulate childrens' behavior. Parents bequeath wealth to children in exchange for their services in the form of 'attention to parents', 'helping parents with chores', 'visits to the physician', etc.

Empirical Evidence: Transfer Motive Versus Life-Cycle Motive

The importance of the transfer motive relative to the life-cycle motive for household wealth accumulation has received wide attention since the publication of a United States study conducted by Kotlikoff and Summers (1981). Their study provides strong support for the significant role played by the bequest motive for saving. They observe that about 81 percent of capital stock in the United States is attributed to intergenerational transfers. If people bequeath, it is conceivable that savings during retirement are augmented by the social security program. They conclude:

> Life-cycle models of savings that emphasize savings for retirement as the dominant form of capital accumulation should give away to models that illuminate the determinants of intergenerational transfers (1981, p706).

In a recent paper, Modigliani (1988) responded to this attack on the life-cycle theory. The debate concerns the following question: Is the bequest motive the main source of existing wealth as opposed to the life-cycle motive? From the early study of Morgan *et al.* (1962) to the more recent studies by Kotlikoff and Summers (1981), Auerbach and Kotlikoff (1987) and Modigliani (1988) this question has been a focal

point. The answer to this question is crucial in designing economic policies towards the mobilization of domestic savings because the two different sources of savings are likely to respond to different stimuli. A review of the evidence on the relative importance of life-cycle and bequest motives is presented below.

Evidence Indicating a Strong Life-Cycle Motive

Several methods have been employed to quantify the relative importance of the bequest and life-cycle motives for savings. Morgan *et al.* (1962), Projector and Weiss (1964) and Barlow *et al.* (1966) have carried out studies in the United States using the survey method. This method involves asking individuals directly about their motives for saving. The major findings of the three surveys are reported in the first three rows of Table A2.1 in the Appendix. All of these studies signify a modest share of transfer wealth in total nonhuman wealth, which is a reflection of a strong life-cycle motive for savings.

Another method of quantifying the share of bequest wealth is to first estimate the flow of bequests and transform that into a stock of inherited wealth. Modigliani (1988) computed the share of transfer wealth based on his own definition of transfer wealth and the information on the flow of bequests as reported in three earlier studies. These three studies include Projector and Weiss (1964), Kotlikoff and Summers (1981), and Menchik and David (1983). The results are reported in the middle three rows of Table A2.1. The results show that the share of transfer wealth is less than 19 percent.

The third method derives the intergenerational transfer component of wealth as a residual from the estimated life-cycle wealth and observed wealth. Ando and Kennickell (1985) estimated a saving-age profile from survey data to obtain estimates of savings for

any given year by age-cohorts.[25] For any age cohort A_C, the nonbequeathed wealth in year t is the sum of the savings of cohort A_C up to year t.[26] The aggregate (national) non-bequeathed wealth in year t is obtained by summing over the age-cohorts present in that particular year. They observed that the nonbequeathed wealth lies between 15 to 20 percent of national wealth during 1974 to 1980 and 30 to 35 percent during the period 1960 to 1973.

The accuracy of this method depends on the appropriateness of the specification of the life-cycle model of savings. If an included exogenous variable in the life-cycle saving model is not orthogonal to any variable that affects bequeathed wealth, the estimates of life-cycle savings by age-cohort will be subject to a systematic bias. As an extreme example, we may refer to the variable: number of children. This variable affects both life-cycle and bequest savings of a household. If we include this variable in a pure life-cycle saving equation, the life-cycle saving will be overestimated and as a residual (observed total saving minus predicted life cycle saving) the bequest saving will be underestimated.

Another way to verify the relative importance of the life-cycle motive is to examine whether the rate of decline of wealth in retirement is high or low. The last two rows of Table A2.1 reports the findings of King and Dicks-Mireaux (1982) and Hurd (1986) with respect to net wealth accumulation. The former is based on Canadian data and the latter uses United States data. Both studies seem to confirm an important role of life cycle saving.

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[25]They used data from the Bureau of Labour Statistic Consumer Expenditure Survey for 1972 and 1973, United States

[26]Ando and Kennickell (1985) ignored the capital gains or losses in calculating cohort-specific self-accumulated or non-bequeathed wealth.

Evidence Indicating a Strong Bequest Motive

In this section we review evidence which argues for a quantitatively important role for bequests. The findings of a sample of representative studies that reveals either a strong role of the transfer motive or a weak role of the life-cycle motive are reported in Table A2.2 in the Appendix. Instead of repeating those findings in the text the focus here is on the underlying reasons for obtaining two extreme results in the empirical literature.

Wealth-accumulation behavior in old age provides indirect evidence for the role of bequests. Several empirical studies observe that the estimated age-saving profile is not consistent with the life-cycle hypothesis. Mirer (1979) observes a rising wealth profile in retirement. Thus, as earnings approach zero with retirement a possible wealth reduction will be completely offset by a decline in consumption.[27] Other studies (Lydall, 1955; Menchik and David, 1983) observe only a little dissaving in old age. These findings do not support the life-cycle hypothesis as stated by Modigliani (1988:23):

> In the stylized, pure life-cycle model, wealth must be clearly declining after retirement, and at a sufficiently fast pace to reach exhaustion at the end of life.

Does a low rate of decline of marketable wealth during retirement imply a strong bequest motive? Modigliani (1988) argues that the answer to this question depends on both the post- and preretirement time path of wealth accumulation. One can think of an infinite number of time paths from age 20 to 65 to reach a particular peak level of wealth on the eve of retirement. Each time path yields a different amount of national wealth. The earlier the typical time path tends to peak, the larger will be national wealth and the life-

[27]Note that if the life cycle hypothesis is true, then even in the presence of a bequest motive dissaving in retirement is likely unless income from accumulated wealth is large (Hurd, 1986).

cycle component of it. Thus, Modigliani concludes that a slow decline in wealth after its peak may be consistent with the notion that inherited wealth is quantitatively modest.

The most influential study suggesting a predominant role of intergenerational transfer motive is the work of Kotlikoff and Summers (K&S, 1981). They claim that the share of transfer wealth (bequests and gifts) in total nonhuman wealth may be as high as 81 percent (see Table A2.2). However, using the same data set Modigliani arrives at an estimate of only 17 percent as reported in Table A2.1. This discrepancy arises from the fact that Modigliani's definition of life-cycle wealth differs from that of Kotlikoff and Summers. Modigliani uses the following definition:

> ... self-accumulated wealth for an individual household is the summation of saving from the formation of the household to the present, where saving is defined as income (inclusive of capital gains) minus consumption (Modigliani, 1988: 26).

K&S differ from this definition in two ways. First, they consider the return on inherited wealth as a part of the flow of bequests while Modigliani considers this as part of income or life-cycle savings. Second, K&S impute labor income and consumption to all individual males and females age 18 and over. Modigliani considers the household as the basic decision-making unit and claims that expenditure on children age 18 and over must be considered as consumption by the parent. In Modigliani's view, K&S induce a downward bias in the estimation of the share of life-cycle wealth because they add the capitalized value of all expenditures for dependents age 18 and over to bequests and subtract the capitalized value of return on inherited wealth from lifetime income. Thus, the controversy regarding the motives for savings ultimately reduces to a controversy about the definition of life cycle and transfer wealth.

Relevance for the Present Study: Transfer Motive for Saving

This thesis considers bequests as nonaltruistic. Following Blinder (1973), the current study presumes that individuals receive utility directly from the amount of bequeathed wealth rather than the utility of their children. This choice is reasonable because the overlapping generation model of transfer saving (Barro and others) can not be tested with a cross-sectional data set such as that employed in this study. It may not be possible to resolve the controversy about life cycle versus transfer motive with this single cross section study. The present study should be regarded as an empirical example adding to this historical debate. This study, however, attempts to answer the following question: Does the principal motive for saving for Canadian-born households differ from that of foreign-born households?

2.4 Household Portfolio Choice: Theoretical Literature

An extensive theoretical literature has emerged on portfolio selection since the pioneering work of Markowitz (1952, 1959). This section begins with a brief discussion of Markowitz's one-period model of portfolio choice. Further developments of the one-period mean-variance model by Tobin (1958) are also outlined. Next we focus on the multiperiod or lifetime portfolio selection model developed by Samuelson (1969) and Merton (1969) and recently extended by Bodie, Merton and W. Samuelson (1992). One feature common to all of these models is that each model involves maximization of expected utility by selecting a portfolio in a world of perfect information, perfect capital markets and no taxes or transaction costs.

Markowitz-Tobin Portfolio Selection Model

Generally, in a world of uncertainty a rational choice is made by invoking the principle of expected utility developed by Von Neuman and Morgenstern. It is assumed that the individual's utility function is increasing and concave downward in wealth. The first part of this assumption implies that investors prefer more wealth to less while the second indicates that investors are risk averse. Denoting w as the end of period wealth, the utility function can be written as u =u(w). Expected utility, E[u(w)] depends on all the statistical moments of the probability distribution of w.[28] However, previous empirical studies show that the first two moments- mean and variance of the end of the period wealth are highly significant statistically. Thus, it is reasonable to express expected utility as a function of expected return and variance:

$$E\{u(w)\} = f\{E(w), v(w)\}$$

Expected utility is increasing in expected return and decreasing in the variance of the return. Thus, the indifference curve in the expected return-variance space is upward sloping as depicted in Figure 2.3. The indifference curves are convex downward indicating that a risk-averse individual needs increasingly larger amount of return, as variance increases, to maintain the same level of utility.

Any portfolio of risky assets can be represented by a point in the risk-return space. A portfolio is said to be efficient if for a given expected return it gives the minimum possible variance. The efficient frontier in the set of portfolio which has the minimum

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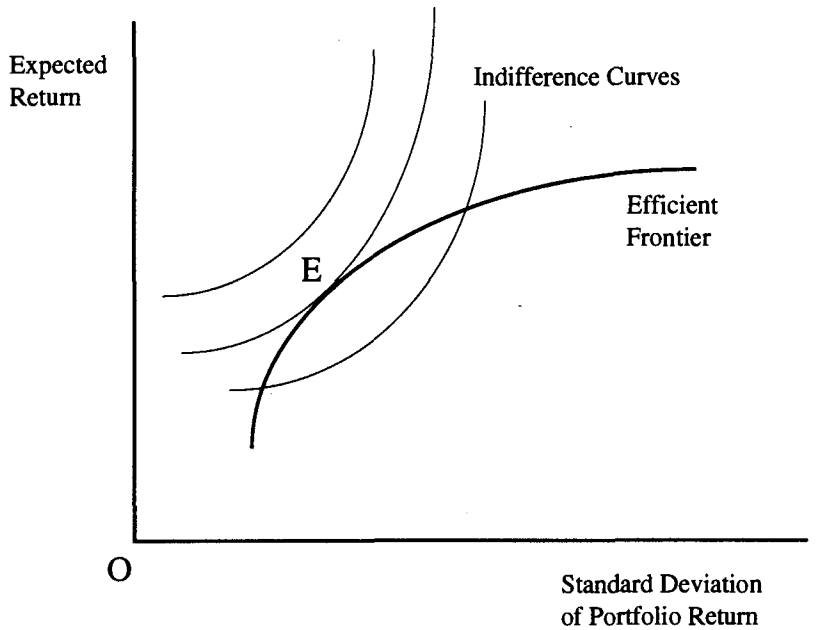
[28] A Taylor series expansion of the utility function u(w) around mean wealth, E(w)= m yields the following expression for expected utility:

$E\{u(w)] = u(m) + u'(m)\,E(w - m) + \frac{1}{2}u''(m)\,E(w - m)^2 + \frac{1}{3!}u'''E(w - m)^3 + \frac{1}{4!}u''''(m)E(w - m)^4 + ...$

where u(m) is the utility evaluated at mean wealth level.

variance for each level of expected return, or the maximum return for each level of variance. An individual selects a particular point from this efficient frontier given his subjective trade off between risk and return. The optimal portfolio can be found at the point of tangency between the efficient frontier and the highest attainable indifference curve. In Figure 2.3 the point E indicates such a portfolio.

Figure 2.3. Markowitz Portfolio Choice



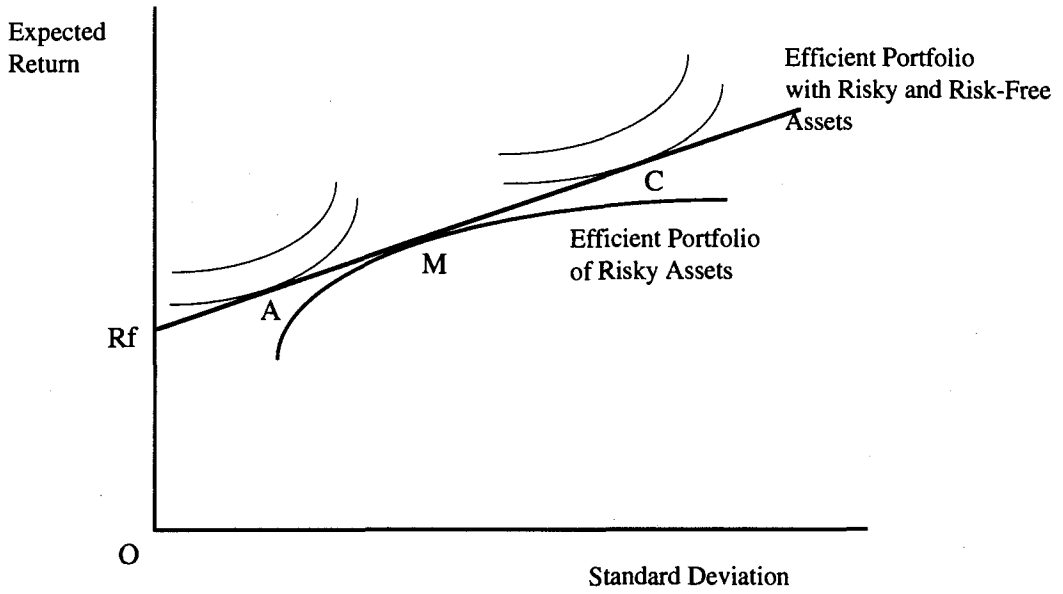
Tobin (1958) extended the Markowitz portfolio selection model to include a riskless asset. He discovered that the set of efficient risk-return combinations turned out to be a straight line if a riskless asset is included. The standard deviation of returns for a risk-free asset is zero and the covariance between any risky asset or portfolio of risky assets and a risk-free asset is also zero. The expected rate of return and standard deviation of a portfolio that combines the risk-free asset and a portfolio of risky assets can be written as:

$$E(R_{port}) = (1-\alpha_k)(r_f) + \alpha_k E(r_k)$$

$$E(\sigma_{port}) = \alpha_k \sigma_k$$

where, α_k and $E(r_k)$ are the proportion of portfolio invested in risky assets and the expected rate of return on risky asset portfolio respectively; r_f is the risk-free rate of return and σ_k is the standard deviation of the risky portfolio. Recognizing the fact that both the expected portfolio return, $E(R_{port})$ and the portfolio standard deviation, $E(\sigma_{port})$ are linear combinations of the underlying returns $[r_f, E(r_k)]$ and risk $[0, \sigma_k]$, it can be shown that the efficient portfolio frontier is a straight line in the presence of a risk-free asset (see Figure 2.4). At point R_f on the expected return axis the individual invests all of his or her wealth in the risk-free asset i.e., $\alpha_k = 0$. On the other hand, at point M investors pool all wealth in the risky portfolio, i.e., $\alpha_k = 1$. The points between R_f and M represent portfolios that combine the riskless asset with the risky asset portfolio. Points to the right of M can be achieved by leverage, that is by borrowing money at the risk-free rate and investing it in the risky portfolio (implying $\alpha_k > 1$). As noted earlier, all investors face the same efficient frontier in the asset market given the homogenous beliefs about the probability distribution of asset returns, but their portfolio selections may vary. A more risk averse individual will choose a point close to R_f such as the point A in figure 2.4, while a less risk averse individual will select a point such as C.

Figure 2.4. Portfolio Selection in the Presence of a Risk-Free Asset



Implications for the Present Study: Markowitz-Tobin Model

With respect to the present research, the Markowitz-Tobin model implies that a typical immigrant may hold a different portfolio than a typical Canadian born individual if their attitudes towards risk differ. There exist a priori reasons to believe that may be the case. The degree of risk aversion may depend on personal characteristics of an investor such as his or her age, socio-cultural background, marital status, number of dependents, etc. Indeed, the foreign born (especially recent immigrants) differ from the Canadian born with respect to these attributes. As noted in chapter 1, the role of demographic variables in portfolio choice in general has not been explored extensively. The only exception is the demographic variable, age. The appropriate framework to analyze the role of age is the Merton-Samuelson model of lifetime portfolio choice.

Merton-Samuelson Lifetime Portfolio Selection Model

Prior to the publication of Merton (1969) and Samuelson (1969), most analyses of portfolio selection were conducted under the Markowitz-Tobin mean-variance model or a more general type of one-period model. Both Merton and Samuelson address the problem of optimal portfolio selection and consumption rules over the lifetime of an individual. Merton analyzed the problem in a continuous-time framework, while Samuelson used a discrete-time framework. The implications of both models for household portfolio selection are the same. The individual is assumed to maximize expected lifetime utility subject to an intertemporal stochastic budget constraint. The only source of income in this model is returns from two assets: one is risk free and the other is risky. The individual's problem is to select optimal portfolio shares and consumption to maximize lifetime utility (see Appendix for the formal model). The solution to this problem has important implications. If the individual exhibits constant relative risk aversion (CRRA),

(1) the portfolio shares are independent of age and wealth level;

(2) the portfolio selection decision is separable from consumption decisions.

It must be noted that these results are based on the assumption of a perfect capital market, zero transaction costs, no taxes, no labor income or human capital. In a recent paper, Bodie, Merton and W. Samuelson (1992) relaxed the last assumption and found that age has an important impact on portfolio selection. In a simulation example, they have shown that once human capital and labor supply flexibility are taken into account, the demand for risky assets decreases as age increases. They put forward several implications of their model for empirical testing. Among these, two hypotheses are relevant for the present study given the available sample. First, an individual tends to invest less in risky assets as he or she nears retirement. Second, for any given age the individual will exhibit a more

aggressive investment strategy (i.e., greater risk taking) the greater the labor supply flexibility. The labor supply flexibility can be measured by age, occupational category and family characteristics.

Empirical Evidence: Household Portfolio Choice

The study by Friend and Blume (1975) is the first attempt to systematically analyze household demand for risky assets using cross sectional US data. Despite the existence of this seminal empirical work and other subsequent research based on United States microdata, empirical studies on household portfolio selection are limited in Canada. DeVoretz (1989) provides estimates of household asset demand using microdata for two broad categories of assets by birth status: financial assets and real assets (housing). The equations are estimated separately without imposing the adding up (balance sheet) constraint. The general form of the equations is:

$$\frac{\text{Total Financial Assets}}{\text{Net Worth}} = f(\text{age}, \text{age}^2, \text{Income}, \text{Education}, \text{number of children})$$

$$\text{Market Value of Housing} = f(\text{age}, \text{age}^2, \text{Income}, \text{number of children})$$

It should be noted that the appropriate scale variable in the asset demand equations is net worth, not income. This is required to satisfy the Brainard-Tobin (1968) balance sheet restrictions (sum of asset shares equals unity). Furthermore, financial asset demand is expressed in 'proportion' form while the housing demand is expressed in 'level' form. This specification suggests that demand for financial assets is linear homogenous in net worth but housing demand is independent of net worth. There is no obvious reason for this asymmetric specification. To the best of my knowledge, except DeVoretz (1989), there exists no other Canadian studies of portfolio choice that uses household microdata.

This thesis extends the Canadian literature on asset demand by estimating a system of share equations imposing the adding-up constraint. An empirical model is developed to test the implications of the lifetime portfolio selection model outlined above. Since this study uses cross-section data of households, the interest (or the rate of return) elasticity for asset demand cannot be estimated. However, the effects of net worth, tax rate, labor supply flexibility, age and human capital on portfolio choice are empirically determined, by birth status.

CHAPTER 3

WEALTH ACCUMULATION MODEL

Introduction

This chapter presents a formal theoretical model of wealth accumulation. It is assumed that wealth accumulation decisions are separable from wealth allocation or portfolio selection decisions. Theoretically, this assumption implies that the elasticity of marginal utility with respect to consumption is a constant.[29] Under this class of utility functions it is possible to obtain an explicit solution for optimal consumption and wealth holdings. Furthermore, we treat earnings as exogenous. The presumption of an exogenous stream of earnings is compatible with a variable labor supply if leisure is additively separable from consumption in the utility function and if the separability takes a Cobb-Douglas form (Beach, Boadway and Bruce, 1988). The basic implications of the life-cycle model remain unchanged if leisure and bequests are separable from consumption in the utility function.

This chapter begins with a standard problem of selecting an optimal consumption rule over the lifetime with no bequests and no public social security. From this problem explicit expressions for pure life-cycle consumption and wealth accumulation equations are derived. Then the pure life-cycle model is augmented by including first a bequest motive and then social security. The implications of this model for empirical testing are discussed with specific reference to foreign-born and Canadian-born households.

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[29]This result was first derived by Samuelson (1969) and Merton (1969) in a model where saving and portfolio selection decisions are made simultaneously.

3.1. Wealth Accumulation Model with Pure Life-Cycle Motive

Consider a representative household with a known span of life.[30] Over the lifetime the household receives an exogenously given stream of earnings, E(t). The individual uses capital markets to smooth consumption over his or her life cycle. It is assumed that the capital market is perfect where the individual can borrow or lend at the interest rate r. The individual obtains utility from a stream of consumption C(t). The utility function is additively separable and strictly concave in its arguments.

$$\text{Maximize } U = \int_{t=0}^{T} u(C(t))\, e^{-\delta t}\, dt \tag{3.1}$$

subject to

$$\int_{t=0}^{T} C(t)\, e^{-rt}\, dt = a_0 + \int_{t=0}^{T} E(t)\, e^{-rt}\, dt \qquad = K \tag{3.2}$$

where δ = the subjective rate of time preference;

r = market rate of interest;

a_0 = initial level of wealth;

K = lifetime wealth evaluated at time zero.

In the present analysis t=0 can be interpreted as the beginning of the planning period for a household with a life span of T years. The household chooses an optimal time path of consumption that maximizes the utility function (3.1) subject to the budget constraint (3.2). The solution to this problem is:[31]

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[30] The span of life of the head of the household can be regarded as the life span of the household.

[31] The *maximum principle* is used to solve this problem. For a detailed derivation of the result see Appendix. The term η indicates elasticity of marginal utility with respect to consumption and is defined as: $-\frac{u''(C(t))}{u'(C(t))} C(t) = \eta$.

$$C^*(t) = \frac{K\{(r-\delta)/\eta - r\}}{e^{\{(r-\delta)/\eta - r\}T} - 1} e^{\{(r-\delta)/\eta)\}t} \tag{3.3}$$

$$\text{Letting, } \mu = \frac{\{(r-\delta)/\eta - r\}}{e^{\{(r-\delta)/\eta - r\}T} - 1} \tag{3.4}$$

we rewrite equation (3.3) as:

$$C^*(t) = \mu\,[r, \delta, \eta, T]R\, e^{\{(r-\delta)/\eta)\}t} \tag{3.5}$$

The term μ is the marginal propensity to consume out of lifetime resources R. It depends on the rate interest , the preference parameters (δ, η) and the number of remaining years to live, T. From the above expression for μ we derive the following properties:

$$\frac{\partial \mu}{\partial T} < 0 \qquad \text{and} \qquad \frac{\partial \mu}{\partial r} > \text{or} \leq 0$$

A decrease in the number of remaining years to live (T) or an increase in age raises the marginal propensity to consume while the effect of the interest rate on propensity to consume is indeterminate. The sign of $\partial\mu/\partial r$ can be determined in a special case. The marginal propensity to consume is independent of the rate of interest if the utility function is logarithmic.[32] The effect of the interest rate on consumption can be indeterminate due to another reason. An increase in the interest rate reduces the implicit price of future consumption as well as decreases the present value of lifetime earnings. This latter effect is called by Summers (1981) the *human wealth effect* . The relative price effect induces households to consume more in the future (and less at present) while the sign and magnitude of the wealth effect depends on the household's income profile.[33]

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[32]The elasticity of marginal utility is unity for a log utility function. Setting μ=1 in equation (3.4) it can be verified that the marginal propensity is independent of the interest rate.

[33]This point can be easily illustrated with the following pair of Slutsky equations in the context of a two-period desecrate time utility maximization problem:

Given the optimal consumption profile (3.5) and an exogenous earning profile I derive the desired wealth holdings over the household's lifetime. By definition, wealth of a household at age A can be written as:

$$W^*(A) = a_0 e^{rA} + \int_{t=0}^{A} S(t)\, e^{r(A-t)}\, dt \qquad (3.6)$$

Wealth of a household at age A is its initial asset accumulated at compound interest to the present plus all of its savings accumulated to the present. Substituting E(t) - C(t) for S(t) in equation (3.6) and rearranging the terms we obtain:

$$W^*(A) = e^{rA}\left[a_0 + \int_{t=0}^{A} E(t)\, e^{-rt}\, dt - \int_{t=0}^{A} C(t)\, e^{-rt}\, dt\right] \qquad (3.7)$$

By assumption E(t) is exogenous. Denoting, $\int_{t=0}^{A} E(t)\, e^{-rt}\, dt = E(A)$ and substituting the optimal consumption path (3.5) in equation (3.7) we obtain optimal wealth holdings of the household at age A:

$$W^*(A) = e^{rA}\left[a_0 + E(A) - \int_{t=0}^{A} C^*(t)\, e^{-rt}\, dt\right] \qquad (3.8)$$

where, $C^*(t) = \mu\,(r, \delta, \eta, T) R\, e^{\{(r-\delta)/\eta)\}t}$

$$\frac{\partial C_0}{\partial P} = \frac{\partial C_0}{\partial P}\Big|_u + (E1 - C1)\frac{\partial C_0}{\partial A}$$
$$(+) \qquad\qquad (+)$$

$$\frac{\partial C_1}{\partial P} = \frac{\partial C_1}{\partial P}\Big|_u + (E1 - C1)\frac{\partial C_1}{\partial A}$$
$$(-) \qquad\qquad (+)$$

where P is the price of future consumption ($P = \frac{1}{1+r}$). C_0 and C_1 are normal goods. Both $\partial C_0/\partial P$ and $\partial C_1/\partial P$ are of ambiguous sign and depend on whether in period 0 the individual is a net lender (C1 > E1) or borrower (C1 < E1).

Equation (3.8) states that household optimal wealth holdings at any age depend on the stage of the life cycle, the household's total earnings to date, the rate of interest, the preference parameters and initial (at the beginning of economic age) human and nonhuman wealth. The optimal stream of consumption for the case $r > \delta$ is illustrated in Figure 3.1. For an individual whose earnings cease at retirement, the profile of wealth holdings indicated by equation (3.8) is drawn in the bottom portion of Figure 3.1. This desired wealth-age profile $W^*(t)$ is drawn for given taste parameters (δ, η), interest rate (r), initial assets (a_0), retirement age (N) and stream of labor income (E(t)).

3.2 Wealth Accumulation Model with a Bequest Motive

Now I incorporate a bequest-motive into the original utility maximization problem presented in the last section. Assume that the household head begins his or her economic life with inheritances b0. The problem is to choose an optimal bequest B_T and a stream of consumption C(t) to maximize utility. In contrast to Barro's altruistic model of bequests, the study assumes that the household receives direct utility from a bequest itself rather than the utility of its heirs. Following Blinder (1974) it is further assumed that utility from a bequest, $V(B_T)$ is separable from utility of consumption, U(C(t)). The problem can be stated as:

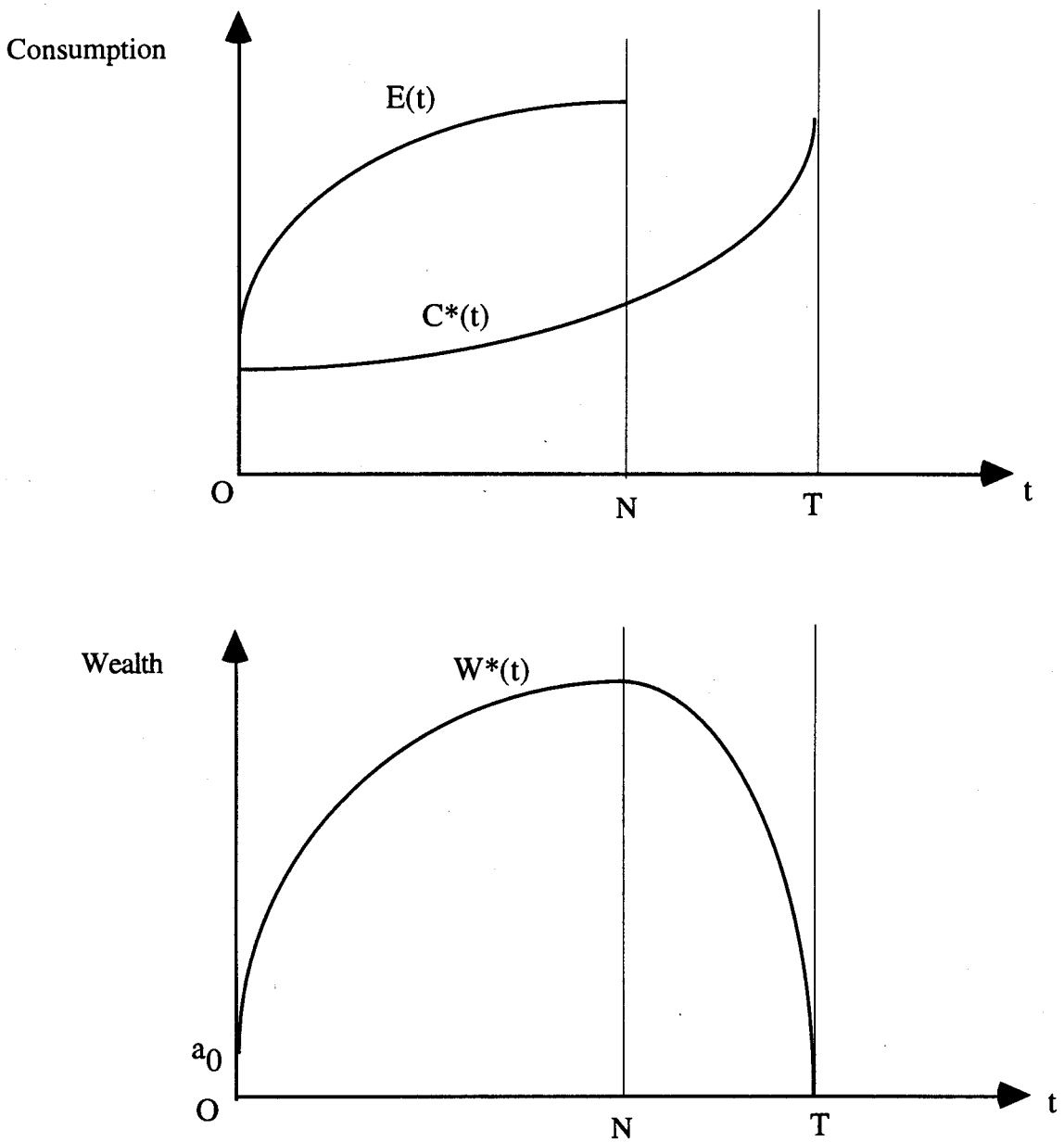
$$\text{Maximize} \qquad U = \int_{t=0}^{T} u(C(t))\, e^{-\delta t}\, dt + V(B_T)^{-rT} \tag{3.9}$$

subject to

$$\int_{t=0}^{T} C(t)\, e^{-rt}\, dt + e^{-rT} B_T = b_0 + \int_{t=0}^{T} E(t)\, e^{-rt}\, dt \tag{3.10}$$

$$= R$$

Figure 3.1: Life cycle Consumption and Wealth Accumulation Profiles



The solution to this problem yields optimal consumption and bequest plans:[34]

$$C^*(t) = \mu\,(R - e^{-rT} B^*_T)e^{\{(r-\delta)/\eta)\}t} \tag{3.11}$$

$$B^*_T = \beta\, Re^{\{(r-\delta)/\eta)\}T} \tag{3.12}$$

where, $\beta = \dfrac{\mu}{(1 + \mu e^{\{(r-\delta)/\eta - r)\}T})}$ with $\dfrac{\partial\beta}{\partial T} < 0$ and $\dfrac{\partial\beta}{\partial r} > \text{or} \leq 0$; μ and β are the marginal propensity to consume and bequeath respectively. As before, μ is defined by equation (3.4). Notice that the optimal consumption path described by equation (3.11) is the same as that of equation (3.5), except that lifetime resources are reduced by the present value of the bequest ($e^{-rT} B^*_T$). From equation (3.12) it is clear that the desired bequest is a certain proportion (β) of lifetime resources, where the proportion varies with the length of life, tastes and interest rate. In particular, the propensity to bequeath (β) decreases as the number of remaining years to live (T) increases. The effect of market interest rates on the propensity to bequeath is indeterminate. Obviously, the overall effect of interest rates on bequests is indeterminate as well. An increase in the interest rate reduces the implicit price of bequests (e^{-rT}) and decreases the present value of lifetime resources (R). Thus, if a bequest is a normal good, the net effect of interest rates on bequests is indeterminate.

Given the definition of household wealth at any age A (see equation 3.6), the wealth accumulation equation can be derived by using optimal consumption and bequest plans. The basic procedure is the same as that outlined in the last section. The distinctive features of this model compared to the previous model are that the consumption profile

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[34]The solution is derived using the same procedure as before except that I do not impose the restriction W(T) =0 because wealth holdings at the date of death become a choice variable due to the bequest motive. To obtain explicit functions it is assumed that the elasticity of marginal utility of bequest with respect to bequest is the same as the elasticity of marginal utility of consumption with respect to consumption:

$$-\frac{V''(B_T)}{V'(B_T)} B_T = -\frac{u''(C(t))}{u'(C(t))} C(t) = \eta$$

will lie below the pure life-cycle profile [C*(t) in Figure 3.1] and the humped shape of the wealth profile will be less pronounced.

3.3 Social Security and Private Wealth Accumulation

In general, old age social security programs involve three types of income transfers: intertemporal, intergenerational, and intragenerational. Pure intertemporal transfers of earnings over the life cycle imply that the social security program is functioning as a substitute for private capital markets. First, I focus on the intertemporal transfer aspect of social security. The old age social security wealth is introduced into the wealth accumulation model of the last section. Consider an old age social security system which provides a stream of benefits Q(t) after retirement ($t \geq N$) and reduces earnings prior to retirement ($t < N$) by imposing a proportional social security tax θ. Introduction of this program yields a new constraint:

$$\int_{t=0}^{T} C(t)\, e^{-rt}\, dt + e^{-rT} B_T = a_0 + \int_{t=0}^{N} (1-\theta)E(t)\, e^{-rt}\, dt + \int_{t=N}^{T} Q(t)\, e^{-rt}\, dt \qquad (3.13)$$

Equation (3.13) states that a future stream of consumption and bequests are financed by inherited assets a_0, after-tax earnings, $(1-\theta)E(t)$ and a future stream of social security benefits, Q(t). If the social security program provides an implicit rate of return equal to the market rate of interest, the present value of lifetime taxes paid will be equal to the present value of lifetime benefits received:

$$\int_{t=0}^{N} \theta\, E(t)\, e^{-rt}\, dt = \int_{t=N}^{T} Q(t)\, e^{-rt}\, dt \qquad (3.14)$$

Equation (3.14) implies that the social security system is fully funded. In this situation the intertemporal budget constraint remains unchanged. Therefore, the optimal consumption and bequest plans (given by 3.11 and 3.12) also remain unchanged. Thus, a fully-funded social security program simply replaces private wealth dollar-for-dollar leaving the household's entitlement wealth unchanged.

Now consider a social security program which is not fully funded, i.e., the system involves an intergenerational and/or intragenerational transfer. If the present value of social security benefits is less than the present value of taxes, the household's lifetime wealth will be reduced. The household will bequeath less and consume less at every age under the assumption of normal goods. Consequently, the replacement of private wealth will be less than one-for-one. On the other hand, if the system involves an increment in lifetime wealth, a dollar increase in social security wealth will lead to a greater than a dollar decrease in private wealth holding. It is important to note that the magnitude of the departure from dollar-for-dollar replacement effect depends on the stage in the life-cycle, preference parameters and the rate of interest.[35]

So far the wealth *replacement effect* of social security has been explained . Feldstein (1974, 1977) argued that the social security program affects private wealth through an alternative channel. As noted in section 2.2, the social security program affects the labor supply decision and hence earnings of individuals who would work after the standard retirement age (65). The program provides benefits after age 65 and imposes an implicit tax on earnings in the form of an earnings test. Therefore, individuals who would work in the absence of social security may change their labor supply or retirement decisions. As an extreme case, as shown in Figure 2.2, those individuals may retire fully

[35]By differentiating equation 3.11 and 3.12 with respect to R it can be verified that $\delta C^*/\delta R$ and $\delta B_T^*/\delta R$ depend on those terms.

at age 65. This early retirement (relative to their previous plan) will induce them to save more. Feldstein named it the *induced retirement effect.* The net effect of social security on private wealth is ambiguous because the induced retirement effect operates in opposite direction of the wealth replacement effect. [36]

3.4 Implications of the Extended Life-Cycle Theory for Wealth Accumulation Profiles of Immigrants vis-à-vis Canadian Born

I began this chapter with a formal life cycle model (Modigliani and Brumberg, 1954) and then extended it, first by including bequests (Blinder, 1974), and second, by including social security (Feldstein, 1974, 1977). The implications of this theory for the wealth accumulation behavior of foreign-born and Canadian-born households are discussed in this section.

In the framework of the present theory, the optimal wealth holdings of immigrants may differ from those of the Canadian born due to two basic reasons: (a) foreign-born households may face a different intertemporal budget constraint compared to Canadian-born households and (b) foreign-born households may have different tastes and preferences compared to those born in Canada. It must be noted that within the framework of the present model demographic variables can affect household wealth holdings only through these two channels. It is relevant to note the arguments of Marr and McCready (1989) in this respect. They argued that consumption patterns may differ by birth place for two "generic causes":

> ... (1) since consumption patterns differ by age, income, education, gender, occupation, and other factors, the foreign-born may differ from the Canadian-born on one or more of these characteristics; (2) cultural, social or assimilation factors

[36] In order to show the result mathematically, it is necessary to include 'leisure' in our utility function of section 3.2. Since the inclusion of social security does not change the basic implications of the life-cycle model and the sign of the effect is indeterminate, I choose not to expand this model further.

> impart differences to consumption patterns. Cultural and background characteristics may impart permanent consumption differences to the foreign-born while assimilation factors could be temporary so that consumption differences disappear over time. (Marr and McCready, 1989, P6).

The present study argues that the factors in the first category affects household wealth holdings primarily through the intertemporal budget constraint while the socio-cultural factors primarily work through the channel of taste and preferences.[37] With this understanding in mind, we now put forward *a priori* reasons for different budget constraints and different preferences by birth status.

Different Intertemporal Budget Constraint

From equation (3.13) it is clear what factors determine the lifetime resources available to households. These are: inheritance or initial assets (a_0), the earnings-profile over the life cycle and social security wealth.

First, by definition the foreign-born population is the first generation of residents in Canada. Therefore, their inheritance or initial assets at the beginning of economic life is expected to be lower than the Canadian-born population.

Second, the age-earnings profile of the foreign born is expected to be different than that of the Canadian born. The average age of immigrants at entry indicates immigrants enter Canada either at the last stage of their schooling period or after the completion of formal education. Nonetheless, they need to invest a larger fraction of their human capital, compared to the Canadian born, to produce further human capital that is *specific* to the Canadian labor market (e.g., language proficiency, formal education, vocational training, firm-specific training etc.). Thus, it would be expected that an immigrant's earnings profile would remain below the profile of a Canadian born individual at the initial stage after entry. Subsequently, the high rate of accumulation of

[37]Of course, one may argue that age, gender, occupational background not only affect earnings but also affect tastes and preference. This study chooses not to endogenize preference.

human capital after entry may reduce current earnings but ultimately raises future earnings. Apart from the human capital arguments, the earnings differential may also arise due to market discrimination by birthplace.

Third, immigrants have limited access to one important component of Canada's social security program due to the existence of a residency test.[38] A typical immigrant enters the Canadian labor market between ages 30 to 40 when potential earnings are high. Given the progressive tax structure in Canada, they will be subjected to a high marginal tax rate, but receive a lower rate of OAS benefits.[39] It is reasonable to expect that for a given age, a typical immigrant's social security wealth will differ from that of a typical Canadian born individual. In response to this limited access to the OAS program an immigrant is expected to accumulate private wealth at a higher rate prior to retirement compared to a Canadian-born household, *ceteris paribus* .

Different Tastes and Preferences

From equation (3.11) and (3.12) it is clear that optimal consumption and bequest plans depend on the rate of time preference (δ) and the elasticity of marginal utility with respect to consumption (η). Thus, the resulting accumulation profile will vary by birth status if the foreign born possess a different δ or η compared to the Canadian born.[40] It is widely believed that immigrants originating from Asian countries have a stronger preference than the Canadian born for intergenerational transfers within the extended family unit.

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[38]The old age social security system in Canada includes three key programs: the Canada/Quebec pension plan (CPP/QPP), Old Age Security Pension (OAS), Guaranteed Income Supplements (GIS) and Spouse Allowance (SPA).

[39]Indeed, an earlier study (Akbari, 1988) shows that a typical immigrant pays more taxes net of all government transfer payments over his/her lifetime compared to a typical Canadian- born person.

[40]It may be noted that in the portfolio selection literature, η is interpreted as Pratt's measure of relative risk aversion.

Thus, immigrants with customs different from Canada may exhibit a different accumulation profile, *ceteris paribus*.

In this chapter the possible causes for differential wealth accumulation by birth-status have been identified based on an extended version of the life-cycle theory. An empirical model of wealth accumulation and the corresponding results will be presented in Chapter 6. To properly estimate the extended life-cycle model of household wealth the data on the household's entire earnings history and social security wealth are required. In a cross-sectional data set such information does not exist. As an alternative, I estimate normal household earnings and the present value of social security benefits for every member in our sample.[41] Normal earnings is estimated from the estimated age-earnings profile and can be interpreted as average lifetime household earnings. The next chapter presents an earnings model and the relevant empirical results. Chapter 5 discusses the method of estimating social security wealth and provides descriptive statistics of key economic-demographic characteristics of households.

[41]The rationale for using 'normal earnings' in the wealth accumulation equation can be found in chapter 6.

CHAPTER 4

LABOR MARKET PARTICIPATION AND EARNINGS OF IMMIGRANTS

Introduction

This chapter provides the life-cycle earnings model. The objective is to employ this earnings model to estimate permanent or normal annual earnings of all sample members. As noted at the end of Chapter 3, the estimated normal earning is used as a control variable in the empirical model of wealth accumulation.[42] This chapter is organized as follows. The first section presents a synopsis of theoretical earnings models and a review of Canadian empirical literature on immigrant earnings. Section 2 presents the general form of the econometric earnings model which explicitly incorporates the labor market participation decision. The final section provides the specific form for the earnings model and empirical results.

The life-cycle earnings profile of an individual depends on his or her labor supply profile and the associated wage profile. In the previous chapter we simplified our wealth accumulation model by assuming that the individual had an exogenously given stream of labor income. The presumption of an exogenous stream of earnings is compatible with a variable labor supply if leisure is additively separable from consumption in the utility function and if the separability takes a Cobb-Douglas form (Beach, Boadway and Bruce, 1988). Assuming that a typical individual satisfies these conditions, the present study

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[42]Feldstein (1979) used average earnings over two years as an estimate of normal earnings. King and Dicks-Mireaux (1982) used predicted earnings (adjusted for cohort effect) based on a cross-sectional earnings equation. In a growing economy the younger generation enjoys an earnings advantage over the older generation due to technological progress and capital accumulation. In such a world, for a given endowment of human capital, normal earnings of an individual of age A in year t will be higher than that of an individual of age A in year t - s. Since in a cross-section study it is impossible to determine the cohort effect, King and Dicks-Mireaux estimated the cohort effect based on an arbitrary assumption and extraneous information from a United States logitudinal study. This study predicts normal earnings without any arbitrary adjustment for the cohort effect. Details are given in the last section of this chapter.

focus on the labor market participation decision independently from the consumption decision

4.1 Economic Theory of Life-Cycle Earning

In the theoretical literature, *human capital theory* is the dominant theory of earnings determination.[43] An alternative to human capital theory is the *screening hypothesis* developed by Arrow (1973) and Spence (1973). Earnings differential by the place of birth or sex may arise due to a differential endowments of human capital or due to attributes unrelated to productivity. Human capital theory explains the former while the screening hypothesis explains the later.

Human Capital Theory

Human capital theory is applicable at two different levels. At the market level it can explain the equilibrium wage structure. At the individual level it focuses on an optimal set of actions an individual undertakes to maximize his/her lifetime earnings (or utility), given the market conditions. In particular, human capital theory attempts to explain the following stylized facts at the individual level:

> ... a life cycle earnings profile which is increasing at early ages and is declining towards the end of the working period. A wage profile which tends to increase over the life cycle with a weak tendency for wage reduction towards the end of the working period. An hours of work life cycle profile which is increasing at early ages and declining at older ages, with the peak occurring earlier than in the earnings or wage profiles. (Weiss, 1986:306)

[43]The principal architects of the human capital theory are Jacob Mincer (1957, 1958, 1962), Theodore Schultz (1960, 1961), and Gary Becker (1962, 1964).

It is primarily young people who invest in schooling because the stream of earnings will be received over a long working span. On the cost side, it is very likely that the opportunity cost of time in the form of foregone earnings is smallest for young people.[44] Let x(t) be an index for the amount of human capital used to produce more human capital. During the schooling period, x(t) is at maximum. After the schooling period, x(t) decreases with age because some human capital is being used to earn money in the market and the other component is used for on-the-job training investment. As long as x(t) remains positive, a worker's actual earnings will be less than his *capacity earnings* given the wage rate.

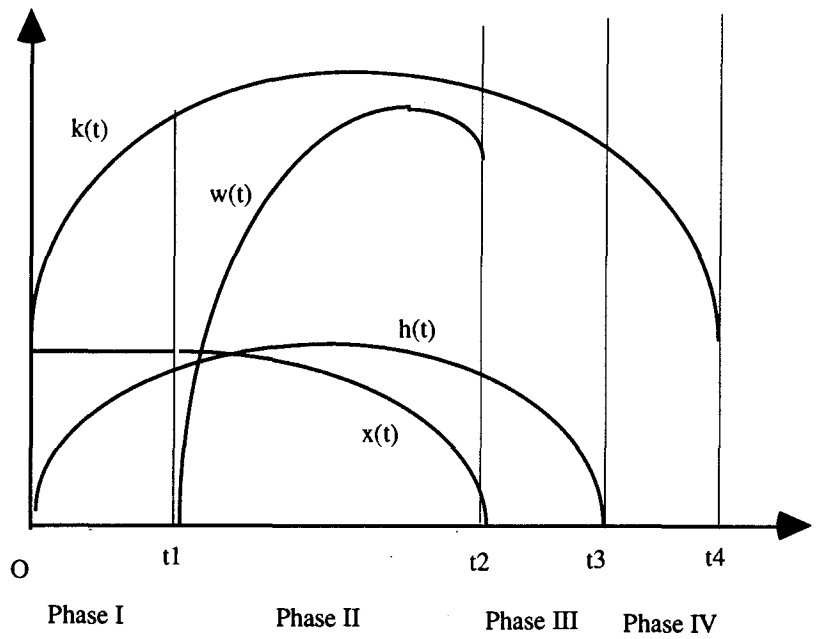
A worker's labor supply choices affect both present and future income because every hour spent on the job produces jointly earnings and knowledge. Following Weiss (1986) it is presumed that wages respond to the process of learning by doing. Therefore, a worker can influence his or her wages by varying labor supply over the life-cycle. The market value of the investment component (on-the-job training) in work decreases when workers approach retirement. Hence, it is in the worker's interest to intensify labor supply while young in order to increase the stock of human capital. Thus, the labor supply profile starts at a low level (indicating schooling, child bearing or caring), then reaches a peak near middle age and declines towards retirement. The stock of human capital increases until on-the-job training investment is outweighed by human capital depreciation. Initially the stock of human capital increases rapidly; then it increases more slowly as individuals leave school and start working. As the investment component of work declines, the stock of capital grows more slowly; reaches a peak and then declines. The wage profile of an individual follows a similar path to that of capital stock but with a lag since present investment activities affect future wages.

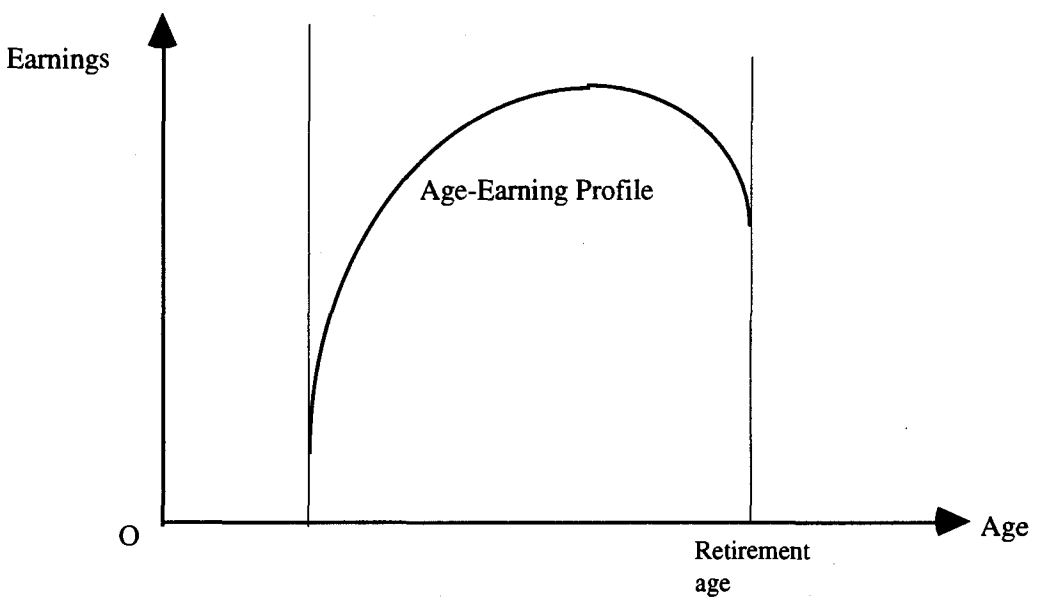
[44]The most productive time (ability) to learn is at a young age. (Lydall, 1955) To minimize the time cost of learning, individuals attend school early in their life cycle.

Figure 4.1 illustrates the age profiles of human capital stock, k(t), wages w(t), investment x(t) and work h(t). A typical individual passes through four phases over the life cycle: schooling ($x = 1, h > 0$); on-the-job training ($0 < x < 1; h > 0$); work ($x = 0, h > 0$); and retirement ($h = 0$).[45] Given these profiles, a typical life-cycle profile of annual earnings will be concave (see bottom panel of figure 4.1). Note that the earnings profile remains concave, even with an exogenously given constant hourly wage.

[45] $(1-x)h$ is time on the job spent in work and hx is time on the job spent in training (see Ben-Porath, 1967).

Figure 4.1: The age profiles of human capital, k(t), wages, w(t), investment, x(t) and work, h(t).





Note: The top pannel of the figure is derived from Weiss (1986:622)

Human capital theory has important implications for the differential earnings profiles for immigrant vis-à-vis Canadian-born households. As noted in the last chapter, a vast majority of immigrants enter Canada after the completion of their formal education.[46] Nevertheless, they need to invest a large fraction of their human capital to produce further human capital which is *specific* to the Canadian labor market. Thus it would be expected that an immigrant's earnings profile would remain below the profile of a Canadian born person at the early stage of the post migration life cycle. The high rate of country-specific human capital investment raises future earnings. Therefore, it is conceivable that after some time immigrant earnings profiles may converge or even overtake the earnings profiles of the Canadian born. This is obviously an empirical issue which will be addressed in subsequent sections.

Screening Hypothesis

This approach argues that earnings may depend on characteristics which are unrelated to productivity. Education may have little or no role in enhancing the productivity of workers (Spence, 1973). Nonetheless, firms view degrees and diplomas as signals of superior abilities and productivity. In a world of limited information, a profit-maximizing employer seeks a cheap screening device. Educational attainment serves as a low cost screen from the employer's perspective.

The screening hypothesis can be generalized to include other convenient screening devices such as place of birth, sex, and race. The principal element of this approach is that earnings of an individual are not only a function of his/her personal skills but also of characteristics which are ascribed to the group to which he/she belongs. Thus, if employers believe that immigrants have a smaller endowment of human capital specific

[46]The median age of immigrants at entry was 26.7 years in 1985 (Foot, 1986).

to the Canadian labor market and therefore are less productive on the average then birth status may serve as a low-cost screening device. Consequently, immigrants whose productivity characteristics are above the average will be subjected to statistical discrimination. Thus, the screening hypothesis suggests that the earnings determination process for an immigrant may differ from that of a Canadian born person. Hence, earnings equations should be estimated by birthplace.

4.2. Empirical Literature on Immigrant Earnings in Canada

Several Canadian studies exist to explain the earnings performance of immigrants and the native born. From the early study of Tandon (1977) until the recent study of Desilva (1992), all Canadian empirical studies basically used Mincer's (1974) human capital earnings model. The basic findings of some representative studies are summerized below.

Tandon (1977) used data on adult males from the 1971 census to estimate annual earnings equations. The study suggests that the rate of return on Canada-specific experience was higher than on the human capital acquired abroad. Tandon also found that given any human capital endowment, the earnings of immigrants from Western Europe (except UK.), Southern Europe, Asia, Latin America and the Caribbean lag behind the earnings of the native born and immigrants from the US and the UK.

With respect to immigrant earning assimilation in Canada, one of the widely cited studies is Chiswick and Miller (1988). They used 1971 and 1981 Canadian census data to investigate the determinants of male earnings by birth status. They observed that a typical newly arrived immigrant earned twenty-five percent less than a comparable Canadian born person. On the average, immigrants reach the earnings of the Canadian

born within 22 years of residence in Canada.[47] Similar to Tandon's study, they also found that post-immigration experience had a greater effect on earnings than pre-immigration experience.

Borjas (1988) is critical of studies based on a single cross section. Previous studies estimated the rate of assimilation from the effect of the 'years of residence in the host country' (YRES) on earnings. Borjas claimed that the coefficient of YRES in an earnings equation captured both the assimilation effect and the cohort effect. The latter effect refers to the mean differences in unobserved characteristics across successive entry cohorts. To isolate the cohort effect from the assimilation effect, Borjas pooled 1971 and 1981 census data and estimated earnings equations for three major immigrant demanding countries: Australia, Canada and U.S.A. The results suggest that the assimilation process is slower than that indicated by the cross-sectional studies because of the secular decline in the quality of immigrants over time. However, Borjas' study ignored the effects of wage inflation and productivity growth on earnings over the period 1971-81.

Desilva (1992) investigated whether there exists earnings discrimination between the foreign born and the native born in Canada. The study found no general tendency of discrimination against the foreign born. However, it found systematic earnings discrimination by sex.

All of the studies above ignored the self-selectivity bias arising from labor force participation choices. The observed earnings distribution is generated by individuals who

[47]Beujot and Rappak (1988) also found that immigrant groups who arrived from Southeast Asia, Southern Europe, Oceania, the Caribbean, South and Central America, and West and East Asia were not able to reach the earnings of Canadian-born individuals even after 20 years of residence in Canada. The recent vintage of immigrants (who arrived in the 1980s) faced adjustment difficulties in the labor market due to a lack of proficiency in English and poor educational attainment. Meng (1987) found a 'catch up period' of only 14 years using the 1973 labor mobility survey of Statistics Canada.

had a choice to enter or leave the labor force. That is, the observed earnings data are not a random variable. Indeed earnings are an outcome of the individual's self-selection process. Therefore, the ordinary least squares estimates of an earnings equation based on observed earnings will produce biased estimates of the regression coefficients (Maddala, 1986: ch. 9). This type of selectivity bias is crucial when addressing a wide range of issues on immigration. It is important to see if the findings of previous Canadian studies on immigrant earnings are robust after correcting for possible self-selectivity bias. To overcome the self-selectivity bias we provide a model of labor market participation and earnings in the next section.

4.3. A General Model of Labor Market Participation and Earnings

The purpose of this section is to present an empirical model of earnings which incorporates the labor market participation choice. The labor supply literature suggests that individuals' participation involves a comparison between their market wage and their reservation wage (Killingworth and Heckman, 1986). The reservation wage is the level of earnings at which the utility-maximizing amount of labor supply reduces to zero. Individuals compare the market value of their productivity characteristics with the benefits they would obtain from nonparticipation in the labor market. The former is their market wage and the latter is their reservation wage. It is assumed that (i) individuals know the potential benefits resulting from their labor market participation choice and (ii) their objective is to make a choice that maximizes their potential benefits. The following pair of structural equations will determine market and reservation earnings:

$$\ln Y_m = \mathbf{X}_1\beta + u_1 \qquad (4.1)$$

$$\ln Y_R = \mathbf{X}_2\alpha + u_2 \qquad (4.2)$$

where Y_m and Y_R denote market earnings and reservation earnings respectively. The structural component ($\mathbf{X}_1\beta$) of equation (4.1) represents the expected log of earnings if the individual participates in the labor market. Similarly, the term $\mathbf{X}_2\alpha$ indicates the expected log of benefits inclusive of the value of both pecuniary and nonpecuniary benefits, if the individual chooses not to work. The vector of observable variables $\mathbf{X}_1$ includes at least one variable which is not included in $\mathbf{X}_2$.[48] The error terms u_1 and u_2 capture the effects of unobserved characteristics such as motivation, ability on earnings and the measurement errors in earnings. $\ln Y_m$ and $\ln Y_R$ have a joint normal distribution with means ($\mathbf{X}_1\beta$, $\mathbf{X}_2\alpha$) and the covariance matrix

$$\begin{matrix} \sigma_1^2 & \sigma^{12} \\ \sigma_{12} & \sigma_2^2 \end{matrix}$$

Thenet benefit from labor force participation can be expressed as:

$$B^* = \mathbf{X}_1\beta - \mathbf{X}_2\alpha + u$$

or

$$B^* = \mathbf{X}\gamma + u \qquad (4.3)$$

where $\gamma = (\beta, \alpha)$, $\mathbf{X} = (\mathbf{X}_1, \mathbf{X}_2)$, $u = u_2 - u_1$ and $u \sim IN(0, \sigma^2)$.

Although by assumptions (i) and (ii) individuals themselves know their reservation earnings, Y_R, but the available data do not provide its distribution. Their observed market earnings are

$$Y_i = Y_m \quad \text{if} \quad B^* > 0,$$

otherwise $Y_i = 0$

[48]There exist two alternative conditions for identification of this model: (i) the market earnings equation (1) includes at least one independent variable not included in the reservation earnings equation (2); or (ii) $\text{cov}(u_1, u_2) = 0$.

Therefore, net benefit, B^* is not observable. The individual either participates in the labor market (if $B^* > 0$) or does not (if $B^* < 0$). This participation choice can be represented by a reduced form probit model:

$$L_i = 1 \qquad \text{if } B^*_i > 0$$
$$L_i = 0 \qquad \text{if } B^*_i < 0 \tag{4.4}$$

and the associated probabilities are:

$$\text{Prob[Participation]} = \text{Prob}[L_i = 1] = \text{Prob}\,[B^*_i > 0] = F(\frac{\mathbf{X}_i\gamma}{\sigma}) \tag{4.5}$$

$$\text{Prob[Non-participation]} = \text{Prob[Li= 0]} = \text{Prob}[B^*_i < 0] = 1 - F(\frac{\mathbf{X}_i\gamma}{\sigma})$$

where, F (.) is the cumulative density function and

$$\sigma^2 = \text{var}\,(u_2 - u_1) = \sigma_1^2 + \sigma_2^2 - 2\sigma_{12}$$

If the self-selection criterion (4.4) is ignored and the earning equation (4.1) is estimated by OLS using the observations for which positive earnings data are available, the resulting estimates will be biased. The conditional expectation of u_1 is no longer zero due to self-selectivity bias (Maddala, 1986, p. 224):

$$E(u_{1i} | \mathbf{X}_{1i}\beta > u) = -\sigma_{1u}\frac{f(z_i)}{F(z_i)} \tag{4.6}$$

where.

$$z_i = \frac{\mathbf{X}_i\gamma}{\sigma} \qquad \text{and} \qquad \sigma_{1u} = \text{cov}\,(u_1, u_2) = \frac{(\sigma_{12} - \sigma_1^2)}{\sigma}$$

and f(.) and F(.) are the density function and the distribution functions of the standard normal variable evaluated at $\mathbf{X}_i\gamma$. Similarly, for individuals who choose not to be in labor force, the conditional expectation of u_i can be written as:

$$E(u_{1i} | \mathbf{X}_{1i}\beta < u) = \sigma_{2u}\frac{f(z_i)}{1 - F(z_i)} \tag{4.7}$$

Denoting $\lambda_{1i} = \frac{f(z_i)}{F(z_i)}$ and $\lambda_{2i} = \frac{f(z_i)}{1 - F(z_i)}$ and using equation (4.6) and (6.7) the market and reservation earnings equations can be written as:

$$\ln Y_{mi} = \mathbf{X}_{1i}\beta - \sigma_{1u}\lambda_{1i} + V_{1i} \quad (4.8)$$

$$\ln Y_{Ri} = \mathbf{X}_{2i}\alpha + \sigma_{2u}\lambda_{2i} + V_{2i} \quad (4.9)$$

where V_{1i} and V_{2i} are distributed with the following moments:

$$E(V_{1i}|L_i = 1) = E(V_{2i}|L_i = 0) = 0$$

and

$$Var(V_{1i}|L_i = 1) = \sigma_1^2 - \sigma_{1u}^2 \lambda_{1i}(\mathbf{X}_i\gamma + \lambda_{1i})$$

$$Var(V_{2i}|L_i = 0) = \sigma_2^2 - \sigma_{1u}^2 \lambda_{2i}(\mathbf{X}_i\gamma + \lambda_{2i})$$

Note that the error terms V_{1i} and V_{2i} are heteroscedastic because the conditional variances of these error terms are related to the explanatory variables. If we estimate equation (4.8) by running OLS of $\ln Y_m$ on $\mathbf{X}_1$ the resulting estimators will be inconsistent and inefficient.[49] Heckman (1976) proposed a two-stage estimation procedure which yields consistent estimators of the earnings equation. At the first stage we obtain the maximum likelihood estimates of the parameters in γ from the probit model of labor force participation. The dependent variable is a dichotomous variable (in the labor force or not). Then an estimate of z is derived by using the estimated parameters from the probit equation. At the second stage we compute the ratio f(z)/ F(z) for each sample member and employ this as a regressor in the earnings equation (4.8). Now using

[49] They will be inconsistent due to the omission of a variable, $\frac{f(z_i)}{F(z_i)}$ which is not orthogonal to included explanatory variables. The inefficiency arises from the presence of a heteroscedastic error term V_1.

OLS consistent estimators of β and σ_{1u} can be obtained.The expected earnings of nonparticipants, had they chosen to participate in labor market, would be

$$E(\ln Y_{Ri}) = \mathbf{X}_{1i}\beta + E(u_{1i} | \mathbf{X}_{1i}\beta < u) = \mathbf{X}_{1i}\beta + \sigma_{1u}\lambda_{2i} \qquad (4.10)$$

Employing equations (4.8) and (4.10) the normal annual earnings of all sample members can be predicted. Note that the reservation earnings equation (4.9) can not be estimated directly because the distribution of reservation earnings is not observable. Using the estimated probit equation and the market earnings equation one can derive the parameters of the reservation earnings equation (Maddala, 1986; p229).[50]

4.4 Specification of Earnings and Probit Equations

In the last section the general econometric model for earnings and labor force participation is presented. Now the specific form of the model will be provided with a detailed discussion of relevant theoretical and empirical issues.

To capture the arguments of human capital theory an augmented version of Mincer's (1974) earnings model is employed. Mincer's model presumes that earnings are a function of the number of years of schooling, the number of years of post schooling experience in the labor market, experience squared (to capture diminishing returns to experience) and the number of weeks worked - a proxy for labor supply. He used age minus years of schooling minus 5 as a measure of experience. This measure is based on

[50]From the probit model one can obtain estimates of β_j/s and α_j/s for the elements of α and β associated to non-overlapping variables in $\mathbf{X}_1$ and $\mathbf{X}_2$, and for the overlapping explanatory variables in $\mathbf{X}_1$ and $\mathbf{X}_2$ we get estimates $(\beta_k - \alpha_k)/\sigma$. On the other hand from the estimate of market earnings equation (6.8) we obtain all the elements of β. For an explanatory variable j in $\mathbf{X}_1$, which is not included in $\mathbf{X}_2$, now we have β_j and β_j/s which can be used to compute σ. Thus, all the coefficients in the reservation earnings equation can be drived.

the presumption that an individual is either employed or in school at any particular time. In other words, individuals are assumed to have continuous work histories uninterrupted by childbearing, unemployment, etc. The cross-sectional data set used in this study does not provide the work histories of individuals. Consequently, the age variable is used as a proxy for the experience variable.

Different levels of educational attainment are represented by a set of dummy variables. For immigrants a distinction should be made between pre- and post-immigration schooling and experience. The previous literature suggests that the rate of return on post-immigration experience is higher than the return on pre-immigration experience. A similar argument may apply to schooling. This issue is particularly important for the recent immigrant cohort (post-1967). Since a large number of these immigrants originated from countries with schooling and labor market systems very different from those in Canada, Chiswick and Miller (1988) used a years-of-residence (YRES) variable to measure the post immigration labor market experience. Only grouped data are available on dates of arrival i.e., the period of arrival is known rather than the particular year of arrival. Therefore, the post immigration experience variable is represented by a set of dummy variables for different arrival periods. The main shortcoming of this approach is that the labor market progress (assimilation rate) of immigrants can not be isolated from the difference in quality among successive vintages of immigrants (cohort effect). To make a distinction between the assimilation and cohort effect more than one cross-sectional data set is needed. Unfortunately the Survey of Consumer Finances does not report the arrival year of immigrants.[51] Due to these data limitations the study uses a single cross-section to estimate earnings equations.

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[51]For example, the1977 Survey of Consumer Finances divided immigrants into two groups by period of arrival: immigrants who arrived before or after 1949. The 1983-84 survey on the other hand, documents the date of arrival by several successive periods. Therefore, Borjas' (1988) technique cannot be applied to isolate quality changes from the rate of assimilation.

The proposed earnings equation refers to potential rather than actual earnings (Blinder, 1976). Actual earnings of an individual may deviate from his or her potential earnings as noted earlier because of the individual's choice with respect to his/her labor supply. For example:

(i) Individuals may not work at all if reservation earnings exceed their market earnings;
(ii) Individuals may work full time but part of the year;
(iii) Individuals may work part time rather than full-time.

That self-selectivity bias whiches arises from the first aspect of labor supply has been explicitly taken into account in the general form of our earnings model presented in the last section. The second and third aspects of labor supply behavior can be accounted for by including two control variables in the earnings function. These are the 'number of weeks worked' and a 'dummy variable for full-time work'. Meng(1987) and Chiswick and Miller (1988) included the 'log of the number weeks worked' as an explanatory variable following the suggestion of Mincer (1974). Desilva (1992) used the log of the average weekly earnings as the dependent variable, which implicitly assumes a unit elasticity of annual earnings with respect to the number of weeks worked. The coefficient of the log of the number of weeks worked is expected to be unity.[52] This implies that the weekly wage structure is the same as the annual wage structure. To take into account the third aspect of labor supply a dummy variable for full-time work is included.

Up to this point the qualitative dimension of education and experience have been ignored . The human capital stock can not be accurately measured by only considering

[52] Previous literature on this elasticity estimate is not conclusive. Meng (1987) reported elasticities ranging from 0.673 to 0.895. Akbari (1988) obtained an elasticity coefficient greater than 2 when gender, part-time work and place of residence in Canada were omitted from the earnings equation. Inclusion of these variables reduced the elasticity coefficient to near unity (Akbari, 1988: 155).

the years of schooling and years of labor market experience. A student of law may spend the same number of years at a university as a physician. However, the market rate of return of the university degree may not be the same for both individuals. Similarly, the market rate of return on experience as a business executive will differ from that as an agricultural worker. The occupational structure in the labor market has evolved in such a way that in most cases a specific occupation is related to a specific kind of formal schooling. Academic institutions and professional associations often use aptitude tests to exclude persons from certain types of occupations (e.g., doctors, accountants and lawyers). Therefore individuals will tend to work in different occupations according to their abilities. To capture the effects of differential abilities and the specificity of occupational experience a set of occupational dummy variables are included in the earnings equation.[53]

A set of locational dummies representing the place of residence in Canada is also included in the earnings equation. The rationale for this variable is as follows. First, the labor market conditions in Canada differ significantly across provinces. Second, immigrants are concentrated in three provinces: Ontario, British Columbia and Quebec. This may cause a systematic earnings differential between Canadian-born and foreign-born workers due to differential locational preferences.

The previous literature also documented a systematic earnings differential by gender. In the case of Canada, Kuch and Haessel (1979) and Miller (1987) report that in general male workers obtain an earning advantage over females due to a greater endowment of human capital as well as the existence of earnings discrimination by sex. Hence, earnings equations are estimated by gender and birthplace. This will be helpful in

[53]Another aspect of human capital that is specific to the Canadian labor market is English and French proficiency, which could not be included due to lack of data.

comparing earnings of male native-born workers with those of male foreign-born workers as well as the earnings of female native-born workers with those of female foreign-born workers. The specific form of the general earnings model.is presented below using the following variable definations.

ln Y = natural logarithm of annual employment income
AGE = age represented in years

Dummy Variables for Educational Attainment
UNV = university degree
PSEC = some post secondary and
SEC = 9 to 13 years of elementary and secondary education.
Omitted category= less than or equal to 8 years of schooling

Control variables for labor supply:
lnWKS = natural logarithm of the number of weeks worked in a year
FUL = a dummy variable for full-time work
SELF = a dummy variable for self-employment

Occupational Dummy Variables:
MAD = managerial, administrative and professional occupations which include natural sciences, engineering, mathematics, social science, religion, teaching, medicine and health, artistic, literacy, recreational and related occupations;
CSR = clerical, sales and services
PCT = product fabricating, assembling and repairing, construction, trades, transportation equipment operation, materials handling, other crafts and equipment operation
Omitted Category = mining and quarrying processing, farming, horticultural and animal husbandry, fishing, hunting, trapping, forestry and logging

Dummy Variables for Family Characteristics and Place of Residence :

CHL6 = presence of children in the family six or less years of age
ATLN = primary residence in Atlantic region
PQ = primary residence in Quebec

PRA = primary residence in prairie provinces
BC = primary residence in British Columbia
Omitted Category = primary residence in Ontario

Dummy Variables for Urban residence:
URBAN = resident of an urban center with a population greater than 30,000
Omitted Category =resident of a rural area or a small urban center with a population less than or equal to 30,000

NLI = non labor income

Given the above definitions of variables the specific form of the market earning equation is written below:

$$\ln Y_{mi} = \beta_0 + \beta_1 AGE_i + \beta_2 AGE^2_i + \beta_3 UNV_i + \beta_4 PSEC_i + \beta_5 SEC_i + \beta_6 MAD_i + \beta_7 CSR_i + \beta_8 PCT_i + \beta_9 SELF_i + \beta_{10} \ln WKS_i + \beta_{11} FUL_i + \beta_{12} ATLN_i + \beta_{13} PQ_i + \beta_{14} PRA_i + \beta_{15} BC_i + \beta_{16} URBAN_i - \sigma_{1u} \lambda_{1i} + V_{1i} \quad (4.11)$$

Hypothesized signs are:

(1) $\beta_1 > 0, \beta_2 < 0$: Market earnings profile is concave in age (implying diminishing marginal returns to experience).

(2) $\beta_3 > \beta_4 > \beta_5 > 0$: Schooling raises earnings.

(3) $\beta_{10} = 1$: Annual wage structure is same as weekly wage structure

(4) $\beta_{11} > 0$: Full-time job provides greater opportunities for on-the-job training which raises potential earnings.

(5) $\beta_{16} > 0$: An urban worker may expect additional compensation to cover higher costs of employment.

I now focus on the determinants of reservation income. An individual's reservation income depends on the pecuniary benefits in the form of government transfer payments (unemployment insurance, social security benefits), non pecuniary benefits in

the form of the value of non market activities (household work, child care etc.), the costs of employment, investment income and age. The specific form of the reservation earnings equation is given below:

$$\ln Y_{Ri} = \alpha_o + \alpha_1 AGEi + \alpha_2 AGE^2_i + \alpha_3 UNVi + \alpha_4 PSECi + \alpha_5 SECi +$$
$$+ \alpha_6 CHL6 + \alpha_7 NLIi + \alpha_8 ATLNi + \alpha_9 PQi + \alpha_{10} PRAi + \alpha_{11} BCi + \alpha_{12} URBANi$$
$$+ \sigma_{2u}\, \lambda_{2i} + v_{2i} \qquad (4.12)$$

where, expected signs are:

(i) $\alpha_1 > 0$ and $\alpha_2 > 0$:

Reservation earnings are increasing in age due to experience and biological factors.

(ii) $\alpha_3 > \alpha_4 > \alpha_5 > 0$:

Schooling increases the level of minimum earnings required to induce workers to participate in the labor market.

(iii) The hypothesized sign for α_6 is positive in female equation but zero in male equation; i.e., the effects of the 'presence of children less than or equal six years of age' are expected to vary by gender.[54]

(iv) $\alpha_7 > 0$: an increase in non labor income such as unemployment insurance, old age social security benefits and investment income will raise reservation earnings.[55]

Let $\mathbf{X}_1$ is the vector of explanatory variables included in the market earnings equation while $\mathbf{X}_2$ is that vector for the reservation earnings equation. Some elements in $\mathbf{X}_1$ are not observable for individuals who do not work. These are occupational dummies, number of weeks worked and dummy variables for full-time and self-employment.

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[54] Since males are not continuously involved in caring for young children, it is reasonable to expect $a_6 = 0$ in the male reservation earning equation.

[55] See Berndt (1991, p.618) and Killingsworth (1983). It is assumed that leisure is a normal good. Therefore, an increase in non labor income induces workers to consume more leisure. This will raise the minimum earnings necessary to ensure labor market participation.

Therefore, these variables are excluded from the net benefit equation. The probit model is based on the following specific form of the net benefit equation:

$$B^*_i = \gamma_0 + \gamma_1 AGE_i + \gamma_2 AGE_i^2 + \gamma_3 UNIV + \gamma_4 PSEC_i + \gamma_5 SEC_i + \gamma_6 CHL6_i + \\ + \gamma_7 NLI_i + \gamma_8 ATLN_i + \gamma_9 PQ_i + \gamma_{10} PRA_i + \gamma_{11} BC_i + \gamma_{12} URBAN_i + u_i \qquad (4.13)$$

Since B* is unobservable, a dummy variable for labor force participation is included as a dependent variable in the probit analysis (see equation 4.4). The next section presents empirical results on probit and earnings equations. First, the probit equation is estimated and an estimate of λ_{1i}.is derived from the probit results. Substituting the estimated λ_{1i} for the true λ_{1i} in equation (4.11), we estimate the market earnings equation using the OLS technique.[56]

4.5 Empirical Results

The analysis of labor market performance of immigrants is based on microdata contained in the Public Use Sample Tape entitled *Income (1983), Assets and Debts (1984) of Economic Families and Unattached Individuals.* This tape contains 14,029 observations on the economic and demographic characteristics of households. From this data set a sample of 8877 married couples is extracted. Three types of families are excluded from the analysis: (i) special family units, (ii) unattached individuals and (iii) other families.[57]

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[56]Based on the estimated parameters in the market earnings equation and the probit equation one can derive the parameters of the reservation earning equation (4.12). Since the main focus of the chapter is to obtain predicted market earnings, parameter estimates for the reservation earnings equation are not provided. Interested readers may consult Maddala (1986) for the derivation procedure.

[57]The first category includes 72 extremely wealthy families. To protect the identity of these families, their age and other economic-demographic characteristics have been suppressed in the sample, which prevents this study from conducting any empirical analysis of their wealth holdings. A significant proportion of the second and third type of families is headed by elderly women, perhaps widows. Permanent household income and hence the stock of net worth of these families depends on the lifetime income of their deceased husbands for which there exists no information in the data net. Furthermore, the families under the title "other families" includes the following types of households - 'brother and sister living in the same dwelling'

The labor market performance of immigrants is examined at two different levels. First, it is assumed that human capital and other personal characteristics affect identically the earnings of both the Canadian born and the foreign born. This assumption allows me to estimate a single earnings equation for all male or female workers irrespective of birth status. To analyze the assimilation rate of immigrants a set of dummy variables representing six distinct periods of arrival in Canada is included in the probit and earning equations. Second, the above assumption is relaxed and estimate birth status-specific probit and earning equations.

The empirical results for the restricted probit and the earnings equations are presented in Table 4.1(a) and Table 4.1(b) respectively. First, the results on labor market participation of potential workers are interpreted. The individual's likelihood of labor market participation increases with age in the early stage of the life cycle but decreases with age after they pass a threshold age. The latter phenomenon captures the fact that greater compensation is required to induce a middle-aged person than a younger person to participate in the labor market.

The estimated coefficients for the educational attainment dummy variables indicate a significant increase in the probability of labor market participation with higher education levels. Note that the omitted category here is "less than or equal to eight years of schooling." The positive impact of education on labor market participation is more pronounced for the potential female worker than for their male counterparts. The presence of children under age seven significantly reduces the likelihood of female participation. The participation decision of potential male workers, however, is statistically insensitive to the presence of young children. The coefficient for the

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or 'grandparent living with grandson or granddaughter' in the same house. The head of these families is not necessarily the principal earner. The data are available only for the economic-demographic characteristics of heads of households for the "other families" category. Indeed, these families are expected to dissolve through marriage of younger members and the death of its older members (grandparents). Hence, profiles of earnings and wealth for the 'male-headed families with wife present' is expected to differ significantly from the 'unattached' and 'other families'. This study is restricted to focus on 8877 couples.

nonlabor income variable obtains a theoretically expected negative sign in the male equation but an unexpected positive sign in the female equation. An increase in nonlabor income raises the reservation wage of an individual and hence reduces the likelihood of labor market participation. The positive impact of nonlabor income on the probability of female market participation either reflects that leisure is an inferior good for females or higher nonlabor income opens up new market opportunities for women.[58] The coefficients for regional dummies and urbanization are self-explanatory. With respect to immigration dummies, we observe that a typical newly arrived male immigrant catches up to the labor market participation probability of the typical Canadian male within twelve years of residence in Canada. Foreign born females, however, require only two years from the date of arrival to catch up and pass the labor market participation probability of Canadian born females. This indicates a lower reservation wage for the foreign born females as compared to Canadian born females, ceteris paribus.

[58]For example, women with higher nonlabor income may be able to afford day care expenses for their children and job training for themselves, which facilitates their market participation.

Table 4.1(a)
Probit Model for Labor Market Participation by Sex.
Dependent Variable: D = 1 for participation and D = 0 otherwise

Variables	Male Equation	Female Equation
Constant	-0.7983 (-3.09)	0.0154 (0.09)
Age	0.1466 (14.51)	0.0422 (5.52)
Age^2	-0.00196 (-19.65)	-0.00096 (-11.39)
University	0.6289 (7.21)	0.7647 (11.61)
Some Post-Secondary	0.4211 (5.91)	0.5754 (11.62)
Secondary	0.1808 (3.62)	0.3363 (8.25)
Children $\leq$ 6 years	-0.0203 (-0.30)	-0.6511 (-16.35)
Nonlabor income/1000	-0.0505 (-18.86)	0.0149 (3.28)
Atlantic	-0.2563 (-3076)	-0.1271 (-2.62)
Quebec	-0.1252 (-2.07)	-0.1548 (-3.69)
Prairies	0.2274 (3.46)	0.1426 (3.30)
B.C.	-0.1124 (-1.47)	0.0168 (0.31)
Urban Household	-0.0108 (-0.22)	0.1381 (4.17)
IMG46	0.0609 (0.54)	0.0906 (0.90)
IMG66	0.0735 (0.97)	0.1804 (3.40)
IMG71	-0.0665 (-0.44)	0.1869 (1.97)

Table 4.1(a) Probit Model for Labor Market Participation by Sex.
cont'd

Variables	Male Equation	Female Equation
IMG76	-0.3035 (-2.24)	0.1210 (1.36)
IMG81	-0.2753 (-1.64)	0.3132 (2.65)
IMG84	-1.3755 (-6.65)	-0.3562 (-1.84)
Number of Participants	7314	4989
Number of Non-Participants	1563	1888
χ^2 [Degrees of freedom]	3878.0 [18]	2191.2 [18]

Note: The figures in ( ) parentheses are the t-values.

Now the focus will be on the earning equations presented in Table 4.1(b). The coefficients of age and age squared suggest that the earnings profile for a typical male reaches its peak at age 47.6 years while females obtain their peak earnings at age 49.4 years. Educational attainment, log of the number of weeks worked and dummy variables for full time work and urbanization - all have significant positive effects on earnings. The catching up point for earnings occurs for a typical male immigrant after seventeen years and for female immigrants the corresponding figure is twelve years. It should be pointed out that the assimilation effects are statistically insignificant for female workers as indicated by t-statistics of the coefficients of dummy variables for the period of arrival. The coefficients of the Inverse Mill's Ratio are found insignificant in both equations.

Table 4.1(b) Earning Equations for all Workers by Sex
Dependent Variable: log (annual earnings)

Variables	Male Equation	Female Equation
Constant	4.4531 (37.34)	4.7783 (25.53)
Age	0.0714 (13.64)	0.0316 (4.22)
Age^2	-0.00075 (-11.96)	-0.00032 (-3.27)
University	0.4318 (14.44)	0.5692 (9.07)
Some Post-Secondary	0.2419 (9.66)	0.3511 (6.71)
Secondary	0.1337 (6.59)	0.2139 (5.02)
Managerial, Adm. and Professional	0.1140 (4.45)	0.0372 (0.70)
Clerical, Sales and Services	-0.0945 (-4.00)	-0.2542 (-5.33)
Transportation, Construction, Product Fabricating, etc.	0.0403 (1.88)	-0.2612 (-4.29)
Self-Employed	-0.3980 (-16.57)	-0.5392 (-9.28)
ln (Weeks worked)	0.8575 (61.27)	0.7929 (55.63)
Full Time	0.4773 (12.74)	0.6740 (25.77)
Atlantic	-0.1742 (-7.21)	-0.0776 (-1.96)
Quebec	-0.0811 (-4.00)	0.0429 (1.28)
Prairies	-0.0227 (1.10)	0.0784 (2.39)
B.C.	-0.0977 (-4.00)	0.1368 (3.28)
Urban Household	0.0930 (5.56)	0.1645 (5.93)

Table 4.1(b) Earning Equations for all Workers by Sex
cont'd

Variables	Male Equation	Female Equation
IMG46	-0.0157	0.1183
	(-0.25)	(1.16)
IMG66	-0.0348	0.0520
	(-1.35)	(1.24)
IMG71	-0.1657	0.0978
	(-3.83)	(1.47)
IMG76	-0.1748	-0.0790
	(-4.17)	(-1.22)
IMG81	-0.3168	-0.0788
	(-5.90)	(-0.98)
IMG84	-0.5760	-0.2019
	(-5.23)	(-1.25)
IMR	-0.0198	-0.0941
	(-0.83)	(-1.10)
Adjusted R^2	0.548	0.575
F-statistic	386.1	294.3
(Degrees of Freedom)	(23,7290)	(23,4965)
Standard Error Corrected for Selection	0.6014	0.8006

The Labor Market Performance of Immigrants vis-à-vis Canadian born

So far this section have been devoted to an analysis of immigrants' labor market assimilation experience. Now the analysis will be conducted under the assumption that the earnings determination process for the foreign born is different from that of the Canadian born. The hypothesis of an identical earnings generation process for the Canadian born and the foreign born is in fact rejected by the F-test. The empirical results for the probit and earning equation by the place of birth are reported in Table 4.2(a) and Table 4.2(b) respectively. The main findings with respect to labor market participation are the following.

The likelihood of labor market participation responds in the same way with respect to the stage of life cycle for both the foreign-born and Canadian-born males. Foreign born females experience that their net gains from participation (market wage - reservation wage) increase with respect to age until age 30 and then decrease. On the other hand, the net gain from participation for Canadian-born females begins to decline at the beginning of their working life (age 21). This may be due to the differential reservation wage by birth place. Educational attainment increases the likelihood of labor market participation, but the effect is more pronounced for Canadian-born females than for their foreign-born counterparts. The dummy variables for 'university education' and 'some post-secondary education' obtain coefficients of similar magnitude in both Canadian-born and foreign-born probit equations. The probability of participation for a foreign born person with secondary school education (at least nine years of schooling) is not significantly different from a secondary school dropout (the omitted category). In the case of a Canadian born person, however, schooling (at least nine years) does make a significant difference. The remaining coefficients can be interpreted in a fashion similar to the previous explanation for the restricted probit model.

Estimated earning equations corrected for labor market participation are presented in Table 4.2(b). For the given vector of observed characteristics, the age-earnings profiles reach a maximum at age 48 for a Canadian-born male, age 45 for a foreign born male, age 50 for a Canadian born female and age 46 for a foreign-born female. Although the coefficients for age differ by birth status (signifying a differential rate of return to post-schooling experience) the coefficient of age squared does not vary with the place of birth. This finding implies that the rate of depreciation of human capital is the same for both the Canadian born-male (female) and foreign born-male (female).[59]

The results on educational attainment are also consistent with human capital theory. The benchmark for comparison is the omitted education level, i.e., 'less than grade nine education.' The gross return for the jth education level compared to the omitted education level is computed using the following procedure. The percentage change in earnings with respect to the educational level is computed holding experience, occupation and other characteristics constant. Let $\ln Y_u$ and $\ln Y_o$ stand for the log of earnings with a university degree and less than nine years of schooling, respectively. The expected log of earnings can be expressed as

$$\ln Y_u = \omega Z + R_u$$

$$\ln Y_o = \omega Z$$

where Z contains all the explanatory variables except the educational dummies and ω is the relevant parameter vector, R_u is the coefficient of university education dummy in the earning equation. From the above pair of equations we obtain:

$$\ln Y_u - \ln Y_o = R_u$$

or

$$\frac{Y_u}{Y_o} = \exp(R_u)$$

[59]It may be noted that the finding with respect to human capital depreciation is similar to an earlier study (Akbari, 1988) based on the 1981 Census.

Subtracting 1 from both sides we obtain an estimate for the percentage difference in earning between a university graduate and a school dropout, ceteris paribus:

$$\text{i.e.,} \qquad \frac{Y_u - Y_o}{Y_o} = \exp(R_u) - 1$$

Table 4.3 provides the estimated gross rates of return for different education levels. A typical Canadian-born male university graduate earns 57.9 percent more than a school dropout belonging to the same group. A male immigrant with a university degree earns only 41 percent more than a male foreign born school dropout. It is clear from the table that females experience a greater percentage gain in earnings vis-à-vis males. Most noticeably, annual earnings for a female immigrant with a university degree are almost 80% higher that of a female school drop out. Other values in Table 4.3 can be interpreted in a similar fashion.

The impacts of occupational dummies on earnings are qualitatively similar regardless of birth status, but not by sex. For all groups, self-employed workers earn less than wage workers. The coefficients for weeks worked and the dummy variable for full time work obtain expected signs with a high degree of statistical significance.

With respect to assimilation effects it is observed that the most recent vintage of immigrants (arrived in 1983-84) catches up to the earnings of the pre 1967 cohort of immigrants after seventeen years in Canada for males and after twelve years in Canada for females. This interpretation is based on the assumption that the quality (productivity characteristics) of successive vintages of immigrants remains unchanged over time. Recent studies based on panel data (Borjas, 1988; Baker and Benjamin, 1993) suggest that entry earnings are declining across successive immigrant cohorts. Since the coefficient estimates are based on a single cross section, it is suspected that estimates of assimilation effect partly capture a decline in the cohort quality. If this is the case, then

the Canadian labor market experience (an assimilation factor) will have a less pronounced effect on earnings for recent cohorts over their Canadian life cycle.

This study could not isolate the cohort effect from the assimilation effect because the previous Survey of Consumer Finances (1977) does not provide a detailed breakdown by arrival periods. Therefore, the study restricted its attention to a single cross section (1984). The household's normal annual earnings is estimated by adding the husband's and wife's predicted earnings. Using the results found in Table 4.2(b) the predicted log of the annual earnings is obtained for husbands and wives. Taking the exponential of the log of earnings and then adding the husbands' and wives' earnings household normal earnings are derived for all sample members. As noted in the last chapter, the estimated household earnings will ultimately be used as an explanatory variable in the wealth accumulation function.

Table4.2(a) Probit Model for Labor Market Partaicipation
by Sex and the Place of Birth
Dependent Variable: D = 1 for participation and D = 0 otherwise.

Variables	Male Canadian born	Male Foreign born	Female Canadian born	Female Foreign born
Constant	-0.8951 (-3.18)	-0.4721 (-0.67)	-0.0394 (0.20)	-0.5756 (-1.17)
Age	0.1460 (13.14)	0.1543 (5.91)	0.0285 (4.59)	0.0710 (3.57)
Age^2	-0.0020 (-17.64)	-0.0021 (8.38)	0.0009 (-9.89)	-0.0012 (-5.86)
University	0.6607 (6.40)	0.5751 (3.36)	0.8731 (11.47)	0.4872 (3.59)
Some post-sec.	0.4281 (5.21)	0.4218 (2.84)	0.6713 (11.78)	0.2788 (2.67)
Secondary	0.2059 (3.71)	0.0913 (0.78)	0.3976 (8.38)	0.2106 (2.55)
Children ≤ 6 years	0.0362 (0.48)	-0.2643 (-1.76)	-0.6483 (-14.84)	-0.6651 (-6.79)
Non-labor income/1000	-0.0470 (-16.06)	-0.0688 (-10.02)	0.0156 (3.03)	0.0108 (1.09)
Atlantic	-0.1956 (-2.70)	-0.4622 (-1.61)	-0.1172 (-2.27)	-0;11054 (-0.50)
Quebec	-0.0598 (-0.89)	-0.3171 (-2.19)	-0.1542 (-3.30)	-0.0504 (-0.48)
Prarie	0.3186 (4.22)	-0.0287 (-0.21)	0.1700 (3.47)	-0.0428 (0.46)
B.C.	-0.0512 (0.56)	-0.0246 (-1.76)	0.0190 (0.30)	0.0331 (0.33)
Urban Household	-0.0098 (-0.19)	-0.0027 (-0.02)	0.1152 (3.25)	0.0263 (2.75)
IMG66		-0.1073 (-0.70)		0.0607 (0.50)
IMG71		-0.2329 (-1.07)		0.1280 (0.83)
IMG76		-0.4235 (-1.98)		0.0916 (0.60)
IMG81		-0.3594 (-1.53)		0.2916 (1.71)

Table4.2(a) cont'd

Probit Model for Labor Market Partaicipation
by Sex and the Place of Birth
Dependent Variable: D = 1 for participation and D = 0 otherwise.

Variables	Male Canadian born	Male Foreign born	Female Canadian born	Female Foreign born
IMG84		-1.5414 (-5.63)		-0.3563 (-1.56)
Number of participants	5952	1362	3995	994
Number of nonparticipants	1207	356	3164	724
χ^2	2995.8	889.7	1793	424.5
(Degrees of freedom)	(12)	(17)	(12)	(17)

Table4.2(b) Earning Equations by Place of Birth and Sex
Dependent Variable: log (annual earning)

Variables	Male Canadian born	Male Foreign born	Female Canadian born	Female Foreign born
Constant	4.4395	4.5365	4.7037	5.5481
	(33.24)	(15.60)	(22.64)	(11.06)
Age	0.0722	0.0631	0.0298	0.0281
	(12.25)	(5.11)	(3.50)	(1.47)
Age^2	-0.00075	-0.0007	-0.0003	-0.0003
	(-10.44)	(-5.16)	(-2.66)	(-1.35)
University	0.4568	0.3429	0.5616	0.5861
	(13.19)	(5.82)	(7.30)	(5.41)
Some post-secondary	0.2662	0.1519	0.3674	0.2915
	(9.20)	(3.07)	(5.67)	(3.36)
Secondary	0.1433	0.0893	0.2169	0.1971
	(6.16)	(2.13)	(4.07)	(2.81)
Managerial, Adm. and Prof.	0.0979	0.1728	0.0234	0.1121
	(3.41)	(3.10)	(0.39)	(0.97)
Clerical, Sales, Services	-0.0804	-0.1515	-0.2719	-0.1742
	(-3.01)	(-3.03)	(-5.06)	(-1.71)
Transport, Construction, Product Fabricating, etc.	0.0398	0.0273	-0.2633	-0.1956
	(1.65)	(0.58)	(-3.57)	(-1.71)
Self-Employed	-0.4095	-0.3412	-0.5725	-0.4271
	(-15.21)	(-6.44)	(-8.67)	(-3.56)
ln (weeks worked)	0.8494	0.8921	0.8126	0.7002
	(54.40)	(29.45)	(50.87)	(22.34)
Full Time	0.4690	0.5476	0.6860	0.6368
	(11.46)	(6.03)	(23.25)	(11.39)
Atlantic	-0.1637	-0.0823	-0.0779	0.0930
	(-6.31)	(-0.81)	(-1.82)	(0.63)
Quebec	-0.0587	-0.1866	0.0499	0.0104
	(02.59)	(-3.82)	(1.31)	(0.14)
Prarie	0.0372	-0.0206	0.0890	0.0284
	(1.57)	(-0.48)	(2.35)	(0.43)
B.C.	0.0372	0.0335	0.1646	0.0678
	(4.09)	(0.71)	(3.27)	(0.93)
Urban Household	0.878	0.1240	0.1762	0.0719
	(4.86)	(2.67)	(5.95)	(0.87)

Table4.2(b) cont'd — Earning Equations by Place of Birth and Sex
Dependent Variable: log (annual earning)

Variables	Male Canadian born	Male Foreign born	Female Canadian born	Female Foreign born
IMG66		0.01186 (0.18)		-0.1038 (-0.98)
IMG71		-0.1373 (-1.74)		-0.0944 (-0.77)
IMG76		-0.1608 (-2.02)		-0.2768 (-2.24)
IMG81		-0.3117 (-3.63)		-0.2673 (-2.03)
IMG84		-0.6716 (-5.29)		-0.4181 (-2.27)
IMR	-0.1090 (-1.94)	0.2413 (2.65)		-0.1837 (-0.95)
Adjusted R^2	0.547	0.561	0.584	0.525
F-statistic (Degrees of freedom)	423.3 (17,5934)	80.0 (22,1339)	330.7 (17,3977)	50.8 (22,971)
Standard Error Corrected for Selection	0.6114	0.5654	0.8119	0.7456

Table 4.3 Gross Return on Education by Sex and Place of Birth (in percentage)

Educational Attainment*	Male Canadian Born	Male Foreign Born	Female Canadian Born	Female Foreign Born
University Degrees	57.9	40.9	75.3	79.7
Some Post Secondary Education (diploma, training certificates)	30.5	16.4	44.4	33.8
Secondary Education (greater than or equal to 9 years of schooling)	15.4	9.3	24.2	21.8

Source: Table 4.2(b)
* The reference group is 'less than grade 9 education.'

CHAPTER 5

MEASUREMENT OF HOUSEHOLD WEALTH AND DESCRIPTIVE PROPERTIES OF THE DATA

Introduction

In the last chapter the earnings profiles of the foreign-born and Canadian-born were studied. Based on those earnings profiles, estimates of annual 'normal' earnings were derived for every household in our sample. As noted earlier, normal earnings is to be used as a control variable to estimate wealth accumulation profiles over the life cycle. This chapter first presents the methodology of measuring different components of household entitlement wealth and then discusses the descriptive properties of the data by the birthplace of households.

5.1 Measurement of Household Entitlement Wealth

Household entitlement wealth comes through three different channels of savings. These are (1) personal savings, (2) social security savings, and (3) private pensions (employer-sponsored retirement saving programs). The degree of portfolio choice available to an individual is greatest under a personal savings plan and least under public savings plans. The employer-sponsored plan lies between these two in terms of flexibility. This section defines each component of household entitlement wealth and discusses the measurement issues below.

5.1.1 Household Net Worth

Household net worth consists of all fungible assets net of liabilities over which households have discretion, i.e., wealth accumulated under a personal savings plan. Personal wealth accumulation plans can be classified into two broad categories: accumulation of assets with a tax-shelter or without a tax-shelter. There are two vehicles for individual tax-sheltered asset accumulation in Canada: the registered retirement savings plan (RRSP) and the registered home ownership savings plan (RHOSP). The RRSP was introduced in 1957 as an entirely voluntary program. It must be deregistered between ages 60 and 71 and may be transformed into one of the following post-maturity options: (i) term certain annuity to age 90, (ii) life annuity and (iii) registered retirement income fund (RRIF) - a retirement income provision indexed against inflation.

Personal wealth accumulation which is not protected by a tax shelter includes all other kinds of assets. These are cash in hand, bank deposits, Canada Savings Bonds, stocks, market value of vehicles, the market value of owner-occupied homes, and equity in business, real estate, farm or profession. Assets do not include the values for public or private pension rights, the household's human capital, or consumer durables other than automobiles. On the other hand, household debt includes loans from financial institutions and individuals, amounts outstanding on credit cards and the principal outstanding on all mortgages on homes. Data on asset (debt) holdings of all family members aged 15 years and over were combined in order to derive the family wealth (debt). It should be noted that household net worth does not include human capital or the future return from investment on children.

5.1.2 Social Security Wealth

Social security wealth is defined as the present value of the future stream of benefits from public retirement savings plans. As noted earlier public retirement saving plans in Canada include three key programs: the Canada /Quebec pension plan, Old Age Security and Guaranteed Income Supplements and Spouse Allowance.

Canada/Quebec Pension Plan (CPP/QPP)

The CPP/QPP originated in 1966. Participation in this program is mandatory for all residents of Canada with employment income. Retirement pensions were first paid in 1967, survivors' pensions and benefits in 1968, and disability benefits in 1970. Contributions to this plan are tax deductible and are made on earnings between the yearly basic exemption (YBE) and the yearly maximum pensionable earnings (YMPE). In 1991, the YBE was $3,000, YMPE was $30,500 and the rate of contribution was 4.6 percent of pensionable earnings. For an employee, contributions are equally divided between the employer and employee, while a self-employed person contributes the full amount. CPP/QPP benefits are calculated at the rate of 25 percent of the contributor's average lifetime adjusted pensionable earnings. Benefits are determined by the following formula:

$$RP_{it} = .25(\overline{YMPE}_t * AER_{it}) \tag{5.1}$$

where,

RP_{it} = the retirement pension for individual i, who retires in year t,

$\overline{YMPE}_t$ = maximum pensionable earnings - averaged over the three years ending with the year of retirement, i.e.,

$$\overline{YMPE}_t = \frac{1}{3}[YMPE_{t-2} + YMPE_{t-1} + YMPE_t] \tag{5.2}$$

and

AER_{it} = average earnings ratio, i.e., the ratio of annual pensionable earnings[60] (PE_i) to the maximum pensionable earnings averaged over the lifetime contributory period, i.e.,

$$AER_{it} = \frac{1}{T}\sum_{j=1}^{T}\frac{PE_{i.t-j}}{YMPE_{t-j}} \qquad (5.3)$$

T is the number of years in the contributory period.[61] For an individual with an income at or above the average levels during the contributory period, the value of the AER will be 1. This hypothetical individual will receive a pension equal to 25 percent of the $\bar{\bar{Y}}\bar{\bar{M}}\bar{\bar{P}}\bar{\bar{E}}_t$ which will be roughly one-quarter of the average industrial wage. On the other hand, an individual whose earnings are less than the maximum pensionable earnings on average will receive reduced retirement benefits. For example, an individual whose AER is 0.50 will receive 12.5 percent, as opposed to 25 percent, of the $\bar{\bar{Y}}\bar{\bar{M}}\bar{\bar{P}}\bar{\bar{E}}_t$ as pensions. The CPP/QPP benefits are indexed against price inflation and remain fixed in real terms in the subsequent years of retirement.

Old Age Security (OAS)

The universal old age security pension was introduced in 1952. This benefit is available to all Canadians sixty-five years and older, subject to a residency test. To be eligible for full OAS benefits individuals have to reside in Canada for 40 years after age 18. Residency requirement may be satisfied by an alternative method. In this method

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[60] Pensionable earnings, PE_i, can be defined as:

PE_i = actual earnings (Y_i)	if	$YBE < Y_i \leq YMPE$
PE_i = YMPE	if	$Y_i > YMPE$
PE_i = 0	if	$Y_i \leq YBE$

[61] Note that the lowest 15 percent of earnings ratios are excluded from the calculation of AER.

individuals who were at least 25 years of age on July 1, 1977 and either a resident in Canada on that date or with 10 consecutive years of residence prior to approval of the application for OAS pension are also eligible for full OAS benefit. In 1977, the government introduced provisions for partial pensions. This partial pension provides benefits at the rate of 1/40th of the full benefit for each year of residence in Canada. For example, a 65 year old foreign-born with 20 years of prior residence in Canada will receive one half of the full OAS pension. To be eligible for partial OAS benefit an individual has to reside in Canada for at least 10 years. In January 1991, the full OAS pension was $354.92 per month. The OAS pension level is indexed against inflation and is provided irrespective of employment status or income level. Unlike CPP/QPP, the OAS benefits are taxable. This program is funded from current revenues on a pay-as-you-go basis.

Guaranteed Income Supplements (GIS) and Spouse Allowance (SPA)

The GIS pension has been in effect since 1967. It provides benefits to OAS pensioners with little or no income other than the OAS benefit. The Spouse's Allowance was introduced in 1975 to assist the spouse of a pensioner who has little or no other income and if that spouse is between 60 and 65 years of age. Both GIS and SPA are means tested. Maximum GIS and SPA benefits are limited and partially offset by other income. The GIS benefit is reduced by $1 for every $2 of other income. On the other hand, the SPA benefit is reduced by $3 for every $4 of the couple's combined monthly income from OAS. In January 1991, the maximum GIS benefit was $421.79 for an eligible single pensioner and $274.73 for each spouse in a married couple. The regular SPA benefit was $629.65. All benefits are paid monthly.

Estimation of Social Security Wealth

The household social security wealth is estimated based on the above social security rules. For retirees (r) the method of calculating social security wealth is straightforward. Let SSB_r be the sum of currently received public pension benefits in the form of CPP/QPP, OAS and GIS; LE is the conditional life expectancy; g and d respectively stand for the expected real growth rate of social security benefits (SSB) per annum and the real discount rate. For current retirees household social security wealth (SSW) is estimated as:[62]

$$SSWr = \int_{t=0}^{LE} SSB\, e^{(g-d)t}\, dt \qquad (5.4)$$

$$= \frac{SSB}{g-d}\{e^{(g-d)LE} - 1\}$$

The method of estimating social security wealth for current workers is given below. The expected social security 'benefit' of a worker (w) at the first year of retirement (age 65) is given by

$$ESSB_w = SSB_w e^{gLR} \qquad (5.5)$$

where ESSB indicates expected social security benefits in the first year of retirement, LR stands for the years to retirement (65 minus AGE), g stands for the real rate of growth in average social security benefits for prospective retirees, SSB_w is the imputed base social security benefit for a current worker, i.e., benefits one would receive if he or she retired in the current year. The imputation of SSB among current workers is based on Canada's old

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[62] Life expectancy data are available for males and females separately. However, SSB_r data are not available for husband and wife separately. For a family with both husband and wife of at least 65 years of age household life expectancy is computed as the average of husband and wife's life expectancy.

age income security provisions outlined in the last section. Social security wealth for current workers can be expressed by the following relation:

$$SSW_W = \int_{t=0}^{LD} ESSB\, e^{gt}\, e^{-d(t + LR)}\, dt \qquad (5.6)$$

$$= \frac{ESSB*e^{-d*LR}}{g - d} \{e^{(g - d)LD} - 1\}$$

where LD stands for the expected *years of retirement.*[63] Note that the term, $ESSB*e^{-d*LR}$ represents the present value of the annual social security benefit attainable at the first year of retirement (age 65). This benefit is expected to grow at the rate g per annum in the post retirement years until the date of death. Different components of ESSB may grow at different rates. For example, the real growth rate of CPP/QPP benefits is zero after retirement while the growth rates of OAS, GIS or SPA benefits are subject to government discretion.

5.1.3 Private Pension Wealth

Private pension wealth is the present value of retirement incomes from private pension plans. Under this plan the employer and employee contribute at regular intervals to provide a retirement income for the employee. This provision may be viewed as a reward for long service or a deferred payment for an employee's past service. Data do not exist for workers' participation in private pension plans. Hence, we ignore private pension wealth and confine our focus to household net worth and social security wealth.

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[63] For a detailed calculations of social security wealth see the Appendix.

5..2 The Data and Economic-Demographic Characteristics of Households

To test the implications of the life-cycle model on wealth accumulation longitudinal microdata is required. Such a data set on individuals' earnings and asset holdings does not exist for Canada. Therefore, the cross-sectional data is used as an alternative. The primary data source for this study is Statistics Canada microdata tape: *Income (1983), Assets and Debts (1984) of Economic Families and Unattached Individuals*.. The empirical work is based on the sample of married couples.[64] The income data in this sample refers to the year 1983 and assets data corresponds to May, 1984. Statistics Canada claims that this time lag in data collection is expected to encourage household response, and facilitates accurate reporting. Along with data on income, assets and debts, this microdata tape contains a large set of variables which characterize the activities of households in both labor and capital markets. This rich data set helps to empirically analyze household wealth accumulation.

Assets, Income and Demographic Characteristics of Households

Table 5.1 presents relevant sample means of the different components of net worth and the associated portfolio shares by birthplace. Immigrants' average net worth holdings were 20 percent higher than those of the Canadian born circa 1984. The ratio of debt to total assets is also lower for immigrants compared to Canadian-born families. However, these average figures suppress the fact that the post-1966 vintage of immigrants have a very high debt-asset ratio compared to both the pre-1967 cohort of immigrants and the Canadian-born households. How much of this differential net wealth holdings is attributed to the stage in the life cycle versus the differential propensity to save among successive cohorts of immigrants will be explored empirically in the next chapter. With

[64]The sample selection procedure was discussed in the last section.

respect to the portfolio of assets held by immigrants and Canadian born the following observations can be made from Table 5.1.

1. A typical immigrant family held 66.2 percent of its net wealth in the form of an owner-occupied home and/or real estate. In contrast this share is only 58.9 percent for the Canadian born. The post-1966 immigrant cohort shows a stronger tendency for holding assets in the form of real estate than the earlier cohort of immigrants. Indeed, a typical post-1966 immigrant family held about 80 percent of its net worth in real estate (home plus equity in real estate) compared to 62 percent by a typical native born family.

2. Canadian-born families, on the average, held a larger proportion of net worth (circa 1984) as equity in business than their foreign-born counterparts.

3. Canadian-born families held a larger fraction of net worth in the form of vehicles: 7.53 percent versus 5.05 percent for foreign-born households.

4. The share of financial assets, i.e., bank deposits, savings bonds, cash in hand, stocks, RRSPs and RHOSPs, is similar for the Canadian- and foreign-born families.

Family income characteristics of households are reported in Table 5.2. Both labor and investment income of a typical foreign-born household exceed that for a typical Canadian-born household. On the other hand, government transfer payments do not vary by birth status. Substantial differences, however, are observed with respect to unemployment insurance benefits, social assistance and provincial income supplements. The per capita unemployment insurance benefit is $937 per annum for a Canadian-born

household and $768 per annum for a foreign-born household. Immigrant households on average receive $238 annually in the form of social assistance and provincial income supplements, while Canadian-born units receive $438. The tax burden, measured by taxes as a percentage of family income, is almost identical for both Canadian-born and foreign-born households. However, in absolute term, immigrants pay more in taxes due to their higher average family income.

Table 5.3 summarizes some economic-demographic characteristics of family units. On average, immigrant families are larger than Canadian-born families. Moreover, the dependency ratio is higher for the recent cohort of immigrants, exceeding both the Canadian born and the older vintage of immigrants. Table 5.2 indicates the high degree of urbanization of the foreign-born.[65] About 87 percent of the post 1966 cohort of foreign born families live in large urban areas, while only 52 percent of Canadian families live in large urban centers.

[65]Only 0.4 percent of the recent cohort of immigrants are engaged in farming as opposed to 2.1 percent and 2.8 percent for the earlier cohort of immigrants and the Canadian born respectively.

Table 5.1
Family Wealth Components*
Mean Values in 1984 Dollars
(Sample size: 13,957)

Variable Titles	Canadian- born	Immigrants		
		Arrived before 1967	Arrived in 1967-84	All Immigrants
Number of Families	11,426	1,605	926	2,531
Total Deposits[1]	9,127 (12.04)	13,851 (12.05)	6,542 (10.96)	11,177 (11.80)
Canada Savings Bond	2,319 (3.06)	4,772 (4.12)	1,259 (2.11)	3,455 (3.65)
Cash in Hand	168 (0.22)	174 (0.15)	144 (0.24)	163 (0.17)
Total Liquid Assets[2]	12,092 (15.96)	19,136 (16.65)	8,020 (13.43)	15,069 (15.91)
Stock Holdings	1,765 (2.33)	2,310 (2.01)	890 (1.49)	1791 (1.89)
RRSP	3,328 (4.39)	5,494 (4.78)	2,437 (4.08)	4,376 (4.62)
RHOSP[3]	133 (0.18)	162 (0.14)	191 (0.32)	172 (0.18)
Other Non-liquid Financial Assets	2,037 (2.69)	2,406 (2.09)	2,789 (4.67)	2,546 (2.69)
Total Financial Assets[4]	19,356 (25.55)	29,508 (25.67)	14,327 (23.99)	23,954 (25.28)
Market Value of Vehicles	5,0704 (7.53)	5,099 (4.44)	4,239 (7.10)	4,784 (5.05)
Market Value of Owner-Occupied Home	27,73 (49.82)	59,216 (51.52)	42,514 (71.20)	53,105 (56.06)
Equity in Real Estate[5]	6,891 (9.10)	11,996 (10.44)	5,458 (9.14)	9.604 (10.14)
Equity in Business Farm or Profession	17,32 (22.97)	19,025 (16.55)	10,658 (17.85)	15,963 (16.85)
Total Assets	87,006	124,844	77,196	107,412

Table 5.1, continued

Personal Debt	-3,727 (-4.920	-2,784 (-2.42)	-4,119 (-6.90)	-3,273 (-3.46
Mortgage Outstanding on Owner Occupied Home	-7,531 (-9.94)	-7,129 (-6.20)	13,367 (-22.39)	-9,411 (-9.93)
Total Debt	-11,257 (-14.86)	-9,913 (-8.63)	-17,487 (-29.29)	-12,684 (-13.40)
Ratio of Total Debt to Total Assets(%)	12.94	7.94	22.65	11.81
Family Net Worth	75,748 (100.00)	114,930 (100.00)	59,710 (100.000	94,727 (100.00)

* Figures in parentheses are portfolio share of assets (debts) in net worth.
1. Includes savings certificates
2. Sum of three preceding items
3. RHOSP= Registered Home Ownership Savings Plan
4. Sum of all liquid and non-liquid financial assets
5. Excludes owner-occupied home.

Table 5.2
Family Income Components
Mean Values in 1984 Dollars
(Sample size: 13,957)

Variable Titles	Canadian- born	Immigrants		
		Arrived before 1967	Arrived in 1967-84	All Immigrants
Number of Families	11,426	1,605	926	2,531
Wages and Salaries[1]	20,222	20,089	23,766	21,434
Net Income from Self-Employment	1,563	1,909	1,298	1,685
Total Earnings	21,785	21,998	25,064	23,119
Net Investment Income	1,622	2,668	1,304	2,170
Family and Youth Allowances	258	187	382	259
Child Tax Credit	150	79	216	129
OAS and GIS	1,012	2,068	276	1412
CPP/QPP Benefits	438	724	101	496
Unemployment Insurance Benefits	937	640	990	768
Social Assistance and Provincial Income Supplements	438	205	297	238
Other Govt. Transfer Payments	259	265	166	229
Total Govt. Transfer Payments[2]	3,494	4,170	2,429	3,532
Private Pension Benefits[3]	700	990	170	690
Other Money Income	263	316	311	314
Total Family Income	27,863	30,143	29,278	29,826
Family Income After Tax	23,573	25,751	24,956	25,460
Taxes as Percentage of Family Income	15.4	14.6	14.8	14.6

1. Includes military pay and allowances.
2. Sum of seven preceding items
3. Includes retirement pensions, superannuation and annuities.

Table 5.3
Demographic Characteristics of Family Units[1]
(Sample size: 13,957)

Variable Titles	Canadian born	Immigrants		
		Arrived before 1967	Arrived in 1967-84	All Immigrants
Number of Families	11,426	1,605	926	2,531
Family Size: Mean Number of Persons	2.63	2.58	3.25	2.83
Dependency Burden[2]	0.48	0.47	0.52	0.48
Number of Farm Families	315 (2.8)	34 (2.1)	4 (0.4)	38 (1.5)
Number of Non-Farm Families	11,111 (97.2)	1,571 (97.9)	922 (93.2)	2,493 (98.5)
Number of Unemployment Insurance Recipients per Family				
None	8,572 (75.0)	1,294 (80.6)	665 (71.8)	1,959 (77.4)
One	2,374 (20.8)	264 (16.4)	214 (23.1)	478 (18.9)
Two or more	480 (4.2)	47 (2.9)	47 (5.1)	94 (3.7)
Family Character: Marital Status				
Number of Married Couples	7,159 (62.7)	1,055 (65.7)	663 (71.6)	1,718 (67.9)
Unattached Individuals	3,065 (26.8)	421 (26.2)	165 (17.8)	586 (23.2)
Other Families	1,202 (10.5)	129 (8.0)	98 (10.6)	227 (9.0)
Area				
Large Urban Centers (with a population of 100,000 and over)	5,948 (52.1)	1,138 (70.9)	802 (86.6)	1,940 (76.6)
Minor Urban Centers	3,194 (28.0)	277 (17.3)	76 (8.2)	353 (13.9)
Rural Areas	2,284 (20.0)	190 (11.8)	48 (5.2)	238 (9.4)

1. Figures in Parentheses are percentages
2. Dependency Burden = $[1 - \frac{\text{Number of Earners}}{\text{Number of persons in a family}}]$

CHAPTER 6

HOUSEHOLD WEALTH ACCUMULATION: THE EMPIRICAL MODEL AND RESULTS

Introduction

The primary objectives of this chapter are to specify an empirical model based on the extended life-cycle theory of wealth accumulation and present the empirical results. In Chapter 3 the wealth accumulation equation was derived from the optimal consumption path with an exogenously given earnings profile. The empirical specification of the wealth equation was then generalised to capture the roles of a pure life cycle motive, a bequest motive and the effects of old age social security in net worth accumulation.

6.1 Empirical Specification

The wealth accumulation equation derived under the pure life-cycle motive suggests that desired wealth holding depends on lifetime earnings, the stage of the life cycle, the interest rate and preference parameters (see Equation 3.8 in Chapter 3). Obviously, in a cross section it is impossible to estimate the interest rate effect since all sample members face a uniform market rate. Furthermore, lifetime earnings can only be computed from the earnings history of an individual over his/her life cycle. An estimate of the household's normal earnings is used to capture the effect of lifetime earnings on desired household wealth holding.[66] With respect to the bequest motive it is clear from an earlier theoretical analysis (see Equation 3.12) that the desired bequest is a proportion of lifetime

[66]The estimation procedure is discussed in chapter 4. It may noted that Feldstein (1979) used average income of two consecutive years as proxy for average lifetime earnings.

resources where the proportion varies with the length of life, tastes and the interest rate.[67] The most important determinant of the taste for bequests is the number of children. Blinder *et al.* (1983) expressed desired bequests as a quadratic function of the number of children. They hypothesized that bequests increase at a decreasing rate as the number of children increases. This is a reasonable specification since the life cycle and the bequest motives are competing for the same lifetime resources.

Theoretically, household wealth can be partitioned into life-cycle wealth (W_L) and intergenerational transfer wealth (W_B). Households are not asked to declare their wealth holdings by different motives of accumulation in the *Survey of Consumer Finance* (1984). Hence, it is not possible to estimate a separate bequest function.[68] Since the dependent variable I intend to explain includes assets held for both life-cycle and transfer motives, the wealth equation must include determinants of both W_L and W_B. Since households cannot choose their social security benefits, social security wealth must be included as an exogenous variable in the wealth accumulation equation. This section proceeds with a general form of the wealth accumulation function and then imposes parametric restrictions on the model as suggested by theory. The general form of the wealth equation is

$$\ln W = f(L, \ln Y^*, \ln SSW, NKID, X) + U \qquad (6.1)$$

where, W = household fungible wealth or net worth,

L = stage of the life cycle of the household,

Y^* = normal earnings,

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[67]The remaining years of life obviously depends on the age and health of the individual. We do not have data on individuals' health conditions. However, given uniform conditional life expectancy for any given age, the age variable itself is a good indicator of remaining years to live.

[68]The bequest function can only be estimated using probate statistics. Menchik and David (1983) used United States probate statistics to estimate a bequest function.

SSW = social security wealth,

NKID = number of children, and

X = a vector of observable variables which influence the wealth-age relationship.

The *1984 Survey of Consumer Finance* reported the husband as the head of household regardless of whether he is the principal earner in the family or not. This is done to maintain compatibility with previous surveys when female participation in the labor force was less significant. Therefore, it is reasonable to include both the husband's and wife's age as measures of the stage of household life cycle, L. The estimation procedure for normal earnings (Y^*) and social security wealth (SSW) have been explained in Chapter 4 and Chapter 5 respectively. The vector X includes the following control variables: (i) presence of unemployed (UNEMP), (ii) farm family (FARM), (iii) urban area (URBAN), and (iv) regional dummies (REGION). Observed wealth may differ from desired wealth temporarily due to unemployment. Hence, the dummy variable for unemployment captures this transitory effect. Furthermore, the net worth of a farm family is expected to be greater than that of nonfarm family, ceteris paribus. Recognizing the nonlinearity of net worth in the stage of the life cycle and the number of children, we express the specific form of the wealth equation as

$$\begin{aligned} \ln W_i = {} & a_0 + a_1 Hage_i + a_2 Hage_i^2 + a_3 Wage_i + a_4 Wage_i^2 + a_5 \ln(Y_i^*) \\ & + a_6 \ln(SSW_i) + a_7 NKID_i + a_8 NKID_i^2 \\ & + a_9 UNEMP_i + a_{10} FARM + a_{11} URBAN_i + \sum_{j=12}^{15} a_j REGION_{ij} + U_i \end{aligned} \qquad (6.2)$$

where, Hage and Wage are the husband's age and wife's age respectively. The theoretically expected signs of the coefficients are:

(i) $\alpha_1, \alpha_3 > 0$ and $\alpha_2, \alpha_4 < 0$ (life-cycle hypothesis);

(ii) $\alpha_5 > 0$ (positive income elasticity of asset demand);

(iii) $\alpha_6 <$ or ≥ 0 (ambiguous effect of social security wealth);

(iv) $\alpha_7 > 0$ and $\alpha_8 < 0$ (transfer wealth increases at a decreasing rate with the number of children)

Since the distribution wealth is skewed to the right, the log of net worth is employed as the dependent variable to avoid any potential heteroscedasticity. Although the basic form of the model is similar to King and Dicks-Mireaux, it differs from theirs in the following respects.[69] An important determinant of the taste for bequest (NKID, $NKID^2$) is included in the wealth equation. Furthermore, unlike their study, this empirical work explicitly takes into account the residence test to compute old age security benefits.[70] Lastly, but most importantly, the effects of birth place on the accumulation profile is investigated. Burbidge and Robb (1985) used the same data set as King and Dicks-Mireaux but a different empirical framework. They regressed family net worth on 125 variables. There are 96 interaction variables in this set which interact with the age spline variables. This model is subject to the multicollenearity problem. Moreover, it is difficult, if not impossible, to provide a theoretical interpretation to the large set of coefficients in such a model.

The wealth equation (6.2) is estimated using data for 8877 married couples. The rational for this sample selection is discussed in Section 4.5 (see footnote 18). Previous

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[69]King and Dicks-Mireaux (1982) estimated a equation of the following form:

$\ln(\frac{W}{Y}) = b_0 + b_1 \ln Y + b_2 \ln(\frac{SSW}{Y}) + \sum_{j=3}^{k} b_j X_j + u$, where X_j is the vector of all explanatory variables except normal earning and social security. By simple rearrangement of the terms it can be shown that the coefficient of lnY in equation (6.2), $a_5 = (1 + b1 - b2)$.

[70]See their later paper for a discussion of the method of compution (Dicks-Mireaux and King, 1984: 123-124).

studies suggest that the wealth accumulation behavior of low-wealth holders is significantly different from the rest of the population. King and Dicks-Mireaux (1982), Diamond and Hausman (1984) and Hubbard (1986) excluded the low wealth holders from their analysis of household wealth accumulation. Indeed, the preliminary analysis also suggests that the wealth-age profile of low wealth holders does not follow an inverted U-shape. It is argued that low wealth holders face a liquidity constraint since they have little or no wealth to use as collateral to borrow money. Thus, to facilitate a strong test for the life-cycle model households with less than $3500 of net worth are excluded from the sample. Heckman's (1976) two-stage estimation procedure is used to avoid potential selectivity bias resulting from sample truncation.[71]

6.2 Empirical Results

The analysis of wealth accumulation is conducted at two levels. First, a single wealth holding equation (the restricted model) is estimated for the whole sample under the assumption that economic and demographic characteristics affect the savings behavior of the Canadian born and the foreign born identically. A set of dummy variables indicating distinct periods of arrival in Canada is included to find time required for a newly arrived foreign-born household to catch up to the wealth level of a comparable Canadian-born household.[72] Second, the assumption of the identical parameter vector by birthplace is

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[71]In the first stage we estimate a probit model for low wealth holders and obtain an estimate of the Inverse Mill's Ratio (IMR) for every household in the whole sample. In the second stage, the OLS technique is employed to estimate the net worth equation by including the inverse Mill's ratio as an additional regressor.

[72]It may be noted again that the dummy variables for periods of arrival correspond to the following periods:

IMG46 = immigrated before 1946,
IMG66 = immigrated between 1966 and 1946,
IMG71 = immigrated between 1971 and 1967,
IMG76 = immigrated between 1976 and 1972,
IMG81 = immigrated between 1981 and 1977, and
IMG84 = immigrated between 1984 and 1982.

relaxed and a birth status-specific wealth accumulation equation (the unrestricted model) is estimated.

The results of the restricted model is presented in Table 6.1 The coefficients of age and age squared are highly significant and confirm the life-cycle hypothesis. The income elasticity of asset demand is 0.15. It implies that for an individual with a wealth-income ratio of 2, the asset demand increases by 30 cents for each dollar increase in normal earnings.

The coefficients of children and children squared are highly significant and agree with the hypothesized signs. The coefficient of the social security wealth variable (-0.102) indicates that each one dollar increase in social security wealth displaces twelve cents of wealth for a typical family.[73] Unemployment in the family reduces net worth. Also a farm family holds greater net worth than a nonfarm family. The coefficients of urbanization and regional dummies are self explanatory. The dummy variables for the periods of arrival indicate that if a foreign born person arrives in Canada with a vector of observable characteristics comparable to a typical resident in Canada, his or her wealth holding catches up with that of an average Canadian born person within 12 years of residence in Canada. Section 4.5 reported that the catching up point for earnings occurs for a male immigrant after 17 years and for a female immigrant after 12 years. Given the fact that wives earn considerably less than husbands, the overtaking of family wealth holding thus occurs relatively quickly compared to earning. It implies that the assimilation with respect to consumption is slower than that of earnings. Finally, the coefficient of the Inverse Mill's Ratio was found to be insignificant.

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[73]From equation (6.2) we can find that the displacement effect depends on the ratio of net worth to social security wealth:
$\frac{\delta W}{\delta SSW} = -0.1021(\frac{W}{SSW})$; substituting the mean net worth and mean SSW in this equation one can find the displacement effect for a typical household.

Table 6.1
Wealth Accumulation Model: All Households
Dependent Variable: Log (Net Worth)

Variables	Coefficients
Constant	7.592 (19.15)
Husband's Age	0.06034 (5.93)
Husband's Age^2	-0.00046 (-4.65)
Wife's Age	0.0581 (5.81)
Wife's Age^2	-0.000415 (-4.17)
Log (normal earnings)	0.1452 (9.74)
Children	0.1056 (4.82)
Children^2	-0.0212 (-4.37)
Log (SSW).	-0.1021 (-3.23)
Presence of Unemployed	-0.2826 (-10.90)
Farm Family	1.186 (20.28)
Urban Area	0.00903 (0.321)
Atlantic	-0.2767 (-7.72)
Quebec	-0.2621 (-8.48)
Prairies	-0.0805 (2.57)
B.C.	0.1370 (3.52)
IMG46	0.06070 (0.91)

Table 6.1 Wealth Accumulation Model: All Households
cont'd

	Dependent Variable: log (net worth)
IMG66	0.1716 (4.48)
IMG71	0.0434 (0.612)
IMG76	-0.2635 (-3.74)
IMG81	-0.5379 (-5.89)
IMG84	-0.5046 (-2.90)
IMR	-0.0911 (-0.64)
Adjusted R^2	0.30
F-statistic	154.1
(Degrees of Freedom)	(22,7852)
Standard Error Corrected for Selection	0.9402

Canadian born vis-à-vis Foreign born Accumulation Profile

The results of the birth status-specific wealth accumulation equation are presented in Table 6.2. The coefficients for age and age squared are consistent with the life-cycle hypothesis. The wealth accumulation profile reaches a maximum with respect to household head's (husband) age at approximately 65 years for both Canadian-born and foreign-born households. The shape of the wealth profile in relation to head's age is illustrated in Table 6.3. The first derivative of the log of the wealth equation with respect to head's age yields the rate of accumulation (see the note below Table 6.3). The rate of accumulation at different ages is evaluated and it is found that a typical foreign-born household accumulates wealth at a higher rate prior to age 65 and also decumulates at a higher rate after age 65 compared to a typical Canadian-born household. The income elasticity of wealth demand is 0.16 for the Canadian born and 0.08 for the foreign born. The foreign born exhibit a stronger preference for bequests than the Canadian born. Recognizing the fact that the wealth equation is semilogarithmic in children and children squared and the number of children is a discrete variable, the marginal bequest ($\Delta W/\Delta Children$) functions can be expressed as the following:

$$\text{Marginal bequest}|_{\text{Canadian Born}} = [0.0981 - 0.0196\{(\text{children})^2 - (\text{children} - 1)^2\}]W$$

$$\text{Marginal bequest}\ |_{\text{Foreign Born}} = [0.1393 - 0.0272[(\text{children})^2 - (\text{children} - 1)^2]]W$$

For the first child, the marginal bequest for a typical foreign-born family is $13,072 and for a typical Canadian born family is $7,761. These figures are derived by substituting the birth status-specific mean net worth in the relevant marginal bequest function. Obviously, households with an initial wealth level above the mean exhibit a greater marginal propensity to bequeath than a poorer household. Using the above pair of marginal bequest

functions one can derive the increment in bequests with respect to the number of children by birthplace and wealth level. Table 6.4 summarizes the results for the bequest motive. It is clear from the table that foreign born households have a strong motive for intergenerational transfers within the family network. The increment in the size of the bequest, however, is negligible after the second child. Note that the average family size is 2.63 for the Canadian born and 2.83 for the foreign born (figures are based on the 1984 Survey of Consumer Finance). This result is consistent with the fact that the bequest motive is competing with the life-cycle motive for saving for a share in lifetime resources.

The effect of social security on household net worth is presented in Table 6.5. One dollar of social security wealth displaces fourteen cents of savings of the foreign born while the displacement effect is only nine cents for the Canadian born. Dicks-Mireaux and King (1984) conducted robustness analysis of displacement effects for alternative specification of the wealth accumulation equation. The extreme bound on the substitution effect was found to lie within a range of 0.107 to 0.273 for a dollar increment in SSW. The displacement coefficient for the foreign born (0.14) lies within this range and the estimate for the Canadian born (0.09) is close to the suggested lower bound. Our results confirm Feldstein's extended life-cycle theory which argues that the displacement effect of social security on private savings is different from the dollar-for-dollar effect predicted under the pure life-cycle model.

The interpretation of the coefficients for control dummies is straight forward. The coefficient of the unemployment dummy is highly significant with a negative sign in both the foreign born and the Canadian born equations. It implies that the observed wealth holding for a household will be less than the desired level if there exists an unemployed person in the household. The farm family dummy has a positive effect and the corresponding coefficients are almost identical in magnitude for both groups. The urban

dummy obtains a negative and statistically insignificant coefficient in the Canadian-born wealth function but has a positive and significant coefficient in the foreign born equation.[74] This result is due in part to involuntary accumulation in the from of capital gains in urban real estate. Our data show that since foreign-born households hold a greater fraction of their wealth in real estate inclusive of owner-occupied homes, their capital gains are larger than those of their Canadian-born counterparts.

The coefficients of dummy variables for the five distinct periods of arrival (the omitted category is the immigrant who arrived before 1946) suggest a strong assimilation effect. A typical newly arrived immigrant (i.e., arrived in the survey year 1983-84) catches up to the mean wealth level of pre-1946 immigrants within 12 years. This reflects a rapid rate of accumulation given the earnings disadvantage at the entry date into the Canadian labor market. This finding is based on the presumption that the cohort characteristics remain constant across successive vintages of immigrants. The coefficient of IMG71 suggests that the wealth holdings of immigrants who arrived circa 1967-1971 is not significantly different from the pre-1946 cohort.

A summary of the major findings on wealth accumulation is given below. The empirical test confirms the implications of the pure life-cycle hypothesis. The shape of the wealth-age profile, however, differs by birth status. Faced with uncertainty in the new country of residence - Canada, immigrants accumulate wealth at a higher rate during the working stage of their lives. Also, immigrants have a limited access to the OAS benefit plan (due to the residency test) and coupled with little or no parental bequests, the foreign born households dissipate wealth at a higher rate than the Canadian born to finance retirement consumption. The accumulation rates presented in Table 6.3 (which are indeed the slopes of the log of wealth profile evaluated at different stages of life-cycle) suggest that the foreign-born profile reveals a more pronounced inverted U-pattern than the Canadian-born profile. Among other findings, the effects of children and SSW

[74]The urban dummy variable takes a value 1 if the family lives in an urban area with at least a population of 30,000, and zero otherwise.

are worth mentioning. Compared to Canadian born households, immigrants exhibit a strong bequest motive. Furthermore, the net effect of public social security programs on national savings is positive since the displacement effect of SSW is less than unity. Finally, immigrants exhibit a slightly greater displacement effect on personal savings than the Canadian born.

Table 6.2
Household Wealth Accumulation Model
Dependent Variable: Log (Net Worth)

Variables	Canadian-born Households	Foreign-born Households
Constant	7.2692 (12.21)	8.1254 (11.91)
Husband's Age	0.0570 (5.07)	0.0737 (2.90)
Husband's Age^2	-0.00044 (-3.99)	-0.00057 (-2.44)
Wife's Age	0.0577 (5.15)	0.0487 (2.15)
Wife's Age^2	-0.00039 (-3.49)	-0.00038 (-1.75)
Log (Normal Earning)	0.1552 (9.11)	0.0754 (2.21)
Children	0.0981 (4.00)	0.1393 (2.75)
Children^2	-0.0196 (-3.59)	-0.0272 (-2.52)
log (SSW)	-0.0827 (-1.43)	-0.1054 (-2.29)
Presence of Unemployed	-0.2851 (-10.15)	-0.2257 (-3.26)
Farm Family	1.1829 (19.25)	1.1741 (6.21)
Urban Area	-0.0142 (-0.48)	0.1634 (2.07)
Atlantic	-0.2950 (-7.79)	0.2521 (1.63)
Quebec	-0.2604 (-7.68)	-0.2878 (-3.57)
Prairies	0.0805 (2.27)	0.0705 (1.02)
B.C.	0.1335 (2.88)	0.1663 (2.30)
IMG66		0.0889 (0.98)

Table 6.2 cont'd — Household Wealth Accumulation Model
Dependent Variable: log (Net Worth)

Variables	Canadian-born Household	Foreign-born Household
IMG71		-0.0514 (-0.40
IMG76		-0.3483 (-2.56)
IMG81		-0.6402 (-4.25)
IMG81		-0.5884 (-2.47)
IMR	-0.1052 (-0.78)	-0.2554 (-0.67)
Adjusted R2	0.307	0.257
F-statistic (Degrees of Freedom)	175.2 (16,6324)	0.257 (21,1512)
Standard error corrected for selection	0.9345	0.9636

Table 6.3
Wealth Accumulation Rates by Birth Place*
(in percentage)

Age Group	Canadian Born	Foreign Born
Below 25	3.8	4.9
25-29	3.3	4.3
30-34	2.9	3.7
35-39	2.4	3.2
40-44	2.0	2.6
45-49	1.6	2.0
50-54	1.1	1.4
55-59	0.7	0.9
60-64	0.2	0.3
65-69	-0.2	-0.3
70-74	-0.6	-0.8
75-79	-1.1	-1.4
80 and above	-1.5	-2.0

*The rate of accumulation is defined as: $\frac{1}{W}\frac{\delta W}{\delta A} = (\beta_1 - 2\beta_2 A_i^m)$, where, A_i^m is the median age of the group i, β_1 and β_2 are the coefficients of the husband's age and age^2 in the accumulation equation, respectively.

Table 6.4

Marginal Bequest with Respect to the Number of Children
(in Dollar)

	Canadian Born Households: Number of Children			Foreign Born Households: Number of Children		
Initial Wealth	1	2	3	1	2	3
$25,000	1,963	983	3	2,803	1,443	83
$100,000	7,800	3,930	10	11,210	5,770	330
$500,000	39,250	19,650	50	56,050	28,850	1,650

Table 6.5
Effects of Social Security Wealth

	Mean Net Worth	Mean SSW	Effect of a dollar increase in SSW on private net worth*
All Households	102,306.8	86,936.3	-0.12
Canadian Born Households	98,873.9	86,155.9	-0.09
Foreign Born Households	116,611.4	90,187.8	-0.14

*Evaluated at mean net worth and mean social security wealth.
Source: Table 6.1 and6.2

CHAPTER 7

HOUSEHOLD PORTFOLIO SELECTION

Introduction

The purpose of this chapter is to analyze the determinants of household portfolio choice. The analysis has been conducted at two distinct levels. First, a demand function for risky assets is estimated to determine whether households' attitudes towards risk differ by birth status. Second, asset demand functions are estimated at the disagreggated level to analyze whether the effects of economic and demographic variables on portfolio composition differ by birth status. Section 1 of this chapter presents the theoretical background for the analysis with the associated empirical model. Section 2 provides an analysis of the empirical results.

7.1 Theoretical Background and the Empirical Model

First, this section presents a theoretical model of the demand for risky assets in a continuous time framework. Next, the theoretical and empirical issues concerning the estimation of asset demand function are addressed. The section concludes with an empirical model of asset demand.

The Demand for Risky Assets

Following the development of the household demand function for risky assets by Friend and Blume (1975), a theoretical model of risky asset demand is presented. It is assumed that all assets are acquired for investment purposes. Assets can be unambiguously dichotomized into two groups: risky and risk-free assets. It is also assumed that a

frictionless capital market exists where assets can be traded without transaction costs and sold short to use the proceeds for accumulating another asset. All assets are perfectly divisible and households have homogenous expectations about the distribution of future returns. Under this strong set of assumptions, Friend and Blume proposed the following wealth conservation equation for an investor/household:

$$W_{k,t+dt} = W_{kt}\,[1 + \{r_f + \alpha_k E(r_m - r_f)\}dt + \alpha_k \sigma_m y(t)\,dt] \qquad (7.1)$$

where, α_k is the fraction of the net worth of household k invested in the portfolio of risky assets, r_m and r_f denote the rate of return on the market portfolio of all risky assets and the rate of return on risk-free assets respectively, σ_m is the standard deviation of the returns on the portfolio of risky assets, and y(t) is a standardized normal random variable. The term, $\{r_f + \alpha_k E(r_m - r_f)\}$ can be interpreted as the risk-adjusted anticipated rate of return of the portfolio per unit of time while the other term, $\alpha_k \sigma_m y(t)$ is adding noise or variability around the time path of anticipated return. Let us denote utility of wealth as $U(W_{k,t+dt})$. By expanding the utility function about W_{kt} by Taylor series and taking expectations the following equation is obtained:[75]

$$E[U(W_{k,t+dt})] = U(W_{kt}) + U'(W_{kt})W_{kt}\{r_f + \alpha_k E(r_m - r_f)\}dt + \frac{1}{2}U''(W_{kt})W_{kt}^2\alpha_k^2\sigma_m^2 dt \qquad (7.2)$$

Maximization of the expected utility function (7.2) with respect to α_k yields the following demand function for risky assets:

[75]Higher order terms in the Taylor series expansion have been dropped from (7.2) due to their negligible quantitative importance.

$$\alpha_k = \frac{E(r_m - r_f)}{\sigma_m^2} \left[- \frac{U''(W_{kt})}{U'(W_{kt})} \right] \frac{1}{W_{kt}} \tag{7.3}$$

The demand for risky assets depends on the expected risk premium on risky assets, $E(r_m - r_f)$, the variance of the portfolio of risky assets, σ_m^2, and a function representing Pratt's measure of relative risk aversion. The utility function is increasing and strictly concave in wealth; i.e., $U'(\,.\,) > 0$ and $U''(\,.\,) < 0$. Denoting $S_k = \left[- \frac{U'(W_{kt})}{U''(W_{kt})} \right] W_{kt}$ we rewrite equation (7.3) as:

$$\alpha_k = \frac{E(r_m - r_f)}{\sigma_m^2} \frac{1}{S_k} \tag{7.4}$$

Note that Pratt's coefficient of relative risk aversion (RRA), S_k is same as the elasticity of marginal utility with respect to wealth. Under the assumption of homogenous expectations the market price of risk, $E(r_m - r_f)/\sigma_m^2$ is the same for every household. Therefore, α_k gives an estimate of the reciprocal of the coefficient of relative risk aversion, S_k^{-1} up to a multiplicative positive constant.[76] Thus, the variation in α_k with respect to net worth can be used to determine how S_k varies with net worth. For example, an increase in α_k with respect to net worth is equivalent to a decrease in S_k with respect to net worth which implies a decreasing relative risk aversion.

The theoretical model presented above is based on the assumption of a perfect capital market with no taxes, no nonmarketable assets, and no indivisibilities. In reality, asset returns are taxable, households hold nonmarketable assets in the form of human capital and social security wealth and they also hold a significant proportion of nonhuman wealth in the form of indivisible assets such as a home.

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[76]Note that this equation is same as equation (25) in Merton's seminal work (1969) on the continuous time model of lifetime portfolio selection.

First, the issue of taxation will be discussed. Tobin (1958) showed that a proportional tax increases the demand for risky assets for a risk-averse investor, provided the riskless asset has zero return and either the utility function is quadratic or the distribution of risky asset returns is normal.[77] Obviously these assumptions are very restrictive. The effect of taxes become ambiguous if the assumption of a zero risk free rate of return is dropped.[78] Contrary to Tobin's assumption, the studies by Friend (1974) and Cohn *et al.* (1975) provide strong evidence for decreasing relative risk aversion. Siegel and Hoban, Jr. (1991) observe increasing relative risk aversion for the poor half of households and decreasing relative risk aversion for the richer half of the households in their sample. Moreover most theoretical studies are based on the assumption of a proportional tax with a full loss offset. In reality however, the income tax system is progressive and tax rates differ by types of investment. Since the development of a new theory about the effect of tax on portfolio choice is beyond the scope of this study and the existing literature imposes strong restrictions on preferences and presumes an unrealistic tax structure to sign the tax effect. This study chooses not to impose any a priori restriction on the effect of tax on portfolio composition.

Second, households hold nonmarketable assets such as human capital and social security wealth. The theoretical framework presented above presumes that all assets are liquid and can be transacted with zero costs. The effect of nonmarketable assets on the demand for a risky asset has been theoretically investigated by Friend and Blume (1975), Hubbard (1983) and Bodie, Merton and W. Samuelson (1992). The first study deals with the effect of human capital, the second study focuses on the effect of social security and the most recent study introduces human capital in the Merton-Samuelson life-cycle portfolio choice framework to determine the effect of labor supply flexibility on the

[77]A quadratic utility function implies increasing relative risk aversion.

[78]See Feldstein (1976, Section I) for a critical analysis of Tobin's work.

demand for risky assets. Non marketable assets yield implicit rates of return in the form of labor inome (in case of human capital) and indexed annuity income (in case of social security). The first two studies conclude that if the rate of return on a risky asset is positively correlated with the implicit rate of return on a nonmarketable asset, an increase in the ratio of the nonmarketable assets to net worth reduces the demand for the risky asset.[79] The introduction of labor supply flexibility by Bodie *et al.* (1992) adds a new dimension in the analysis of household portfolio selection. They argue:

> An individual who has flexibility in choosing how much or how long to work later in life will prefer to invest substantially more of his money in risky assets than if he has no such flexibility. Viewed in this way labor supply flexibility creates a kind of insurance against adverse investment outcomes (p2)

To test this hypothesis, some indices of labor supply flexibility are required. The possible indices include age, occupational category and family size. The young enjoy greater labor supply flexibility than the old over their working life span. Some occupations provide opportunities for working extra hours, taking a second job, or choosing when and how much to work. Each of these attributes contributes to more flexibility in labor supply. A large family is likely to have multiple potential workers than a small family which contributes to labor supply flexibility. The empirical model is generalised to allow for the effect of nonmarketable assets and labor supply flexibility on the demand for marketable assets.

Now the issue of indivisibility of assets will be addressed. The most important form of indivisible asset in the household portfolio is the home. To deal with this problem, the demand for risky assets may be estimated both inclusive and exclusive of homes. This procedure helps determine the sensitivity of parameter estimates in the

[79] The covariance between the return on a marketable risky asset and that of a nonmarketable asset may be interpreted as an index of "substitutability."

demand equation with respect to treatment of home. It is worth noting that a home has both a consumption and investment value. Therefore the return from the home may not be compatible with the return from other assets. Thus, estimating two alternative equations for risky assets (exclusive or inclusive of home) may be a fruitful exercise.

Since this study uses cross-section data, households in the sample are heterogeneous with respect to the holdings of non-marketable assets, labour supply flexibility and tax rates.[80] As noted earlier (see interpretation of equation 7.4), the direction of the relationship between α_k and net worth helps determine whether households are subject to constant, decreasing or increasing RRA. This relationship cannot be determined precisely by omitting other determinants of α_k listed above. Hence the following demand function for risky assets is specified:

$$\alpha_k = \phi 0 + \phi 1 HAGE + \phi 2 HAGE^2 + \phi 3 lnW + \phi 4(\alpha_{ssw}) + \phi 5(Tax) + u_k \qquad (7.5)$$

Where,

HAGE = head's or husband's age,

lnW = log of net worth,

α_{ssw} = the ratio of social security wealth to net worth,

Tax = personal income tax rate and

u_k= a random error term

The model includes one important determinant of labour supply flexibility – the age variable.[81] The model is augmented later to include other indices of labour supply

[80]Given the progressive personal income tax system in Canada, the tax rate faced by households varies with income bracket and household characteristics.

[81]In line with the specification of the family wealth accumulation, the family's demand for risky assets should include the wife's characteristics, particularly age. The preliminary analysis of the data reveals a statistically insignificant impact of the wife's characteristics on family portfolio composition. Thus, the

flexibility (occupational category, family size), an index of human capital (educational attainment) and control dummies for the presence of unemployed persons, farm family and urban household. Labour supply flexibilty decreases with age and hence the demand for risky assets is expected to decrease with age. To allow for the rate of decrease to vary with age, an age squared term is included in equation (7.5). The sign of $\phi 3$ determines the household's attitude towards risk:

$\phi 3 > 0$ implies decreasing RRA;

$\phi 3 = 0$ implies constant RRA and

$\phi 3 < 0$ implies increasing RRA

To determine whether a foreign born household's RRA differs from that of a Canadian born household, a dummy variable for a foreign born family (IMG) is interacted with the net worth variable (IMG*lnW) and included as an additional regressor in equation (7.5). It is difficult to assign any apriori sign to the coefficient of the ratio of social security to net worth (α_{ssw}) variable. The implicit rate of return from old age social security programs depends on the government's future fiscal measures. The government often makes ad hoc changes in the potential CPP/QPP benefits, the OAS payments, and the threshold income for the means-test in case of GIS benefits. Therefore, it is not obvious how households perceive the distribution of implicit returns on SSW and it's correlation with the returns of risky assets.[82] The potentially ambiguous effect of the tax rate on portfolio composition was discussed earlier. The demand for risky assets equation has been estimated for all households and by birth place. Prior to the presentation of empirical results for equation (7.5), a model of asset demand at a further level of disaggregationwe is put forward.

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share equation includes only the husband's (who is identified as the head of the family in the Consumer Finance Survey) characteristics.

[82]A positive correlation between those returns implies a substitution possibility between α_K and α_{ssw} and a negative correlation indicates complementarity.

Empirical Specification of a System of Asset Demand Equations

In line with the specification of the demand for risky assets, an empirical model of a system of asset share equations is proposed. In the last section all assets are dichotomized into risky and risk-free categories. In reality no asset is completely risk free since no asset can be used as a hedge against unanticipated inflation. Hubbard (1983) developed a model of the system of asset demands which explicitly takes into account the role of social security wealth in portfolio composition.[83] Participation in the social security program is involuntary and entitlement to future social security benefits cannot be used as collateral to borrow money. Similar to the earlier discussion of the demand for risky assets, the effect of social security on the vector of desired asset shares depends on the covariances of the implicit return on social security with the return on marketable assets. Thus, it is not intended to assign any a priori restriction on the effect of social security on wealth. The empirical model proposed here is similar to Hubbard (1983).[84] The primary purpose of Hubbard's study was to empirically determine the effect of social security on the portfolio of marketable assets while the central focus of this study is to determine whether the porfolio choice differ by birth status. Unlike Hubbard (1983) this thesis estimates the system of asset demands with the adding up constraint.

Let $s_i = x_i / W$ represent the portfolio share of the ith asset and r_i denotes the after tax expected rate of return on asset i . The system of asset demand equations can be written as:

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[83]The theoretical development of a system of asset demand equations in a continuous time framework can be found in Merton (1969). Hubbard (1983) incorporated the effects of social security wealth in this model. See appendix to this chapter for a brief presentation of his model.

[84]Hubbard's model is appropriate for the purpose of this study. Existing time series studies on household asset demands primarily concentrate on estimating the relative price effect (interest elasticity) and scale effect (wealth elasticity) ignoring the effect of ssw and household's demographic characteristics (See Zietz and Weichert, 1988; Noland, 1988; Taylor and Clements,1983).

$$s_i = \pi_{oi} + \pi_{1i} \log W + \sum_{j=1}^{n} \theta_{ij} r_j + \sum_{m=2}^{G} \pi_{mi} Z_m + \varepsilon_i \qquad (7.6)$$

where n stands for the number of asset/debt categories, G is the the total number of explanatory variables beside after tax return variables, Z_m includes the ratio of social security to net worth (α_{ssw}) and other exogenous variables measuring household's economic and demographic characteristics such as age, education and occupation. The balance sheet restriction will hold for all values of the explanatory variables if the following conditions are satisfied:

$$\sum_{i=1}^{n} \pi_{0i} = 1, \quad \sum_{i=1}^{n} \pi_{1i} = \sum_{i=1}^{n} \theta_{ij} = \sum_{i=1}^{n} \pi_{mi} = 0 \qquad (7.7)$$

Although in a cross section every household faces the same pre-tax return on assets, their after tax rate of return may differ. Therefore, the tax rate is included to capture the varation in after tax return across households. The coefficient of α_{ssw} measures the degree of substitutability or complementarity between asset X_i and SSW. The system of asset demand equations is estimated for all households and by birth place using Zellner's SURE method.

7.2 Empirical Results

The cross-sectional data to be analyzed are the sames used to investigate wealth accumulation behavior. The sample contains data on 14 asset and debt categories. Descriptive statistics on these asset/debt categories are presented in Chapter 5 in Table 5.1 for the full sample of 13,957 observations. A vast majority of the households in the

sample do not hold positive holdings of every asset category. It means that for most asset categories there is little variation in the dependent variable due to zero holdings by a significant proportion of the sample members. To overcome this problem, certain asset/debt categories are aggregated to obtain a portfolio of six broad asset/debt categories:[85]

1. Liquid Assets
2. Stocks and Equities
3. RRSP and RHOSP
4. Owner-Occupied Home
5. Automobiles
6. Total Debt

Even after this aggregation it is observed that only 1,604 families out of 8,877 married couples have positive holdings of every broad asset category. This sub sample contains 1,268 Canadian-born and 336 foreign-born families. The analysis of portfolio selection is based on this sub sample. The demand functions for risky assets have been estimated under two alternative scenarios. First, we define a risky asset as the sum of total stock, equities in business, farm or profession and equity in real estate exclusive of the owner-occupied home. Our alternative definition of risky assets includes the market value of the owner-occupied home in the first definition. The measure of risky assets used by Friend and Blume (1975) is compatible with the second definition. Since the owner-occupied

[85]Liquid Assets include deposits, savings certificates, Canada Savings Bonds and cash on hand. The second category is the sum of total stock holdings, equities in business, farm or profession and equity in real estate other than owner-occupied home. The third category includes registered retirement savings plan, registered home ownership savings plans, savings in Deferred Profit sharing plans, and loans to persons and business and other miscellaneous non-liquid assets (gold stocks, copyrights, royalties, patents). The fourth category includes market value of owner-occupied homes. The fifth category is the sum of the market values of passenger cars, trucks, vans, and other vehicles (motorcycles, recreational vehicles, etc.). Finally, the total debt includes consumer debt and all institutional loans including mortgage outstanding on an owner-occupied home.

home is a consumption as well as an investment good it is important to see how the demand function for risky assets responds with and without the home. Thus, two alternative risky assets demand functions have been estimated using two different measures of risky assets. The empirical results corresponding to the risky asset demand function (equation 7.5) is presented in Table 7.1(a) through 7.2(b). The results for the system of asset demand equations (7.5) are reported in Table 7.3 and Table 7.4.

7.2.1 Results for the Demand for Risky Assets

The OLS estimates of the parameters of the demand equation (7.4) can be found in Table 7.1(a) for all households. The coefficients of age and age squared in the first column indicate that the demand for risky assets decreases at a decreasing rate until the end of life.[86] This result confirms the 'labor supply flexibility hypothesis' put forward by Bodie, Merton and W. Samuelson (1992). The longer future working life span and the associated earnings stream for the young act as an insurance against unforeseen outcomes resulting from risky investment. This explains why the young hold larger fractions of their net worth in risky portfolios than the old.

The coefficient of the log of net worth in the first column implies that a typical household exhibits decreasing relative risk aversion. This finding is not sensitive to the inclusion of the home in the risky assets portfolio. However, the coefficient of the interaction variable (IMG*InW) indicates that immigrants' marginal propensity to hold risky assets (with respect to net worth) is smaller than the Canadian born if the home is excluded from the definition of risky assets, but greater than the Canadian born if the home is included, ceteris paribus. This result simply reveals immigrants' strong preference for housing. An increase in the ratio of social security wealth to net worth

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[86] Since $\frac{\delta X_k}{\delta HAGE} = -0.0168 + 0.00021(HAGE) < 0$ for $HAGE \leq 80$ and $\frac{\delta^2 X_k}{\delta HAGE^2} = 0.0021 > 0$.

(α_{SSW}) increases the demand for risky assets. This result is robust to the inclusion of the home. This complementarity between social security wealth and risky assets reveals the existence of a negative correlation between the implicit rate of return on SSW and the return on the risky assets portfolio. An increase in the tax rate reduces the demand for risky assets if the home is excluded and raises the demand if the home is included. The latter effect, however, is statistically insignificant. The results reveal rational behavior on the part of households because the implicit rate of return from the owner-occupied home is not subject to personal income tax.

Table 7.1(b) presents the results on the demand function for risky assets augmented for educational attainment, occupational categories and other control dummies. The signs of the coefficients of the education level dummies,[87] in the first two columns, suggest a substitute relationship between human capital and demand for risky financial assets. The degree of substitutability, however, is small in magnitude. The occupational dummies and the family size variable were included with age as additional proxies for 'labor supply flexibility.' The results suggest that these indices have no significant effect on risky asset demand. It is suspected that the broad occupational categories do not adequately capture labor supply flexibility. The family size variable has a positive effect on demand when the home variable is included in risky assets. This is obviously a scale effect (i.e., a large family requires a large home) rather than a potential multiple workers-induced (the large family is likely to have multiple workers, and perhaps enjoys flexibility with respect to labor supply) increase in risky asset demand.

The presence of an unemployed person in the family reduces the demand for risky assets if the home is excluded and raises the demand if the home is included in the risky asset portfolio. These effects, however, are statistically insignificant. A farm family

[87]The omitted category is 'less than grade 9' education.

holds a significantly larger fraction of wealth in risky assets than a non-farm family with similar characteristics (see first two columns of Table 71.(b)) The coefficient of the farm family dummy becomes smaller in magnitude and statistically insignificant if the measure of risky assets is augmented by the presence of a home.[88]

[88]By definition, farm families hold 'equity in farm.' The definition of risky assets includes equity in farm. Therefore, the effect for the farm family dummy is pronounced in the first two columns of Table 7.1(b).

Table 7.1(a)
Demand for Risky Assets: All Households
Dependent Variable: $\alpha_k = \frac{\text{Risky Assets}}{\text{Net Worth}}$

Variables	Risky Assets Exclusive of Owner-occupied Home		Risky Assets Inclusive of Owner-occupied Home	
Constant	-2.5718 (-15.60)	-2.5806 (-15.70)	-2.7548 (-8.26)	-2.7316 (-8.23)
HAGE	-0.0168 (-4.32)	-0.0165 (-4.27)	-0.0578 (-7.36)	-0.0585 (-7.48)
$HAGE^2$	0.000105 (2.68)	0.000104 (2.65)	0.000398 (5.02)	0.000402 (5.10)
Ln(w)	0.2855 (22.84)	0.2863 (22.97)	0.4018 (15.88)	0.3995 (15.87)
IMG*Ln(w)		-0.0037 (-3.27)		0.0098 (4.25)
α_{ssw}	0.1335 (10.45)	0.13241 (10.39)	0.8389 (32.44)	0.8418 (32.71)
Tax rate	-0.0050 (-7.03)	-0.0051 (-7.11)	0.0007 (0.461)	0.0008 (0.547)
Adjusted R^2	0.298	0.302	0.512	0.517
F-Statistic	136.9	116.5	337.1	287.9
(Degrees of Freedom)	(5,1598)	(6,1597)	(5,1598)	(6,1597)

Table 7.1(b)
Demand for Risky Assets: All Households
Dependent Variable: $\alpha_k = \frac{\text{Risky Assets}}{\text{Net Worth}}$

Variables	Risky Assets Exclusive of Owner-occupied Home		Risky Assets Inclusive of Owner-occupied Home	
Constant	-2.2849 (-13.820	-2.2959 (-13.88)	-2.7252 (-7.86)	-2.6785 (-7.74)
HAGE	-0.0157 (-3.98)	-0.0157 (-3.98)	-0.0594 (-7.19)	-0.0597 (-7.24)
$HAGE^2$	0.00009 (2.30)	0.00009 (2.31)	0.0004 (5.04)	0.0004 (5.05)
Ln(w)	0.2661 (20.79)	0.2671 (20.86)	0.39097 (14.56)	0.3870 (14.45)
IMG*Ln(w)		-0.0020 (-1.76)		0.0085 (3.56)
α_{ssw}	0.1252 (10.01)	0.1248 (9.49)	0.8336 (31.77)	0.8352 (31.95)
Tax rate	-0.0026 (-3.52)	-0.0027 (-3.58)	0.0006 (0.42)	0.0009 (0.55)
University	-0.0613 (-2.82)	-0.0611 (-2.81)	0.0459 (1.01)	0.0450 (0.99)
Some Post-Secondary	-0.0521 (-2.66)	-0.0514 (-2.62)	0.0678 (1.65)	0.0648 (1.58)
Secondary	-0.0507 (-3.04)	-0.0521 (-3.12)	-0.0111 (-0.32)	-0.0052 (-0.15)
Managerial, Admn., and Professional	-0.0333 (-1.68)	-0.0356 (-1.80)	-0.0392 (-0.95)	-0.0292 (-0.71)
Clerical, Sales and Services	-0.0006 (-0.03)	-0.0011 (-0.06)	-0.0076 (-0.19)	-0.0053 (-0.13)
Transportation, Construction etc.	0.0038 (0.20)	0.0031 (0.16)	-0.0147 (-0.37)	-0.0118 (-0.30)
Presence of Unemployed Persons	-0.0207 (-1.52)	-0.0207 (-1.53)	0.0123 (0.43)	0.0125 (0.44)
Farm Family	0.1148 (4.22)	0.1121 (4.11)	0.0760 (1.33)	0.0877 (1.54)
Family Size	0.00094 (0.20)	0.0015 (0.31)	0.0170 (1.70)	0.0148 (1.48)

Urban Area	-0.0845 (-6.86)	-0.0858 (-6.44)	0.0706 (2.73)	0.0539 (2.06)
Adjusted R^2	0.350	0.351	.515	0.518
F-Statistic	58.5	55.1	114.4	108.8
(Degrees of Freedom)	(15,1588)	(16,1587)	(15,1588)	(16,1587)

Canadian Born vis-á-vis Foreign Born Households

So far the results on the demand for risky assets for all households have been discussed. Now an analysis of the estimates of birth status-specific demand function for risky assets will be provided. The results can be found in Table 7.2(a) and 7.2(b). From Table 7.2(a) it is clear that both for the foreign born and the Canadian born the demand for risky assets decreases with age at a decreasing rate until the end of life, irrespective of exclusion or inclusion of the owner-occupied home in the definition of risky assets. In the case of foreign born households, however, the stage in the life cycle has no statistically significant effect on the demand for risky assets exclusive of the home.

The coefficient for the log of the net worth variable obtains a positive sign in both the Canadian born and the foreign born equations. This implies decreasing relative risk aversion. It is worth noting that the coefficient for ln(W) is increased substantially while the corresponding coefficient for the Canadian born is reduced slightly by the inclusion of the home in the composite risky asset. Similarly, the marginal impact of social security wealth on the demand for risky assets for immigrants exceeds that for the Canadian born by a quantitatively significant amount if the home is included. Both the foreign born and the Canadian born have a similar response to the tax rate. An increase in the tax rate reduces the demand for risky assets exclusive of home but does not affect significantly the demand for risky assets inclusive of home.

The results for the risky assets demand function when augmented for education, occupation, etc., are presented in Table 7.2(b). A higher level of educational attainment reduces the demand for risky assets exclusive of home in the Canadian born equation. The foreign born equation, however, does not reveal any statistically significant relationship between educational attainment and the demand for risky assets.

The occupational dummies are found insignificant in all but the case of foreign born managerial, administrative and professional categories. Households belonging to

this category hold a significantly lower fraction of their net worth in risky assets than the households headed by foreign-born school dropouts. Family size has no significant effect on risky asset demand either for the Canadian born or the foreign born households. The dummy variable for urban residence obtains a statistically significant coefficient in the foreign born demand equation inclusive of home and in the Canadian born equation exclusive of home. The former effect is negative while the latter effect is positive.

Table 7.2(a)
Demand for Risky Assets: Canadian born and Foreign born Households
Dependent Variable: $\alpha_k = \frac{\text{Risky Assets}}{\text{Net Worth}}$

Variables	Risky Assets Exclusive of Owner-occupied Home		Risky Assets Inclusive of Owner-occupied Home	
	Canadian born	Foreign born	Canadian born	Foreign born
Constant	-2.6689 (-14.29)	-2.4591 (-6.47)	-0.8522 (-2.97)	-6.2674 (-6.35)
HAGE	-0.0162 (-3.70)	-0.0123 (-1.38)	-0.0451 (-6.70)	-0.0872 (-3.77)
$HAGE^2$	0.000094 (2.10)	0.000085 (0.98)	0.00029 (4.22)	0.0006 (2.79)
Ln(w)	0.2942 (20.54)	0.2588 (9.64)	0.2318 (10.51)	0.73711 (10.58)
α_{ssw}	0.1386 (9.16)	0.1188 (4.92)	0.5626 (24.15)	1.5012 (23.94)
Tax rate	-0.0052 (-6.50)	-0.0044 (-2.82)	-0.0004 (-0.29)	-0.00079 (-0.20)
Adjusted R^2	0.317	0.228	0.495	0.709
F-Statistic	118.6	20.8	249.7	163.9
(Degrees of Freedom)	(5,1262)	(5,330)	(5,1262)	(5,330)

Table 7.2(b)
Demand for Risky Assets: Canadian-born and Foreign-born Households

Variables	Risky Assets Exclusive of Owner-occupied Home		Risky Assets Inclusive of Owner-occupied Home	
	Canadian born	Foreign born	Canadian born	Foreign born
Constant	-2.403 (-12.72)	-2.1702 (-5.74)	-0.6108 (-2.04)	-6.5244 (-6.46)
HAGE	-0.0156 (-3.48)	-0.0101 (-1.14)	-0.0448 (-6.28)	-0.0829 (-3.48)
$HAGE^2$	0.00008 (1.82)	0.000073 (0.83)	0.000296 (4.03)	0.00059 (2.50)
Ln(w)	0.279 (18.90)	0.2263 (8.24)	0.2039 (8.70)	0.7465 (10.17)
α_{ssw}	0.133 (8.92)	0.1069 (4.50)	0.5470 (23.16)	1.5089 (23.74)
Tax rate	-0.0028 (-3.39)	-0.0017 (-1.01)	-0.0072 (-0.54)	0.0022 (0.48)
University	-0.0845 (-3.40)	0.0273 (0.59)	0.0281 (0.71)	0.1442 (1.18)
Some Post-Secondary	-0.0732 (-3.24)	0.0183 (0.46)	0.0533 (1.49)	0.0931 (0.87)
Secondary	-0.0697 (-3.66)	0.0039 (0.11)	0.0023 (0.08)	-0.0069 (-0.07)
Managerial, Admn., and Professional	-0.0271 (-1.22)	-0.0592 (-1.34)	-0.0044 (-0.13)	-0.2600 (-2.21)
Clerical, Sales and Services	-0.0048 (-0.22)	0.0269 (0.67)	0.0234 (0.67)	-0.1928 (-1.78)
Transportation, Construction etc.	-0.0099 (-0.46)	-0.0063 (-0.16)	-0.0501 (-1.47)	-0.0954 (-0.90)
Presence of Unemployed Persons	-0.0148 (-0.97)	-0.0419 (-1.37)	-0.0266 (-1.09)	0.1383 (1.73)
Farm Family	0.0891 (3.04)	0.3023 (3.86)	0.1056 (2.27)	-0.0444 (-0.21)
Family Size	0.0004 (0.08)	0.0122 (1.21)	0.0089 (1.02)	0.0268 (0.99)
Urban Area	-0.0823 (-6.07)	-0.057 (-1.64)	0.0583 (2.70)	-0.0486 (-0.52)

Adjusted R^2	0.368	0.277	0.502	0.71
F-Statistic	50.2	9.5	86.2	55.8
(Degrees of Freedom)	(15,1252)	(15,320)	(15,1252)	(15,320)

7.2.2 Results for the System of Asset Demand Equations

The estimated system of asset demand equations is presented in Table 7.3 for all households and in Table 7.4 by birth status. To avoid perfect collinearity problem the demand system is estimated by omitting one category (debt). Using the adding up restrictions given in (7.6) the parameters of the debt share equation are derived.

First, the results for all households given in Table 7.3 are interpreted. The results exhibit an important role for age in determining household portfolio composition. After controlling for net worth, social security wealth and the tax rate it is found that as age increases the demand for liquid assets decreases until near the end of life. The demand for stocks and equities also follows a similar pattern. The demand for RRSP and RHOSP (inclusive of DPSP and other non-liquid financial assets) increases until age 77 and then decreases. The share of the owner-occupied home in the portfolio decreases until age 70 and thereafter rises. The share for automobiles increases until age 66 and then decreases. Recognizing that the share of debt in net worth always take a non-positive value, it is observed that this share decreases with age until age 60 and then rises.

As the net worth level increases, a typical household's portfolio composition shifts from liquid assets and RRSP/RHOSP (inclusive of DPSP and miscellaneous nonliquid assets) to stocks/equities, home and automobiles. The coefficient for the interaction variable (IMG*lnW) indicate that immigrants significantly differ from the Canadian born with respect to their demand for stocks, equities and housing. Adjustment in the foreign-born portfolio composition primarily takes place via substitution between stocks and equities, and homes. The foreign born do not differ significantly from the Canadian born with respect to wealth effects on other asset shares. The wealth effect on

the demand (as a share) for debt is positive. The effect is larger for a foreign born household than a Canadian born household.

An increase in the social security wealth induces households to raise their holdings of all categories of assets except liquid assets. Contrary to the a priori expectation, the coefficient of the ratio of social security wealth to net worth obtains a positive sign in the RRSP/RHOSP equation. Nevertheless, the coefficient is small in magnitude. An increment in the ratio of social security wealth to net worth induces households to borrow. The overall results indicate that household portfolio composition shifts from liquid assets to debt and other asset categories in response to an increment in social security wealth.

The share of stocks/equities in the portfolio decreases with an increase in the tax rate. The shares of other assets and debt respond positively to a tax rate increase. The effect on RRSP and RHOSP is worth noting. Households effectively use the tax-sheltered aspect of this asset category in response to a higher tax rate. The tax effect on owner-occupied homes is positive and quantitatively significant. This arises due to the tax exemption on the implicit rate of return from owner-occupied homes.

Canadian Born vis-à-vis Foreign Born Households

The estimates for the system of asset demand equations by birth status are presented in table 7.4. The stage in the life cycle has a statistically significant effect on the share for every asset for Canadian born households. For foreign born households, only the shares of homes and automobiles are statistically affected by the age and age squared variables. The wealth effect causes a differential impact by birth status in only two categories: homes and automobiles. More specifically, immigrants increase their asset shares for

these two categories while the Canadian born reduce those as net worth increases. In addition, birth status affects the increment in the size of debt with respect to net worth. For a given increase in net worth, a foreign-born household increases the debt share by a significantly greater amount than a Canadian-born household.

The social security wealth variable has an expected negative effect on the demand for RRSP/RHOSP in the Canadian born equation, however, the effect is insignificant. In contrast, a positive effect arises in the foreign born equation. The effect of social security on other asset/debt categories is qualitatively similar by birth status but substantial differences arise with respect to the demand for homes, automobiles, and debt. For a given increase in social security wealth, immigrants' demand for these three categories rises three times as much as the corresponding rise for the Canadian-born.

A rise in tax rate reduces the share of stocks/equities and raises the share of debt, RRSP/RHOSP, home and automobiles in the Canadian-born portfolios. In contrast, tax effects are statistically significant only for stocks/equities and RRSP/RHOSP in the foreign born share equation. The foreign born respond to a tax rate increase by incurring more debt and reducing their demand for stocks/equities, and in turn use these released funds to purchase RRSP and RHOSP.[89] It should be noted that augmentation of the system of asset demand equations with education, occupation, and other control dummies for family characteristics leaves the above findings unchanged.

[89]Recall that this category also includes DPSP and misellaneous non-liquid assets.

Table 7.3
System of Asset Demand Equations: All Households

Dependent Variable: $s_i = \frac{\text{Asset}_i}{\text{Net Worth}}$

Variables	Liquid Assets	Stocks & Equities	RRSP & RHOSP	Home	Automobiles	Debt (-)
Constant	0.559 (5.84)	-2.581 (-15.74)	-0.090 (1.36)	-0.151 (-0.45)	0.047 (0.72)	-1.22
HAGE	-0.0074 (-3.31)	-0.0165 (-4.28)	0.0028 (1.81)	-0.042 (-5.34)	-0.0066 (-4.30)	0.0697
$HAGE^2$	0.00011 (4.81)	0.0001 (2.66)	-0.000018 (-1.17)	0.0003 (3.76)	0.00005 (3.34)	-0.00058
Ln(w)	-0.027 (-3.77)	0.286 (23.02)	-0.020 (-2.20)	0.113 (4.47)	0.012 (2.37)	-0.364
IMG*Ln(w)	-0.001 (-1.51)	-0.004 (-3.28)	0.0002 (0.39)	0.014 (5.83)	-0.0002 (-0.45)	-0.009
α_{ssw}	-0.191 (-2.58)	0.132 (10.42)	0.009 (1.84)	0.709 (27.41)	0.095 (18.77)	-0.491
Tax rate	0.0008 (1.96)	-0.005 (-7.13)	0.002 (7.01)	0.006 (4.04)	0.0007 (2.39)	-0.0045
Adjusted R^2	0.073	.302	0.475	0.542	0.369	

Table 7.4
System of Asset Demand Equations by Place of Birth

Dependent Variable: $s_i = \frac{\text{Asset}_i}{\text{Net Worth}}$

Variables	Liquid Assets	Stocks & Equities	RRSP & RHOSP	Home	Automobiles	Debt (-)
Canadian-Born Households						
Constant	0.581 (5.34)	-2.669 (-14.33)	0.162 (2.15)	1.817 (6.25)	0.424 (6.70)	0.685
HAGE	-0.00999 (-3.92)	-0.016 (-3.70)	0.00424 (2.40)	-0.02893 (-4.25)	-0.00461 (-3.11)	0.055
$HAGE^2$	0.00014 (5.37)	0.00009 (2.10)	-0.000033 (-1.81)	0.000196 (2.82)	0.000036 (2.40)	-0.000429
Ln(w)	-0.026 (-3.12)	0.294 (20.59)	-0.019 (-3.23)	-0.062 (-2.80)	-0.021 (-4.33)	-0.166
α_{ssw}	-0.015 (-1.67)	0.139 (9.18)	-0.004 (-0.72)	0.424 (18.01)	0.042 (8.16)	-0.586
Tax rate	0.001 (2.51)	-0.005 (-6.48)	0.0018 (5.63)	0.005 (3.87)	0.0006 (2.23)	-0.0034
Adjusted R^2	0.089	0.317	0.375	0.554	0.310	
Foreign-Born Households						
Constant	0.473 (2.18)	-2.459 (-6.53)	0.014 (0.098)	-3.808 (-3.92)	-0.780 (-4.87)	7.26
HAGE	-0.0023 (-0.46)	-0.0123 (-1.39)	-0.00114 (-0.34)	-0.075 (-3.29)	-0.0092 (-2.46)	0.0999
$HAGE^2$	0.000043 (0.88)	0.00008 (0.99)	0.00002 (0.64)	0.00054 (2.44)	0.000066 (1.81)	-0.00075
Ln(w)	-0.026 (-1.69)	0.259 (9.72)	0.0011 (0.12)	0.478 (6.97)	0.082 (7.23)	-0.794
α_{ssw}	-0.027 (-1.92)	0.119 (4.96)	0.040 (4.44)	1.382 (22.39)	0.222 (21.88)	-1.736
Tax rate	-0.0004 (-0.44)	-0.004 (-2.85)	0.002 (4.09)	0.004 (0.91)	-0.0003 (-0.42)	-0.0013
Adjusted R^2	0.031	0.228	0.223	0.711	0.68	

CHAPTER 8

SUMMARY AND CONCLUSIONS

This thesis investigates wealth accumulation and portfolio selection behavior of the foreign born *vis-à-vis* Canadian born households. The analysis is based on the assumption that saving decisions are separable from portfolio selection decisions. An extended version of the life cycle model, due to Feldstein, is used as the foundation of the empirical analysis of wealth accumulation. The results confirm the implications of the life cycle hypothesis for both the Canadian born and the foreign born. The shape of the wealth-age profile, however, differs by birth place. The rate of accumulation, prior to age 65, is greater for a foreign born household than for a Canadian born household. After age 65, immigrants dissipate wealth at a higher rate than the Canadian households. These contrasting shapes of the wealth-age profiles imply the foreign born have a more pronounced inverted-U pattern than the Canadian born. The findings, however, do not support the strict version of the life cycle as noted by Modigliani (1988:23):

> In the stylized pure life-cycle model, wealth must clearly be declining after retirement, and at a sufficiently fast pace to reach exhaustion at the end of life.

The results in Chapter 6 indicate modest rates of dissipation of wealth with respect to age. Between ages 65 and 79, an immigrant's dissipation rate lies between -0.3% and -1.4% while that for the Canadian born lies between -0.2% and -1.1%. Given these rates, wealth exhaustion will not occur before the end of life for either group. King and Dicks-Mireaux (1982) also reported similar results. They reported an annual rate of decumulation of 1.15% at age 75, once social security and pension wealth are included in the net worth equation. The results indicate that due to uncertainty over longevity, households leave a substantial amount of unintended bequests at the end of their lives.

The foreign born reveal a stronger bequest motive than the Canadian born. This conclusion is based on their differential marginal bequest functions. With respect to social security wealth, this study found a small wealth displacement effect. A dollar increase in social security wealth reduces the foreign born household wealth by fourteen cents and the Canadian born household wealth by nine cents. The results indicate that the old age social security program in Canada had a positive effect on national saving *circa* 1984 because a dollar increase in public saving leads to a less than a dollar decrease in household saving. Thus our results provide support for Feldstein's extended life cycle theory which argues that the substitutability between private and public saving is less than perfect due to the presence of the induced retirement effect.

A comparison of households' wealth accumulation with life-cycle earning performance provides an insight into the underlying consumption profile. First, the focus will be on the results of the labor market performance of the foreign born. Second, these results are to be compared to the wealth accumulation findings. The foreign born male approaches the labor market participation probability of the Canadian born male after twelve years but the corresponding figure for the foreign born female is only two years. The catching up point for male immigrant earnings occurs after seventeen years and for female immigrants the associated figure is twelve years. For wealth holding, a typical foreign born household catches up to the wealth holding of a typical Canadian born household after twelve years.

Recognizing the fact that wealth is a stock variable and wives contribute significantly smaller fractions to household earnings, the rate of assimilation with respect to net worth is very fast. It implies that the assimilation rate with respect to the underlying total consumption level is very low for the foreign born household. This finding of low assimilation rates with respect to consumption accompanied with the finding of steeper

age-wealth profiles for the foreign born (during the working period) relative to the Canadian born indicates that immigration may lead to an increase in household sector wealth in Canada, provided that on the average, the wealth depressing effect of immigration resulting from assimilation factors does not outweigh the wealth enhancing effect of immigration resulting from a steeper wealth-age profile. Policy makers should take this potential benefit into account in addition to present immigration selection criteria.

The results for household portfolio selection have important implications for the demand side of the asset market. Household asset demand equations are estimated at two different levels of aggregation. First, all assets are dichotomized into two groups: risky and risk-free. It is found that the demand for risky assets decreases at a decreasing rate with age both for the foreign born and the Canadian born. This result is robust. The inclusion of the home in the definition of risky assets and the augmentation of the risky asset demand function with education, occupation and other control dummies for family characteristics leave the results unchanged. The 'age effect' in the risky asset demand function can be interpreted in terms of labor supply flexibility. The young have a longer working life span than the old. Thus, they enjoy a greater degree of flexibility with respect to future labor supply and hence future labor income. Labor supply flexibility acts as insurance against possible adverse outcomes from risky investments in non-human wealth. Thus, as age increases the share of risky assets in the portfolio decreases.

Both the Canadian born and the foreign born exhibit decreasing relative risk aversion. This is indicated by an increase in the share of risky asset demand with net wealth for both groups. This result is derived under the assumption of homogenous expectations about the distribution of returns on the risky asset portfolio. The magnitude of the wealth effect, however, differs by birth status. The results suggest a strong preference for homes on the part of immigrants since the wealth effect increases

substantially when the home is included in the definition of risky assets. A complementary relationship between social security wealth and risky marketable assets is found. With respect to the tax rate, it is observed that an increase in tax rate diverts assets from risky investments (stocks, equities in business, farm and profession) toward other assets.

This thesis also reports estimates for a system of asset demand equations. The results suggest that the portfolio composition changes with age for both household groups. The age effect is more pronounced in the case of Canadian born than the foreign born. The stage in the life cycle has a statistically significant effect for every asset category in the Canadian born demand system. In case of immigrants, however, a significant age effect occurs only in demand equations for homes and automobiles. The portfolio composition of immigrants shifts significantly in favor of stocks/equities, homes and automobiles as net worth increases. Similar effects are also observed for immigrants with respect to social security wealth. In contrast, the Canadian born portfolio decreases its share of homes and automobiles as net worth rises.

The results in general suggest that as wealth increases, the foreign born raise their share of debt, reduce their share of liquid assets and channel these released funds to stocks/equities, home and automobiles. With the increase in net worth, the Canadian born households raises the share of debt by a substantially smaller magnitude than the corresponding increase in the foreign born equation and they reduce their demand for homes, automobiles and liquid assets. They channel these released funds towards a single asset category: stocks/equities.

One general pattern emerges; immigrants have a strong preference for real assets (i.e., homes and automobiles, primarily financed by borrowing) while Canadians have a

strong tendency to hold stocks and equities which are mainly financed by reducing their liquid asset demand rather than a substantial increment in debt. At this point, I focus on some of the limitations of this empirical work.

First, this thesis attempts to approximate the life-cycle behavior using one cross section of data. If labor market performance or propensity to consume for a given age-cohort varies over time, the wealth age profile is likely to shift over time. The smaller the magnitude of this shift, the better will be the approximation of the true life-cycle profile.

Second, due to lack of data, this study could not include private pension wealth as an exogenous variable in the accumulation equation.

Third, the results on immigrant's assimilation with respect to labor market performance and wealth accumulation are derived from a single cross-section. If the productivity characteristics, the rate of time preference, and the tastes for bequests vary across successive cohorts of immigrants, the assimilation results may change.

Fourth, the analysis is conducted under the assumption that consumption decision is separable from portfolio selection. This separability assumption is valid if the elasticity of marginal utility with respect to consumption is a constant. This theorem is derived by Samuelson (1969) and Merton (1969) in the context of a life-cycle portfolio selection model where consumption and portfolio selection decisions are made simultaneously. In the portfolio selection literature, the elasticity of marginal utility is interpreted as the coefficient of relative risk aversion. The results on the demand for risky assets indicate a decreasing relative risk aversion.[90]

[90]Recall that the portfolio selection results are derived from a sub sample of 1604 households with positive holdings of every broad asset categories.

Thus, the validity of the separability assumption is questionable. To resolve this issue, further analysis of data is required. One possible direction for future research is suggested here. Households' portfolio selection may involve two stages. At the first stage, households choose which assets to hold and at the second stage they make a decision about how much to hold of each asset. The observed zero holdings for equities or a home by a low wealth holder does not necessarily reflect a greater coefficient of relative risk aversion than that of a rich household. The low wealth holder may not be able to invest in a home due to the obvious indivisibility or in equities due to transaction costs. Thus, further analysis of the portfolio selection is required within a richer theoretical framework where portfolio selections are made at two stages as noted above. Finally, the availability of new survey data on assets and debts will facilitate the analysis of immigrant assimilation effects separately from cohort effects.

APPENDICES

Appendix to Chapter 1

Table A1.1. Saving Rates in G-7 Countries

	Gross Saving as a Ratio of GNP		
Country	1960s	1970s	1980s
Canada			
National	21.9	22.9	20.7
Public	3.6	2.7	-1.6
Household	7.8	10.4	12.3
Corporate	10.5	9.7	9.9
United States			
National	19.7	19.4	16.3
Public	2.0	0.4	-2.1
Household	9.2	10.7	9.5
Corporate	8.5	8.4	9.0
Japan			
National	34.5	35.3	31.6
Public	6.2	4.8	4.6
Household	13.3	17.9	15.6
Corporate	15.0	12.6	11.2
Germany			
National	27.3	24.3	22.5
Public	6.2	3.8	2
Household	6.9	8.7	7.8
Corporate	14.2	1.8	12.7
France			
National	26.2	25.8	20.4
Public	-	3.6	1.3
Household	-	13.6	10.3
Corporate	-	8.6	8.4
United Kingdom			
National	18.4	17.9	16.6
Public	3.6	2.6	0.1
Household	5.4	6.1	6.0
Corporate	9.4	9.2	10.4
Italy			
National	28.1	25.9	21.9
Public	2.1	-5.6	-6.7
Household	-	24.5	21.1
Corporate	-	6.6	7.5

Source: OECD National Accounts. Compiled by Shafer *et. al.* (1992, Page 159).

A note on the Canadian immigration experience

The purpose of this note is to focus on Canada's immigration policies (1953 to 1993) and historical immigration trends. The 1953 immigration act was initially permissive in terms of economic qualifications and total numbers admitted into Canada, but restrictive in terms of the admissible source countries. Under this act, preferential treatment was given to immigrants originating in Western European countries. Potential immigrants from all other countries, except British subjects from the old dominions and US citizens, were included in the non preferred class. The main objective of this policy was to maintain uniformity of customs by controlling the ethnic composition of immigrants.

Throughout the 1950s economic forces were present to remove this preoccupation with social absorption. Green (1976) argues that the postwar economic boom and the resulting demand for skilled workers required a more liberal immigration policy in terms of source countries. The 1962 immigration regulation sought to remove country-of-origin and racial restrictions and shift the emphasis towards skills requirements. Europeans still had an advantage over non-Europeans since they could sponsor a wider range of kin.

In 1967, a point system was adopted to allow immigrants to Canada to be chosen based on suitability to Canada and the Canadian labor market requirements and to mitigate any discrimination by religion, race or country of origin. Canada's immigration policy became truly universalistic in 1967 when the restriction of sponsorship of Asian relatives was dropped. Now regardless of country of origin immigration selection criteria applied equally world wide. Under the 1967 regulation immigrants were grouped into three major categories: (1) sponsored immigrants, which included close relatives of Canadian residents or citizens, (2) nominated relatives, which indicated more distant relatives of Canadian residents or citizens and (3) independent immigrants. Immigrants in the last two categories were screened by employing a point system. A maximum of 100 points was awarded according to the applicant's education, occupational demand in Canada, age, arranged employment and a personal assessment of unobserved skills (motivation and initiative) of the applicant by immigration officers. Initially the pass mark was 50 points. Currently, the minimum number of points required for entry is 70 in the last two classes. As a result of the 1967 immigration regulation and improvement in economic conditions in Europe the composition of immigrants changed after 1967 in favor of non-European countries, especially those in Asia (see Table A1.2). Canada's point system led to an inflow of highly trained immigrants from less developed countries.

Notwithstanding the apparent success of the post 1967 regulations, several criticisms were raised over the point system in a government white paper on immigration. The authors of the white paper cited that the presumed scale economies associated with a larger population were not apparently arising under expanding immigration. These critics further argued that if scale economies were sought they could be better achieved through free trade. Politicians also noticed that there was no precise control mechanism in the form of a yearly quota or target. Hence, politicians proposed closer control over yearly immigrant totals with more emphasis on specific labor market criteria.

A new immigration act was passed in 1978. Under this new law, an annual limit on the flow of immigrants per year was set by the Minister of Employment and Immigration after a review of labor market conditions and anticipated demographic requirements. The level of family class and refugee immigrants was determined independently of domestic labor market conditions. Two contradictory forces appeared to change the potential labor market impact of the post-1978 immigration flow. First the emphasis on job certification potentially reduced the possibility of short term unemployment for the independent class immigrants. On the other hand, the expansion of the family reunification class partially circumvented the job certification criterion for entry and opened the possibility of substantial negative impacts on residents' wages and jobs. In sum, the 1978 act substantially altered the gateways to enter Canada. Table A1.3 shows a rapid decline in independent class immigrants and an increase in family class immigrants and refugees during 1975-84.

In recent years, demographers have expressed concerned about the decline in Canada's population growth rate and the consequent aging of the Canadian population. Since 1972, the fertility rate in Canada has remained below the replacement level of 2.1 births per woman.[91] In response to the above trends, the government adopted an immigration plan for 1991-95. The main objective of this plan was to achieve a moderate increase in immigration levels from 200,000 in 1990 to 250,000 in 1992, where it will be stabilized for the rest of the plan period. More importantly the desire to control the size

[91]The replacement rate is defined as the number of births required to replace one generation by the next, i.e., 2 births to replace the parents and 0.1 birth to replace the deaths that occur before the next generation reaches reproductive age. An immigration level of around 140,000 would prolong the period of population growth until 2025, after that population would begin to decline. Each additional 60,000 net immigrants can delay the population decline by eight or nine years. With regard to population aging, Statistics Canada noted a 7 percent decline in the number of children under 15 years and a 17.9 percent increase in the number of persons over 65 during 1976-81.

of particular entry gates, i.e., family reunification and refugee class and the long processing queues led to the introduction of Bill C-86 in 1992. The result is the 1993 Immigration Act. Under this act the global annual target for immigration flow is replaced by individual entry class targets.

These major policy changes from a closed (1953 to 1967) to open (post 1967) and then, increasingly restrictive policy (after 1978) are strong a priori reasons to expect structural changes in the economic impact of Canadian immigrants over time. Thus, it is important to examine whether successive immigrant cohorts entering under different policy regimes demonstrate differential earnings, wealth accumulation and portfolio choice.

Table A1.2

Distribution of Immigrant Population by Place of Birth

Place of Birth	Total Number	Per cent	Period of Immigration				
			Before 1946	1946-66	1967-77	1978-82	1983-86
			(Percent)				
United States	282,025	7.2	19.4	3.8	7.8	6.3	7.6
Caribbean	193,435	5.0	0.4	1.5	12.0	6.8	5.7
South and Central America	147.305	3.8	0.3	1.0	5.7	7.0	11.3
Africa*	180,170	4.6	0.3	1.9	7.2	7.8	9.9
Europe	2,435,090	62.4	77.9	87.3	45.6	32.1	23.7
Asia	626,850	16.1	1.5	3.9	22.1	39.8	40.5
Other	43,275	0.9	0.2	0.6	1.6	1.2	1.2
Total	3,908,145	100.0	100.0	100.0	100.0	100.0	100.0

* Includes the Middle East
Source: Statistics Canada (1989b, Table 1, 1-5 to 1-8)

Table A1.3
Immigrant Arrivals by Class, 1970-89

Periods	Total arrivals	Family Class	Refugees and designated persons	Independent class
1970-74	158,857	24.7	1.3	74.0
1975-79	130,127	42.8	9.4	47.8
1980-84	114,206	44.1	17.4	38.5
1985-89	137,501	37.4	17.9	44.7

Source: Desilva (P4, 1992)

Table A1.4
Immigrant Flows by Immigrant Class and Place of Birth, 1980-89

Place of birth	Number of Immigrants	Percentage of total	Family class	Refugees and designated class	Independent class
United States	76,880	6.5	8.6	0.1	7.2
Caribbean	68,057	5.8	10.4	0.1	3.8
South and Central America	110,65	9.4	10.5	12.5	7.1
United Kingdom	98,812	8.4	6.5	0.1	13.4
Other Western Europe	39,365	3.3	1.8	0.2	6.0
Central Europe	100,668	8.5	4.6	25.1	5.4
Southern Europe	66,238	5.6	6.8	0.4	6.7
Eastern Europe	15,481	1.3	0.8	4.3	0.6
Northern Europe	7,403	0.6	0.6	0.1	0.9
Africa	52,162	4.4	3.1	5.0	5.4
South Asia	96,200	8.2	15.9	0.9	4.1
Southeast Asia	193,515	16.4	11.6	43.8	9.4
East Asia	158,692	13.3	12.8	0.7	19.2
West Asia	77,737	6.6	3.6	6.6	9.3
Oceania and other	17,473	1.5	2.1	0.1	1.5
All Immigrants	1,179,378	100.0	100.0	100.0	100.0

Source: Desilva (1992)

Appendix to Chapter 2

Table A2.1
Studies Indicating Strong Life-Cycle Motive

Source	Nature of the Study	Major Findings
Studies Based on Survey Method		
Morgan *et al.* (1962)	Based on data from survey question on the size of transfer received; evaluated at the time of receipt	Transfer wealth is less than 10%
Projector and Weiss (1964)	Based on response to survey question on share of wealth from transfer; evaluated at the time of receipt	Transfer wealth constitutes only 16% of total wealth
Burlow *et al.* (1966)	Based on survey question on proportion of wealth transfers; limited to income at least $10,000; evaluated at the time of receipt	Share of transfer wealth is one-seventh
The Flow of Bequests Approach		
(a) Modigliani (1988) Estimates based on bequest flow information given in Kotlikoff and Summers (1981)	Transfer wealth computed from wealth of those dying: age gap 25-30 years; includes intergenerational bequests	Transfer wealth constitutes 17% of total wealth
(b) Modigliani (1988) Estimates based on bequest flow information given in Projector and Weiss (1964)	Based on the answer to survey question on transfer received during year; age gap 25-30 years; includes inheritance and gifts from outside family	Transfer wealth constitutes 15.5 percent of total wealth
(c) Modigliani (1988) Estimates based on bequest flow from Menchik and David (1983)	Data source: US probate records; age gap 25 years; includes all bequests other than intraspousal transfers	Share of transfer wealth was 18.5 percent
Evidence from Estimated Wealth / Saving-age profile		
Ando and Kennickell (1985)	Uses saving-age profiles derived from Bureau of Labor Statistics Consumer Expenditure Survey (U.S.A.) for 1972 and 1973; Transfer wealth is treated as residual; Ignores changes in wealth arising from capital gains or losses.	Life-cycle wealth constitutes 60 to 85 percent of household wealth; Savings decline in old age.

King and Dicks-Mireaux (1982,1984)	Estimated wealth accumulation equations using Canadian microdata for 1976-77	Household net worth declines after retirement indicating a confirmation of life cycle hypothesis
Hurd (1986)	Panel data over a ten-year span extracted from the US Retirement History Survey	Wealth declines at 1.5 percent per year in retirement. If owner-occupied houses are excluded, the annual rate of decline becomes 3 percent per annum.

Table A2.2
Studies Indicating a Strong Intergenerational Transfer Motive

Source	Nature of the Study	Major Findings
Simulation Studies		
Auerbach and Kotlikoff (1987)	Uses a life-cycle simulation model which takes into account US demographics, preferences and fiscal institutions	Ratio of life-cycle wealth to disposable income is very low
Kotlikoff and Summers (1981)	Estimates based on age-specific savings and mortality rates	Life-cycle wealth constitutes only 18.9 percent of total 1974 US household wealth.
Kotlikoff and Summers (1986)	After correcting for the treatment of durable goods expenditure in their 1981 study	Share of life-cycle wealth is 21.9 percent in household wealth
White (1978)	Uses aggregate data on the age-structure of the population, profiles of earnings and consumption over the life cycle and a set of guesstimated parameters	Life-cycle constitute about a quarter of aggregate saving
Atkinson (1971)	Examine the wealth inequality in Britain	Life-cycle model cannot explain the upper tail of the distribution of wealth
Empirical Studies		
Darby (1979)	Inferred longitudinal age-consumption and age-earnings profiles from the cross section profile	At most 29 percent of US private net worth is devoted to future consumption or life-cycle accumulation
Mirer (1979)	Uses 1968 US survey data to explain wealth accumulation behavior of the married couples aged 65 to 99	Wealth holdings tend to rise with age after retirement.
Menchik and David (1983)	A longitudinal analysis of US estate data	Individuals do not decumulate wealth in old age

A2.1 Merton-Samelson Lifetime Portfolio Selection Model

This note presents the basic portfolio selection problem in a discrete-time, two assets, life cycle framework. If the individual invests \$1 in the riskless asset at time t, he/she gets (1 + r) at the end of the period. On the other hand, if the individual invests \$1 at time t in the risky asset he/she gets $\$1Z_t$ as one period rate of return, where Z_t is a random variable. The choice variables are:

α_t = the proportion of wealth in risky asset;

$(1 - \alpha_t)$ = the proportion of wealth in risk free asset; and

C_t = consumption.

The basic optimization problem is

$$\text{Max} \quad E[\sum_{t=0}^{T}(1 + \rho)^{-1}u(C_t)] \qquad (2.6)$$

$$\text{subject to } C_t = W_t - \frac{W_{t+1}}{(1- \alpha_t)(1-r) + \alpha_t Z_t}$$

where, r is the rate of time preference, and the term $\{(1- \alpha_t)(1-r) + \alpha_t Z_t)\}$ represents portfolio return. The individual maximizes (2.6) with respect to C_t and α_t. The solution to this problem can be found in Samuelson (1969).

Appendix to Chapter 3

A3.1. Wealth Accumulation Model

The Pontryagin's maximum principle is used to solve the intertemporal choice problem specified by equations (3.1) and (3.2) in the text. The problem can be rewritten in the following way:

$$\text{Maximize } U = \int_{t=0}^{T} u(C(t))\, e^{-\delta t}\, dt \qquad \text{(A3.1)}$$

subject to the instantaneous budget constraint

$$rW(t) + E(t) = C(t) + S(t) \qquad \text{(A3.2)}$$

Equation (A3.2) describes that at every instant the individual's asset earnings plus labor income must be equal to his/her consumption plus accumulation (savings). The present value Hamiltonion function of this problem can be written as:

$$H = \quad u(C(t))\, e^{-\delta t} + l\,[rW(t) + E(t) - C(t) - S(t)]\, e^{-rt} \qquad \text{(A3.3)}$$

where W is the *state* variable, C is the *control* variable and λ is the *costate* variable associated with state variable W. The end point restrictions are $W(0) = a_0$ and $W(T) = 0$. The choice of C(t) which maximizes H must satisfy the following condition:

$$\frac{\partial H}{\partial C} = u'(C(t))\, e^{-}\, dt - \lambda\ e^{-rt} = 0 \qquad \text{(A3.4)}$$

Differentiating (A3.4) with respect to time (t) we obtain

$$e^{-\delta t} u''(C(t)) \frac{dC(t)}{dt} - de^{-\delta t}\ u'(C(t)) = -\lambda\, re^{-rt} \qquad \text{(A3.5)}$$

We denote the elasticity of marginal utility with respect to consumption as:

$$\eta = - \frac{u''(C(t))}{u'(C(t))} C(t)$$

Using this expression and equation (A3.5) the following first-order differential equation is obtained:

$$\frac{\partial C(t)}{\partial t} - \frac{(r - \delta)\, C(t)}{\eta} = 0$$

The solution to this first-order differential equation yields the following:

$$C(t) = C_0 e^{\{(r - \delta)/\eta\}t} \qquad \text{(A3.6)}$$

Equation (A3.6) suggests that consumption grows over the individual's lifetime if $r > \delta$ subject to the condition that the present value of lifetime consumption cannot exceed the present value of lifetime wealth. Thus, substitution of equation (A3.6) into the lifetime budget constraint (euqation 3.2 in the text) yields:

$$\int_{t=0}^{T} [C_0 e^{\{(r - \delta)/\eta\}t}]\, e^{-rt}\, dt = K \qquad \text{(A3.7)}$$

Solving equation (A3.7) for C_0 yields the following expression for the initial consumption plan:

$$C_0 = \frac{\{(r-\delta)/\eta - r\}K}{e^{\{(r-\delta)/\eta - r\}T} - 1} \qquad \text{(A3.8)}$$

Denoting the propensity to consume out of lifetime resources for an individual with T years to live as

$$\mu = \frac{\{(r-\delta)/\eta - r\}}{e^{\{(r-\delta)/\eta - r\}T} - 1} = \mu[r, \delta, \eta, T]$$

and substituting equation (A3.8) into (A3.6) yields the optimal consumption plan over the individual's life cycle as specified in the text.

$$C^*(t) = \mu\,(r, \delta, \eta, T) A0\, e^{\{(r-\delta)/\eta)\}t} \qquad \text{(A3.9)}$$

Appendix to Chapter 5

Estimation of Social Security Wealth

All households in the sample of married couples are classified into four broad groups according to the stage of their life cycle. These are:

(1) both husband and wife are retirees
(2) husband is a retiree and wife is less than 65
(3) wife is a retiree and husband is less than 65
(4) both husband and wife are less than 65

For retirees the data on actual social security benefits (SSB) are available. Hence, by apply formula (5.5) in the text social security wealth (SSW) can be computed. For current workers, first, individual components of social security benefits (CPP, OAS and GIS) are estimated to obtain a measure of expected social security benefits ($ESSB_w$).

Canada Pension Plan Benefits

Recall, from the text the CPP/QPP benefit equation for individual i in year t:

$$RP_{it} = .25(\overline{YMPE}_t * AER_{it})$$

Using equation (5.2) and (4.3) the CPP benefit equation is rewritten as:

$$RP_{it} = .25\left[\frac{YMPE_{t-2} + YMPE_{t-1} + YMPE_t}{3}\right] * \left[\frac{1}{T}\sum_{j=1}^{T}\frac{PE_{i,t-j}}{YMPE_{t-j}}\right] \qquad \text{(A5.1)}$$

Note that a year's maximum pensionable earnings, YMPE, is the same for all individuals while pensionable earnings, PE, may vary across individuals. From cross-sectional data it is not possible to derive a life-cycle earnings profile for every sample member. Therefore, pensionable earnings over the contributory period cannot be determined. Hence, an alternative procedure is employed to estimate the average earnings ratio (AER). An

individual's normal earning, measured in 1983 dollars, is compared with 1983 maximum pensionable earnings to determine the AER. In particular,

$$\begin{aligned} AER_i &= 1 && \text{if } Y_i^* > YMPE_{1983} \\ AER_i &= \frac{Y_i^*}{YMPE_{1983}} && \text{if } YBE_{1983} < Y_i^* < YMPE_{1983} \\ AER_i &= 0 && \text{if } YBEY_{1983} > Y_i^* \end{aligned} \qquad \text{(A5.2)}$$

In 1983, the YBE was $1,800 and, YMPE was $18,500. To compute a three-year average of maximum pensionable earnings, it is assumed that YMPE will increase at a constant annual rate, g. For an employee who was G years old in 1983, I compute his or her average maximum pensionable earning as:

$$\overline{YMPE}_t = \frac{1}{3}\left[\sum_{t=0}^{2}(1+g)^{65-G-t}\right] YMPE_{1983} \qquad \text{(A5.3)}$$

Now substituting equation (A5.2) and (A5.3) into (A5.1) the CPP/QPP benefit component of expected social security benefits ($ESSB_w$ in equation 5.5) can be computed.

Old Age Security Benefits

In computing old age social security benefits I explicitly recognize residency requirements.[92] It is assumed that all Canadian-born individuals satisfy the residency requirements which enable them to receive full OAS benefits. For all foreign-born individuals of age less than 65 I compute their prospective years of residence at age 65 and then apply the OAS pension rules outlined in the text. In 1983 the maximum annual OAS pension was $3013.44. The expected OAS pension at age 65 is estimated in the following manner (note that this is one of the components of $ESSB_w$ in equation 5.5):

(i) Foreign-born individuals with at least 40 years of residence and all Canadian-born individuals are expected to receive

$$OAS_i = 3013.44\ (e^{gLR_i})$$

(ii) Foreign-born individuals with 10 to 39 years of residence (RES) will receive

[92]Dicks-Mireaux and King (1984) ignored the residency test and assumed that everyone of at least 65 years of age received full OAS benefits. This method overestimates the benefits to immigrants. The main focus of their study, however, was to test the life-cycle hypothesis rather than an examination of immigrant wealth accumulation behavior.

$$OAS_i = [\frac{RES}{40}] * 3013.44\ (e^{gLR_i})$$

(iii) Foreign-born individuals with less than 10 years of residence receive

$$OAS_i = 0$$

Guaranteed Income Supplements (GIS)

The GIS benefit is income tested. To perform this test for current workers I must estimate their future retirement income. The imputation of future retirement income among current workers is based on a regression of the log of annual income of current retirees on their economic-demographic characteristics. The results are reported in Table A5.1 for husband and wife. The following points can be made about the results. Husband's income decreases and wife's income increases with age. This arises because labor income is an insignificant part of the total income for the older cohort of women. Hence, after age 65 women may experience an increase in total income due to the small share of labor income compared to rental and interest income. The situation is just the opposite for men. The coefficients of other independent variables are self-explanatory. Based on these regression coefficients the potential retirement income for current workers is imputed. Given this potential retirement income, an income test for the eligibility of GIS benefits is performed and then GIS benefits are computed for every family. In 1983 the maximum GIS received was \$3025.2 for a single person and \$4664.9 for a married couple. The maximum GIS benefit is reduced by \$1 for every \$2 of other income. The GIS component of expected social security benefits ($ESSB_W$ in equation 4.5) is computed in the following manner:

Wife of a pensioner:

$$GIS_F = Max\{ ((2332.4 - (0.5*WINC)), 0\}e^{gWLR}$$

Husband of a pensioner:

$$GIS_M = Max\{ ((2332.4 - (0.5*HINC)), 0\}e^{gHLR}$$

Both husband and wife are in working age

$$GIS_H = Max\{ ((4664.9 - (0.5*FINC)), 0\}e^{gALR}$$

where, WINC, HINC and FINC are the imputed annual income of wives, husbands and families respectively; WLR and HLR are "years to retirement" for wife and husband respectively and ALR = (HLR+WLR)/2.

Spouse Allowance

In the estimation of CPP/QPP benefits it is assumed that a spouse effectively participates in the labor market until age 65. Under this assumption spouses are not eligible for spouse allowance. Hence spouse allowance is ignored in computing social security benefits.

Table A5.1
Income Equation for Retirees
Dependent Variable: Log of Annual Income

Variables	Husband Equation	Wife Equation
Age	-0.0098	0.0256
	(-2.84)	(5.63)
EDUCATION*		
University	0.5254	0.4403
	(8.10)	(3.51)
Some Post Secondary	0.2605	0.2435
	(4.85)	(3.86)
Secondary	0.1587	0.0971
	(4.82)	(2.25)
OCCUPATION**		
Managerial & Admin.	0.2849	0.3893
	(3.90)	(2.46)
Professional	0.0628	0.2970
	(0.73)	(2.18)
Clerical & Sales	-0.0677	0.2740
	(-1.40)	(3.47)
Mining, Construction & Transportation	0.0555	0.1269
	(1.15)	(0.66)
Full Time	0.1572	-0.0863
	(2.45)	(-0.62)
Self-employed	-0.3128	-0.7029
	(-4.09)	(-3.68)
Number of Weeks	0.0107	0.0079
	(7.49)	(3.08)
Urban	0.1613	0.0239
	(5.08)	(0.57)
REGION***		
Atlantic	-0.2151	-0.1920
	(-4.75)	(-3.13)
Quebec	-0.1145	-0.1453
	(-2.63)	(-2.43)
Prairies	-0.0315	0.0128
	(-0.76)	(0.23)
BC	-0.0592	-0.0201
	(-1.20)	(-0.30)
Immigration	0.1339	0.0797
	(3.83)	(1.69)
Constant	9.7315	6.6862
	(37.15)	(20.21)

R square	0.33	0.13
F statistic	36.29	7.97
Sample size	1248	866

Note: Omitted categories:
* ess than 9 years of education
** farming, horticulture and animal husbandry, fishing, hunting, logging
*** Ontario

Appendix to Chapter 6

Table A6.2
Probit Model for Low Wealth Holdingss
Dependent Variable: $D_W = 1$ if Net Worth ≥ 3500 or $D_W = 0$ otherwise

Variables	Canadian-born Households	-Foregin-born Households
Constant	1.8820 (14.28)	-1.7809 (9.22))
HAGE30	-0.8806 (-5.03)	-0.6691 (-2.02)
HAGE50	-0.5786 (-3.55)	-0.0938 (-0.33)
HAGE65	-0.2646 (-2.04)	0.3499 (1.48)
WAGE30	-0.9874 (-5.29)	-0.1241 (-0.37)
WAGE50	-0.4141 (-2.40)	-0.0045 (0.01)
WAGE65	-0.1281 (-0.93)	0.0562 (0.25)
Normal earnings > $10,000	0.8987 (13.70)	0.5157 (3.58)
Presence of Unemployed	-0.1056 (-2.31)	-0.3627 (-3.73)
Urban household	-0.3739 (-8.25)	-0.3926 (-2.72)
IMG66		-0.0983 (-0.50)
IMG71		-0.5925 (-2.66)
IMG76		-0.7-82 (-3.26)
IMG81		-0.6253 (-2.70)
IMG84		-1.01 (-3.61)
Number of households above the limit	6341	1534
Number of households below the limit	818	184
χ^2	811.23	193.8

Degrees of Freedom	(9)	(14)

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