EVALUATING THE HUMAN CAPITAL FLOWS ACROSS CANADIAN PROVINCES: AN INCOME-BASED APPROACH.

Rapport de recherche

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Novembre 2007

Acknowledgments

I would like to thank my director for this master report, François Vaillancourt, for his advices and answers all along the writing process. I would also like to thank Trinh Le, from the University of Canterbury (NZ) for his help regarding the calculations and the formulas.

Table of contents

Sections Page

List of tables and figures

Abstract

This paper intends to estimate the value of the human capital flows across Canadians provinces for the 1996-2001 period. We use a forward-looking approach based on the method developed by Jorgenson & Raumeni (1989; 1992) modified by Wei (2004) and Le, Gibson & Oxley (2006). This method takes account of the employment, survival and school enrolment rates. Using the micro-data file of the 2001 official census from Statistics Canada, we estimate the flows of future revenues for every province/sex/age/educational level characteristics and we discount them to obtain a present value. We find that the aggregate value of human capital stock in Canada in 2001 equals around 7800 billions of Canadian $ and that internal migrations represents flows with a value of 68 billions of C$ per year in average on the studied period. Of the ten provinces, only two actually gain human capital from the internal migrations process. These are Ontario and Alberta, the already two richest provinces. Thus, to the extent that human capital matters in economic growth as some theories suggest, a convergence between these two provinces and the others is unlikely to happen.

Résumé

Ce rapport cherche à estimer la valeur des flux de capital humain entre les provinces canadiennes sur la période 1996-2001. Nous utilisons une approche prospective basée sur la méthode de Jorgenson & Raumeni (1989 ; 1992) modifiée par Wei (2004) et Le, Gibson et Oxley (2006). Cette méthode tient compte des taux d'emploi, de survie ainsi que d'inscription scolaire. En utilisant le fichier de micro-données du recensement officiel de 2001 de Statistique Canada, nous estimons les flux de revenus futurs pour chaque caractéristique de province/sexe/âge/niveau d'éducation et nous escomptons ces flux pour obtenir une valeur présente. Nous trouvons que le stock agrégé de capital humain pour le Canada en 2001 est égal à environ 7800 milliards de dollars canadiens et que les migrations internes représentent des flux d'une valeur de 68 milliards de C$ par année en moyenne sur la période étudiée. Sur les 10 provinces canadiennes, seules deux gagnent du capital humain en raison des migrations internes. Il s'agît de l'Ontario et de l'Alberta, les deux provinces les plus riches. Ainsi, dans la mesure où le capital humain est important pour la croissance économique, tel que suggéré par certaines théories, une convergence entre ces deux provinces et les autres n'est pas très probable.

EVALUATING THE HUMAN CAPITAL FLOWS ACROSS CANADIAN PROVINCES: AN INCOME-BASED APPROACH.

Every year, hundred of thousands of Canadians residents move from one province to another through what is called internal migrations. People move for many kind of reasons, from personal to professional. Whatever the reason, theses migrations have an economic effect for the provinces. Depending on whether they experience a net gain or loss, the provinces do not face the same kind of situation, regarding labour market or public policies.

Researchers have already examined many issues related to internal migration such as the factors influencing internal migration or their effects on individual earnings. One of theses issues is human capital distribution and redistribution between provinces through the migration process. Because migrants embody skills and knowledge that can be quite valuable, it appears to us that a good and reliable measure of the values of theses internal flows would be quite useful, either for economics or social policies as well as for academic researches. However, such a measure is missing. Therefore, this paper estimates the monetary value of theses human capital flows across the Canadian provinces for the 1996-2001 period.

We proceed using a lifetime income approach. Thus, using the microdata of the 2001 official census from Statistics Canada, we construct a database by dividing the census file into 10 provinces, two genders and five educational levels. For every province/sex/education grouping, we estimate annual income by age. Then, we calculate the present value of the lifetime income by summing and discounting all future incomes flows for every individual until retirement's age.

This paper is divided as follows: First, in section 1, we present a review of the literature on the concept and measurement of human capital. We particularly focus on the cost- and income-based approaches. Section 2, we examine the internal migrations across the Canadian provinces. We discuss the profile of the migrants and their economics effects regarding growth, living standards and convergence. Then in section 3 presents our complete methodology and data used in our calculations. Finally section 4 presents and discusses the results.

1. Literature review.

Since we want to estimate the value of the flows of internal migrants in terms of human capital, we have to review the literature concerning human capital and its measurement methods. This section addresses human capital studies only and do not engage in a review of internal migration works. The next section of this paper does this. In this section, we first try to find a definition of the concept of human capital. We then turn to the review of the different methods used to measure or estimate human capital stocks. We conclude by explaining what method we favor for our calculations and for what reasons.

Defining human capital.

Even if human capital is a commonly used concept in economics, there doesn't seem to be a clear and consensual definition of this concept. Almost every economist can give a definition of physical (or non-human) capital, but it becomes more difficult to do the same with human capital. The concept refers naturally to the skills and knowledge embodied in the human working population of a country or a region. Human capital plays a major role in endogenous growth theory as illustrated by the papers of Romer (1986 and 1989) and Lucas (1988) or can explain much of the wages and income differences between individuals as shown by the works of Mincer (1974 and 1995). We can even go back to Adam Smith (1776) and his *Wealth of Nations* to find some evidence of the role of human capital accumulation: "education as an investment to increase future income". Seminal works of Schultz (1961) and Becker (1964) rekindled interest in the concept of human capital in economics theory. But despite all this, it's still difficult to get a clear definition of the concept. The UNESCO defines it as "People and their ability to be economically productive" recognizing that "Education, training, and health care can help increase human capital"[1]. The Australian government speaks of human capital as "the human resources used in the economy"[2] while the White House's glossary defines it as "Refers to the education, knowledge, skills, and competencies of the personnel of an agency"[3]. Finally, the OECD uses the following definition: "the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being" (OECD 2001, 18).

[1] www.unesco.org/education/tlsf/theme_c/mod13/www.worldbank.org/depweb/english/modules/glossary.htm
[2] www.deh.gov.au/soe/2001/settlements/glossary.html
[3] www.whitehouse.gov/omb/budget/fy2004/glossary.html

Laroche, Mérette & Ruggeri (1999), while using a similar definition as the one above, argue that five specific aspects truly matter. They are: 1. Human capital is a non-tradable good[4]; 2. Individuals do not always control the channel and pace through which they acquire human capital (in the early years of life, the parents decide most of the time for example); 3. Human capital has qualitative as well as quantitative aspects; 4. Human capital can be general or specific; 5. Human capital also creates external effects. This lead to a larger modern definitions of the concept as illustrated by the OECD definition. They also point out that we can commonly define human capital by comparing it to physical capital.

If there does not seem to be a clear and consensual definition of the concept, the literature does agree that investments in human capital are similar to the one in physical capital, because people forgo consumption in order to increase their future income (Wössmann 2003, 239). Adam Smith, again, stated that:

> "A man educated at the expense of much labour and time to any of those employments which require extraordinary dexterity and skill, may be compared to [an] expensive machin[e]. The work which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace to him the whole expense of his education, with at least the ordinary profits of an equally valuable capital"

Investments in human capital yield returns that can be estimated. But this kind of study who assume that difference between incomes come from differences in productivity have to define which kind of human capital they try to capture. We can indeed speak of pure human capital or human capital adjusted for skills and abilities. Such estimations of the rate of return are classical since Mincer (1974).

In conclusion, human capital is a multidimensional concept than can be used in many fields in economic science, from macroeconomic studies to public policy regarding taxation. The concept is at the center of modern theories of growth. But in order to use this concept in economics models, we have first to find a way of calculating or estimating it.

[4] Interestingly enough, because this study intends precisely to put a monetary value on the internal migrants. A monetary value that government could be asked to pay.

Measuring human capital.

There are essentially three approaches used to measure human capital: education-stock-based, cost-based and lifetime-income approach. Each has its advantages and its limitations and some are directly related to the definitions seen above. Indeed, whether we assume that human capital refers to the knowledge of the people or, in contrast, to the future earnings embodied in any individual, leads to very different estimation methods.

Despite its growing importance for the so-called knowledge economy, no systematic estimation of the stock of human capital is done by any statistical or government agency around the world. As pointed out by Wei (2004), such estimation should probably by an integral part of the national account statistics as is the case of physical capital. Postner (1989) also raises the issue that no measure of the human capital stocks and flows exist in Canada despite its growing economic importance.

Independently of the chosen method, the key choice always revolves about specifying the form of the relationship between education and human capital (Wössmann 2003, 240).

Educational-stock-based.

The main idea here is to estimate the stock of human capital based on some educational-level attainment of the population. It's easily understandable why many authors choose this method. It's easy to compute thanks to the available data, even for developing countries, and relates directly to some definition of human capital emphasizing educational investments. Many indicators can be used, but the most common ones are the adult literacy rate, school enrollment ratios and the average years of schooling of the population. Rather than being actual measures of the stock of human capital, such indicators are better seen as proxies that can be used in regressions or in macro-economy studies. This approach is mainly associated with the works of Barro & Lee (1996 and 2001). This is also the method generally used by Coulombe and Tremblay in their Canadian studies.

Some of the problems related to theses method include misspecification of the rate of return to education. This is especially the case with the average years of schooling that attribute the same weight to the first as to the last one, thus not allowing for declining returns. Theses methods

generally don't account for the quality of education, thus leading to complications for international comparisons.

Cost-based approach.

This approach is similar to the one used for the evaluation of the stock of physical capital. According to this measure, the human capital stock equals the amounts spent endowing every individual with human capital. We can go back as far as Engel (1883) who estimates human capital based on child rearing cost to their parents. Interestingly, Engel considered theses costs to extend as far as until the person is 25 and so, according to him, fully autonomous. More recently, Kendrick (1976) and Eisner (1985) used the Engel method augmented by Schultz (1961) to estimate the stock of human capital in the United States. Kendrick takes into account child rearing cost as well as expenditure on health, safety or education. His study leads us to one of the main problem facing this approach: how to separate consumption expenditures and investments in human capital? Kendrick assumes for example that all costs of child rearing to the age of fourteen were actually investment in human capital. More controversial, he also includes 50% of the outlays in health and safety with an ad-hoc assumption. Without entering into too much detail, one can easily see the problems that this approach is raising.

One of the other issues of this approach is the possible missevaluation of human capital. Indeed, since a less healthy child incurs more costs of rearing and health than a healthy one, this child would be considered as having more human capital embodied than a healthy child.

Finally, this method does not account neither for the depreciation, nor the appreciation of human capital. Authors have to assume a depreciation function (straight line or double-declining for example) and apply it. Appreciation is a challenge to incorporate in this method.

Income-based approach.

The last measure of human capital consists in summing and discounting all future earnings of a person. This is actually the most commonly used method in very early studies like the one from Petty (1690) and Farr (1853). One should note that in a completely competitive equilibrium, the cost and income-based method should yield the same amounts, as it is the case in theory for physical capital. But because human capital investments are often made through non competitive means (schooling is provided by governments in many countries), the income-based

approach generally estimates higher human capital stocks. This approach is said to be forward-looking, as opposed to the cost-based approach that only considers incurred costs.

This method naturally has some drawbacks too. One of the main is the assumption that differences in wages and salaries reflect differences in human capital investments and productivity. Work by Mincer for example tend to prove it but we are well aware that wages depend on other factors such as union membership. This method also uses a discounting rate that greatly influences the calculation. Contrary to the cost-based approach, the income approach includes a depreciation formula implicitly. Indeed, because future earnings flows do not continue forever but actually stop at retirement, the present value of theses earnings naturally and automatically falls as age rises. Finally, whether or not maintenance cost should be deducted in order to get net estimates is open to debate. If the purpose is to compare physical to human capital, one should probably deduct some maintenance costs, but theses are difficult to define. Modern studies tend to estimate gross human capital stock by neglecting maintenance or living costs.

Despite the advantages of this method, it has not been used very often because of the lack of necessary data, especially at the micro level. While developed countries like Canada have statistical agencies that provide the information needed with surveys and census, but it could be less suited or infeasible for developing countries. The most advanced method to date is the one of Jorgenson & Fraumeni. They created a method based on Farr and Graham & Webb but made some interesting modifications.

First of all, they include market and non-market activities in the calculation of the stock of human capital. However, the method of estimating non-market activities raised some issues that are not yet addressed in the literature. For example, Jorgenson & Fraumeni assume that human capital raised the productivity of work as well as of leisure and impute to non-market hours activities the same wage rate as for market ones. This means that a PhD working in his garden during one hour will be accounted at a much greater value than a unskilled person doing the same thing. This leads to controversy and some counter-intuitive results: for example, the employment rates matter to allocate human capital between market and non-market activities, but does not influence total human capital stock.

They also innovate by taking account of educational investments currently occurring. That means that people currently studying for a higher grade or diploma will be taken into account with the school enrollment rates. Because such current investments in education are likely to produce higher income for theses people, this is an important addition that correct the bias of previous studies. To illustrate this bias, we can compare the estimation of Jorgenson & Fraumeni before and after the allowance for school enrollment, with the later estimates being 20% higher (Le, Gibson & Oxley 2003, 304). But for New-Zeeland, ignoring enrollment rate generates only a 1.65% drop (Le. Gibson & Oxley 2006, 604). We also make some sensitivity analysis in the results' section.

The JF method is also the first to divide the census data so finely, with two genders, 61 age groups and 18 years of schooling, for a total of 2196 cohorts. Previously, only Graham & Webb took into account of the heterogeneity of the population by incorporating education in the calculation process.

Finally, Jorgenson & Fraumeni simplified the calculation method by showing that the present value of lifetime income for an individual of a given age is only his/her annual income plus the present value of lifetime income in the next period, adjusting for growth and discounting rate and weighted for employment and survival probabilities. Thus, by proceeding by backward induction, we can easily compute the present value for all ages. This formula replaces the old and classical discounting one with the symbol of summation, but yields exactly the same amounts, it's only a different representation. Complete detailed are presented in section 2 of this paper.

The JF method has been used in four countries to date: United States (JF 1989 and 1992), Sweden (Alroth et al., 1997), Australia (Wei, 2004) and New-Zeeland (Le, Gibson and Oxley, 2006). However, except for Sweden, they do not include non-market activities because of the controversies about doing so. The study from Alroth et al. has a unique difference compared to the others: the calculations don't rely on census data but only on a survey sample of 6'000 observations. To "fill the gap" for missing values for some cohorts, they used regressions.

Other methods.

There are other and newer methods used in order to estimate human capital stock. For example, Mulligan & Sala-I-Martin (1997) created a labour income-based measure of human capital (LIHK) that intends to net out the effect of aggregate capital on labour income by using the unskilled people as a numeraire. This method is best suited for macroeconomics studies and international comparisons.

Koman & Marin (1997) also constructed a similar method used and modified by Laroche & Mérette (2000) for estimating the human capital stock of Canada. Their method however produces an index and not a monetary value of the stock of human capital and is thus less suited for our estimation of flows.

There also exist some integrated methods that combine different approaches. We can cite Tao & Stinson (1997) that mix the cost- and income-based approaches. They standardized the human capital stock of the base entrants that serve as a numeraire. The human capital of this base is derived by the accumulated real expenditures in their general education. Thus, the limitations of the cost-based approach apply here too. Other important assumptions are needed in order to make the calculations, such as a constant human capital rate between all educational levels.
Dagum & Slottje (2000) create a human capital latent variable define as a linear combination of some indicators. After having transformed this variable to obtain monetary values, they then use it in a more conventional income-based approach. This method can possibly correct the bias occurring from omitted variables.

Conclusion of this section.

We do not intend to present a complete review of the literature here. Interested readers are referred to the paper by Wössmann (2003) for a very complete survey of the educational-stock-based approach, whereas the cost and income-based approach are well surveyed in Le & Oxley (2003). For a detailed survey regarding the concept of human capital, we suggest the paper of Laroche, Mérette & Ruggeri (1999). However, we think that our review is enough to explain our choice. Table 1 summarizes this section. More details are given for the studies using the JF method, so that comparisons with ours results will further be possible.

We use the Jorgenson & Fraumeni approach because it's the most advanced one based on the present value of future incomes. We don't use the educational-stock-based approach because we actually want to calculate monetary valuation of the flows of human capital across the provinces. The integrated and modern methods are interesting, especially the one from Dagum & Slottje, but we want to avoid the requirement to choose the human capital indicators because of the great challenge it represents[5]. Moreover, the JF method does not need many assumptions and the monetary value derived are exempted of standardization or numeraire setting effect. From the point of view of governments, this is a very useful characteristic. The JF method also allows us to clearly take account of provincial disparities with respect to income profile or employment rates.

The cost-based approach seems suitable but less interesting that the income-based approach, especially because we would have to quite arbitrary decide what kind of expenses to include. However, a cost-based study would be a useful complement to ours. From the point of view of governments, both methods would be correct. The cost-based would actually present the lost expenses made on outgoing individuals, while the income-based is a better measure of lost future taxable income.

[5] Additionally, lack of data could bias our results. As pointed out by Le, Gibson & Oxley, the study from Dagum & Slottje does not contain any measure of intelligence, ability or skills. This is the same with the microdata file of the 2001 census.

Table 1: Summary of selected studies measuring human capital with the cost- and income-based approaches, presented by method and chronologically.

Author(s)	Year	Country	Methods / details	Results / comments
Engel	1883	Germany	Cost-based. Child rearing cost to their parents from the conception until the age of 25.	
Schultz	1961	United States	Cost-based.	
Kendrick	1976	United States	Cost-based. All rearing cost from the conception to the age of 14 and 50% of the outlays in health and safety.	The reference for this method, with Eisner.
Eisner	1985	United States	Cost-based.	
Petty	1690	England & Wales	Income-based. Capitalization of the wage bill, defined as the difference between the estimated national income and property income.	Total stock equals L520 mio; L80 per capita.
Farr	1853	England	Income-based. Present value of future earnings net of personal living expenses, accounting for survival probabilities.	The first reference for this method. The principle is still the same, despite for the living expenses.
Dublin & Lotka	1930	United States	Income-bases. Same as Farr with the addition of the employment rate.	
Weisbrod	1961	United States	Income-based.	
Graham & Webb	1979	United States	Income-based. Same as Dublin & Lotka with the addition of a growth rate.	

Jorgenson & Fraumeni	1989 (1992)	United States	Income-based. Same as Graham & Webb with the following additions: school enrollment rate (1992), non-market activities and new calculation formula.	The most comprehensive study to date. Controversies about the inclusion and the calculation of non-market activities. In 1984, human capital stock is 171 trillions of 1982 constant us $.
Alroth et al.	1997	Sweden	Income-based. JF method with a sample of only 6'000 observations. Regressions used in order to fill the missing gaps.	Human capital stock of 36'822 billions Crowns in 1990 (after income tax), only 15'708 without the inclusion of leisure (but before income tax). Equals 5682 billion C$ and 2424 G C$[6].
Wei	2004	Australia	Income-based. JF method without the inclusion of non-market activities. School level defined with grade rather than with years of schooling.	Human capital stock equals 5575 billions of Australian $ in 2001, (population-based), 4485 G aus$ (labour-force-based). Equals 4848 billions of C$ and 3900 G C$.
Le, Gibson & Oxley	2006	New-Zeeland	Income-based. JF method without the inclusion of the non-market activities.	Stock of human capital of 848 billions of New-Zeeland's $ in 2001 (active-labour-force-based). Equals 633 G C$.

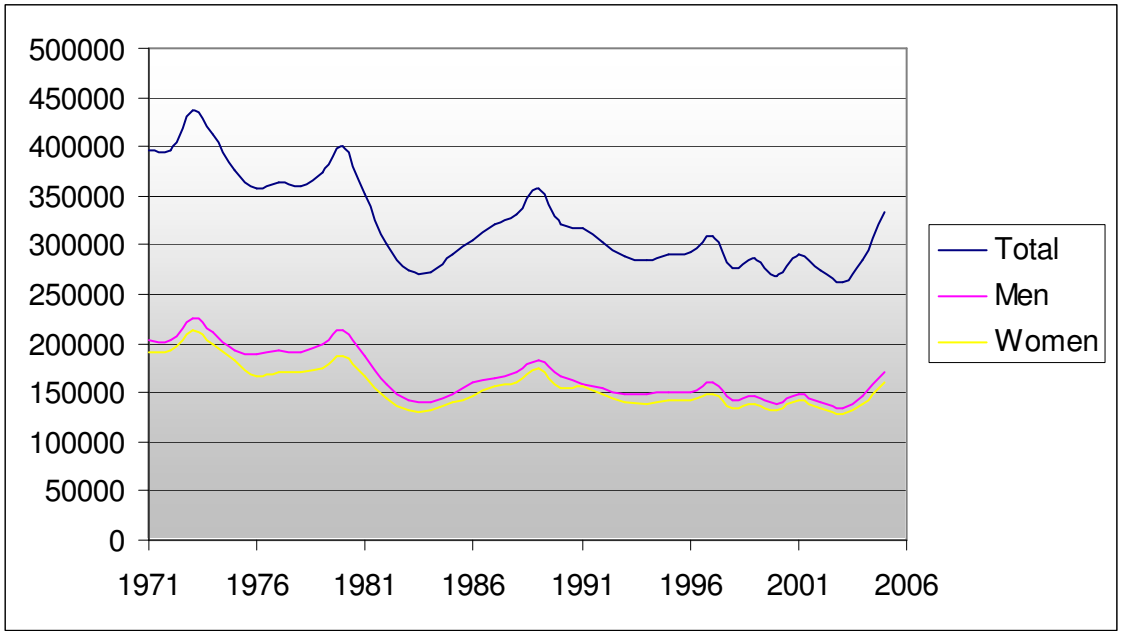
[6] Using the average official exchange rates provided by The Bank of Canada for Wednesday 29th August 2007. The respective rates (foreign / Canadian dollar) for Swedish Crowns, Australian dollars and New-Zeeland's dollars are 6.48, 1.15 and 1.34. Source: http://www.banqueducanada.ca/fr/taux/exchfo-f.html.

2. Internal migrations between Canadian provinces.

This paper is essentially a study of human capital. Nevertheless, because our focus is on internal migration, we think useful to first present some information concerning them. This section is designed to first present the numbers and the directions of internal migrants. We then review some factors affecting the mobility and the profile of the migrants. Finally, a link between internal migrations and the concept of human capital is made.

Statistics Canada defines internal migrants as people who move from one province to another in a given year or period. Figure 1 presents the total number of Canadian internal migrants in the past decades.

Figure 1: Number of internal migrants for Canada, from 1971 to 2005[7].



Source: Statistics Canada CANSIM 051-0012

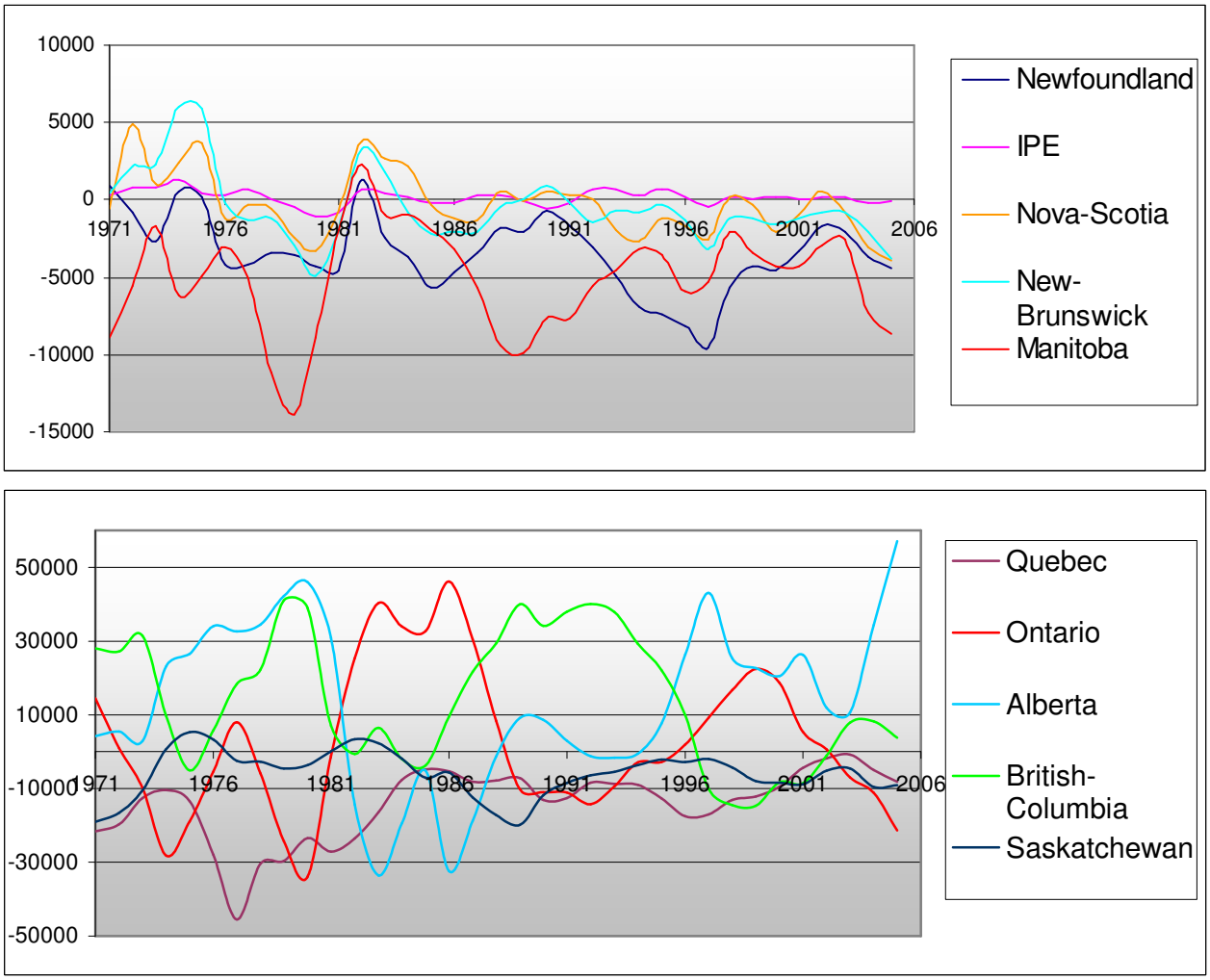
As we can see, internal migrations concern between 275'000 and 425'000 individuals every year. Despite a rise in recent years, internal migrants are less numerous in this century than previously,

[7] As pointed out by Vachon and Vaillancourt (1998), some comparability issues can arise because of the differences in the coverage of the survey used to estimate migrants. However, because Figure 1 only intends to present gross annual migrations for information purposes and are not used in our further calculations, we think that we can neglect the comparability issues.

with a maximum of 437'549 in 1973[8]. Thus, internal mobility of Canadians has decreased since 1971 and we will give some explanation after having reviewed the factors influencing the decision to move.

Because internal migrations necessarily imply that total balance is zero, an individual moving from one province to another represents respectively a loss and a gain. Therefore, provinces can experience very different migrations balances. We have thus to look at data for every province in order to get a better idea of those flows.

Figure 2: Internal migrations balance, in number of persons, by provinces, from 1971 to 2006



Source: Statistics Canada CANSIM 051-0012

[8] Between 1972 and 1973 precisely because data provided by Statistics Canada are for the period between July to June.

Despite variations throughout the years, a gainer-loser trend emerges. Some provinces tend to have systematically positive net balance, while others experiences losses year after year. In average, four provinces have positive net balance. Theses are Ontario, Alberta, British-Columbia and Prince-Edward-Island. Quebec is the only province to face only losses every year, with a medium negative net balance of around -14'000 persons per year.

Figure 2 does not provide us with disaggregated flows, especially the origin and destination of the movers. Vachon and Vaillancourt (1998) analyze theses flows and conclude that there is a trend to move from east to west with a preference for closer provinces. Concretely, Atlantic residents migrate to Quebec and Ontario, Quebec residents to Ontario (and inversely), Ontario residents to the Prairies (Manitoba and Saskatchewan) and Prairies residents to Alberta and British-Columbia. There are naturally exceptions to theses trends.

Finnie (1999) provides us with a very complete description of internal migrations flows by dividing people into four groups: non-movers (or stayers), one-time movers, multiple-times movers and mover-and-return. For the 1982-1995 period for Canada as a whole, the respective shares are 92.6%, 4.5%, 1% and 1.9%. Theses numbers naturally vary with the sex and age of the individual and province of origin but give a good idea of the mobility patterns and rates within the Canadian federation.

To conclude this overview of internal migrations flows, table 2 presents the origin-destination of migrants for every province for the 1996-2001 period. Theses number are drawn and extrapolated from the microdata file of the 2001 census. Theses numbers can differ from aggregate migration data provided by Statistics Canada because the estimation method and period coverage are not the same. Additionally, because we only focus on the 15-65 age-range for our human capital calculations, next table only account for people that met this criteria. This table can further be compared to our results regarding the estimation of human capital net gain/loss in the migration process.

Table 2: origin-destination of internal migrants flows between 1996-2001, in number of persons aged between 15 and 65.

Origin \ Destination	NFL	PEI	NS	NB	QC	ONT	MAN	SASK	ALB	BC	Total	Gain/loss
NFL	0	965	6126	1857	594	16968	334	705	12661	1782	41994	-29415
PEI	187	0	1343	1082	298	2015	37	37	1418	373	6790	-831
NS	2367	1183	0	5547	2256	17935	1183	777	8062	4179	43488	-343
NB	703	1000	7034	0	5220	11772	814	370	5368	1592	33873	-8149
QC	888	296	3147	4516	0	60861	1444	777	9847	11365	93142	-42360
ONT	5294	1740	14882	7700	30282	0	10699	3776	35687	42943	153004	37778
MAN	222	0	1368	665	1515	10940	0	6098	17112	9203	47124	-13551
SASK	188	38	905	302	905	7048	4900	0	31433	9309	55027	-22620
ALB	1434	368	3456	2390	3273	23974	7648	12649	0	38829	94021	100848
BC	1295	370	4885	1665	6440	39268	6514	7217	73280	0	140934	-21358
Total	12579	5960	43146	25724	50783	190782	33573	32407	194869	119576	709399	

Source: extrapolations from the microdata file of the 2001 official census.

Factors influencing mobility.

The choice to move from one place to another is not an easy choice for most people, even if they stay in the same country. Family, friends or language can discourage someone to move. There are many obvious reasons not to move and as we've seen above, an overwhelming majority of individuals don't actually move between provinces. Thus, those who decide to move must have reasons and incentives in order to do so.

The basic principle in order to model the migration choice is a cost-benefit analysis. Thus, a person decides to move if the benefits are greater than the cost. It's quite simple but as we will see when observing the profile of the migrants, this can explain much of their characteristics. This approach is compatible with a utility maximizing individual. To test whether or not a characteristic influences the migration, researchers generally use regressions with probit or logit estimators.

The main benefit to moving is higher earnings perspectives. Whether it's due to greater wages or higher employment rates, people can naturally be motivated to move to another province if this lead to increased income. This fact can explain, for example, the massive outflows from Alberta in the 80's, when oil prices went down, as well as the recent rise of the inflows to this province. Sometimes, individuals just want to move away from a province where they see no job

opportunities. This is the case with the closing of the fisheries in Newfoundland in the early 90's (Day & Winner 2006, 535). However, as illustrated by Coulombe (2006), migrants tend to respond very little to asymmetric shocks within a business cycle. Thus, migrants don't appear to be short-sighted but are rather motivated by structural differential in earnings or employment rates.

But do the migrants really gain in moving? Econometrics analyses using longitudinal data show that migrants are actually gaining from moving (Finnie 2001). This result however varies with the sex, age and province of origin.

In line with the income motive, it's not surprising that many studies try to find a link between fiscal policies and migrations. Some, like Courchene (1970 and 1981), even argue that social programs such as generous unemployment assurance or equalization can lead to inefficient allocation of the labour force. The idea is that governments give people incentives to stay in their provinces while it would be more economically efficient to move. However, as estimated by Watson, the marginal gain per capita of the equalization program is quite small and should not alter significantly many behaviors (Watson 1986, 304). This doesn't mean that fiscal policies don't matter. Shaw (1986) explains the fall in mobility since the 60's with the increased role of social programs in providing income. Day (1992) examines the impact of provincial fiscal and spending policies and concludes that they do influence the internal migration decision. However, an attempt to quantify these impacts by Day and Winner (2006) show that public policies do not count for much in the migration process. Even the elimination of all regional disparities in public policies (differences in unemployment insurance qualification requirements, public spendings, etc) would only lead to a 5% increase of internal migrations. According to them, the main determinants of migration are earnings and employment prospects differentials between provinces and moving cost (2006, 560).

Opposed to the misallocation argument, others academics Boadway and Flatters (1982) argue that an equalization program is indeed necessary in order to avoid misallocation of the labour force. This can happen if the federal government doesn't correct fiscal inequities between provinces.

Opposite the benefits, there are moving costs. Theses are not purely monetary but can indeed be related to family, language or culture. For example, being married is negatively correlated with the probability to move. The low mobility rate for Quebec is mainly due to linguistics factors with the francophones preferring to stay in the only French speaking province of the country even when faced with lower earnings. Interestingly, Finnie (2000) finds that being part of a language-minority within a province is positively correlated with migrations. That means that French-speaking people outside of Quebec tend to have higher mobility rates than Quebecers. This is also the case of the anglophone minority in Quebec compared to francophone Quebecers. Purely monetary costs can explain why people generally tend to move to a closer province as previously seen.

Finally, some political factors can play a role. The election of the Parti Quebecois and the rise of nationalism in Quebec led to a massive outflow from Quebec in 1976, mainly due to anglophones leaving the province.

The profile of the migrants.

Data about the profile of the migrants can come from two sources: descriptive and analytical. The first one relies on survey, census or official statistics provided by agencies like Statistics Canada. The second one is based on studies analyzing internal migrations through econometrics methods. Here is an overview of the mains findings of previous studies.

First of all, we can compare men and women. As illustrated in figure 1, internal migrants tend to be made up proportionally more of men. This finding is however not consistent across all provinces, with greater gaps in the small provinces (Finnie 1998, 27). The mobility rates are higher for men than women for every educational level, except for college diploma (CEGEP in Quebec) (Vachon & Vaillancourt 1998, 105). This can be explained probably by higher returns to moving due to higher earnings in the labour market and lower moving costs (Finnie 1998, 27).

Another key characteristic of people is their age. Sharpe & Ershov (2007, 15) shows that migrants in the 2001 census are concentrated into the 15-24 and 25-44 age-ranges where the proportion of migrants exceeds that for the entire population. Precisely, 24.1% of migrants are in the 15-24 range, whereas this group represents only 13.4% of the population. For the 25-44

range, the respective numbers are 42.4% and 30.5%. More precise and specific numbers can be found in Finnie (1999) with mobility rates calculated for every province, sex and age groups. Despite some variations and exceptions, the clear trend is that mobility rates are higher for younger people and decline as age rises. As pointed out by Finnie (1998), with greater benefits associated to moving (more years to benefit from, say, higher income) and lower costs (regarding family for example with a smaller share of parents and married persons), it's quite normal that young people have higher mobility rates.
However, it should be noted that Finnie (2000, 11) found that the relationship between age and migration wasn't statistically significant when numerous factors are taken into account[9].

Regarding educational level, we generally find in the literature that more educated people are more mobile. For example, Vachon & Vaillancourt (1998) found that mobility rates were between 2 and 3 times higher for an individual with a university degree compared to someone without a high-school diploma for the 1976-1981 and 1986-1991 periods, despite an important drop during the 80's for university degrees holders. Sharpe & Ershov (2007) report that while only 10.7% of the population holds a bachelor degree, the percentage rises to 18.2% for the migrants.

Finally, mobility rates are inversely correlated to the size of the province, with essentially two exceptions being Quebec (with very low rates for linguistic reasons[10]) and Alberta (higher rates because of both important expansion and recession periods) (Finnie 2000, 10). Migrants come also in majority from more urban areas, even if the move from rural to urban areas help explaining the outflows of Saskatchewan and Manitoba, despite the relative low unemployment rate of theses provinces (Coulombe 2006, 220).

Internal migrations and human capital.

Modern theories of growth generally attribute an important role to human capital In growth. For the Canada, Coulombe and Tremblay show that human capital (measured by literacy rates or university degrees) can explain much of the earnings differential across provinces

[9] The econometrics model include the variable Age and Age^2 and not age-range specific dummies.
[10] It applies to some extent to New-Brunswick because of the important minority of francophones.

(2006a), as well as the per capital income convergence process occurring in Canada the last decades (2001).

Nevertheless, because internal migrants embody human capital, internal migrations lead to human capital flows across the Canadian provinces. Polèse (1981) already pointed out that migrants not only contain labour but other sources of growth such as education or capital. We don't have yet estimation of the value of theses flows, but we do have some information related to them. First of all, as we have previously seen in this section, migrants tends to be aged into the 15-44, more educated and slightly more often men than non-movers. All theses traits have implications for human capital flows and could lead to large amounts. Secondly, we know that internal migrations inflows are concentrated in the richest provinces, especially Ontario and Alberta. Thus, internal migrations tend to increase skills disparities between provinces by redistributing human capital (Coulombe & Tremblay 2006b, 29).

Migrations represent human capital flows from an external point of view such as government, but from the point of view of the migrants, migrations should more be seen as investment in human capital. Indeed, because migrants generally increase their earnings by the migration process, we can consider this as an investment in human capital, as pointed out by Laber & Chase (1971) or Schultz (1961).

Finally, an attempt to estimate the value of the flows is made by Sharpe & Ershow (2007). However, they focus on production level (GDP) rather than human capital and their calculations are then only for one year periods. Their results indicate that migrations contribute to global output for 883 mio $ (constant dollars of 1996) in 2006, or 0.074% of the GDP. Theses gains are due to two factors: increased employment and re-allocation of workers from low productivity province to high one. We discuss in section 4 how this result compares with ours.

3. Data and Methodology

This section describes the data source as well as the hypotheses used in order to obtain the results.

Lifetime-Income Approach.

Our method is similar to the one from Wei for Australia (2004) or Le, Gibson & Oxley for New-Zealand (2006). As explained above, in section 2, both papers were based on the Jorgen & Fraumeni method that accounts for survival, employment and school enrolment rates. However, both Wei and Le et al. differ from Jorgen & Fraumeni by not calculating the value of non-market activities. We make the same choice because of the controversy about this inclusion for evaluating the value of human capital. Moreover, because we expect to drawn some evidence for public policy regarding equalization program or educational subsidies, we think that only market activities should matters from the point of view of governments. We also differ from Jorgen & Fraumeni by not calculating schooling with number of years. We rather proceed using the highest degree or diploma completed, information which is divided in 10 categories. Here is a table illustrating how we convert theses 10 levels into 5:

DGREEP (database variable used)	Our categories
1. Unqualified	1. Unqualified
2. High school diploma	2. High School
3. Trade certificate (professional)	3. Post High-School
4. College certificate or diploma	
5. University certificate below bachelor	4. Undergraduate degree
6. Bachelor degree	
7. University certificate above bachelor	
8. Medical degree	5. Graduate degree
9. Master degree	
10. Doctorate	

Here are the steps followed in the calculations:

1) Construct the database.

We use the micro-data of the 2001 census from Statistics Canada. This represents a sample of 2.7% of the entire population of Canada, a very representative file with more than 800'000 observations. We are thus very confident about the quality and reliability of the data. We naturally are subject to all of the limitations and measurement errors from a sample when it comes the time to extrapolate our results to the entire population. However, we have indications about the weight attributed to every observation and how to proceed in order to generalize our results[11].

We take observations for individuals aged between 15 and 65 and then divide this sample into 51 age groups, 10 provinces, 2 genders and 5 educational levels, for a total of 5100 cohorts, for each of these cohorts, we estimate the value of their human capital. We exclude individuals under 15 because of the lack of income data for them, and people older than 65 because of their very low employment rates. We don't include the three territories because of their small population and thus sample size and lack of data from Statistics Canada (employment rates for example).

2) Estimating lifetime-income-profile.

We define income as the sum of wages and salaries and self-employment income, summing the variables WAGESP and SELFIP of the micro-database. We want to find the "income-age-profile" for every province, gender and educational level. We could derive the mean income by age for every province/sex/education characteristics, but the obtained profile would be unsmoothed. To smooth the profile, we use a Mincerian regression for employed individuals, regressing the logarithm of the labour income (as defined by us) on the age and the square of the age (to allow the functional form to be concave). A five-years moving average would have achieved the same purpose but with the disadvantage of losing observations[12]. We thus preferred proceeding by the regression method. With 10 provinces, 2 genders and 5 educational level, this leads to not less than 100 regressions. Even after having divided the sample into 100 sub-samples, we still have enough observations for almost every regression (more than at least 200).

[11] Statistics Canada, Users' Guide for the 2001 Census Public Use Micro-Data File, p. 182.

[12] Moreover, because we rely on sample data, some cohorts would have been empty or composed from very few observations.

However, sometimes, we have been forced to merge some samples. In particular, the province of Prince-Edward-Island has been estimated in common with the province of New-Brunswick. This is a natural merger since these are neighboring provinces facing similar labour market conditions (unemployment rates are fairly similar, as illustrated by the figures of present value for the two provinces in appendix B). We also merged graduates individuals from NF-L and Nova-Scotia, as well as those of Manitoba and Saskatchewan because of the lack of observations. Again, they are neighboring provinces sometime referred as the Prairies.

3. Calculating the present-value of the lifetime-income.

With the income-age-profile obtained, we can then sum the income for any individual from now until he/she turns 65, accounting for survival probability, employment and school enrolment rates, and adjusting for growth and discounting rates. The exact formula is the following:

$$(1) \quad PV_{p,s,a,e_i} = Empr_{p,s,a,e_i} * W_{p,s,a,e_i} + Sr_{p,s,a} * PV_{p,s,a+1,e_i} * (1+g)/(1+r)$$

Where:

PV: Present value of future income

Empr: Employment rate

W: Annual income estimated through regression

Sr: Survival rate (probability to live one more year)

p: Province

s: Sex

a: Age (15-65)

ei : Education level, i=1 to 5.

g: real income growth rate

r: real discount rate.

The probability of survival is defined as 1-mortality rate provided by Statistics Canada[13] by provinces, genders, and age-ranges. There is no differentiation between educational levels, even if such a difference does exist in real life. Nevertheless, the mortality rate does not vary very

[13] Statistics Canada CANSIM 102-0504.

much between ages 15 and 65 and are relatively low, thus not leading to an important bias. The employment rate is used in order to weight the probability to earn the estimated income derived from the Mincerian regression among employed people. It's provided by Statistics Canada[14] with differentiation between provinces, gender, age-ranges and the same five educational levels as we use. In order to get the most accurate rate as possible, we take employments rate from 1990 to 2005 and then calculate the mean. By doing so, we expect to avoid any cyclical effects that could affect the rates.

We use a 1.65% real growth and a 4.40% real discount rate. This growth rate is the mean constant growth rate of the real Canadian GDP per capita over the 1981-2006 period[15], the real discount rate is calculated as the rate on long term Canadian bonds from 1976 to 2007, minus the inflation rate[16]. Both rates are in line with previous studies. For example, Wei used a 1.32% growth rate and a discount rate of 4.58% (Wei 2004, 20). We don't account for provincial differences amongst growth rates because they are influenced by the migration process. For example, the province of Newfoundland & Labrador experienced in recent years an important rise in its per capita GPD in part because the number of people in the province declines. There is thus an endogenous effect that we want to avoid. The discount rate is by definition national in such an integrated financial market as that of Canada. For the discounting rate, one could argue that we should use the same rates as recommended by the Treasure Board of Canada for cost-benefits analysis, that to say a rate of 10%[17]. But we are not doing investment choices analysis and so, we just want to make our data comparable over time. That's why we also don't use estimated rate of return on human capital.

As we already explained above, the Jorgenson & Fraumeni method takes account of the school enrolment rate. We thus define two stages in the life-cycle: education-work and work-only. In order to choose when the first stage ends and the second one begins, we calculate the school enrolment rate with our micro-data. We have to make our own calculations because Statistics Canada does not provide us with enrolment rates precisely enough for us. However, during the

[14] Statistics Canada CANSIM 281-0004.
[15] Statistics Canada CANSIM 384-0002 (real GDP) and 051-0001 (population).
[16] Statistics Canada CANSIM 176-0043 (Bond rate) and 326-0021 (Consumer Price Index).
[17] http://www.tbs-sct.gc.ca/fin/sigs/Revolving_Funds/bcag/BCA2_f.asp

2001 census, Statistics Canada asked the respondents whether they were studying in full or partial time, but not asking which degree individuals were studying for. We have to make the assumption that people can only study for a immediately higher educational level. Thus, an individual with a bachelor degree currently studying will be considered as completing a graduate degree. We only take account of full time students because we were concerned to overestimate the enrolment rate by taking account of every student. Indeed, we should account for probability of completing a degree, as well as to choose a method to standardize partial time students. Because of the measurement errors, we calculate the rate only for the Canada as a whole. This could lead to some bias because the rates can vary across the provinces. Once school enrolment rates have been estimated for every age, we define the education-work period for every educational level attachment as long as the rate is at least 5%. This leads to different age-ranges for the five educational levels. Details can be found in appendix A. The calculations are then made as follow:

(2)
$$PV_{p,s,a,e_i} = Empr_{p,s,a,e_i} * W_{p,s,a,e_i} + Sr_{p,s,a} * [(1 - Enr_{a,e_i}) * PV_{p,s,a+1,e_i} + Enr_{a,e_i} * PV_{p,s,a+1,e_{i+1}}] * d - \sum_{m=1}^{T-1} \left[(T-m) * Enr_{a,e_i} / T\right] * Sr_{p,s,a+m} * (Empr_{p,s,a+m,e_{i+1}} * W_{p,s,a+m,e_{i+1}} - Empr_{p,s,a+m,e_i} * W_{p,s,a+m,e_i}) * d^m$$

Where:

Enr: School enrolment rate.

T: Length of the study for the directly higher grade or diploma.

d: (1+g)/1+r)

As we can see, we have to determine standard length of study required for completing each educational level. The next table displays the estimated length for every diploma or degree[18]:

Degree	Quebec	Canada
High school	1 year	1 year
Post High-school	3 years	3 years
Undergraduate	3 years	4 years
Graduate	3 years	3 years

Except for the high-school degree, every degree or diploma require more than one year of study. We distribute evenly the students between the years required (for example, we assume that 1/3 of the people completing an undergraduate degree in Quebec are in their first year). Because of the difference in the educational systems between the province of Quebec and the Rest of Canada (ROC), we have to account for theses differences. In particular, the high school in Quebec is one year shorter and the diploma does not directly lead to university but indeed to a college, named CEGEP. This one offers pre-university programs as well as professional one. For the ROC only, another assumption has to be made. Even if students can go to the university directly after having completed a high school diploma, there are also some professional colleges. Thus, because of our assumption that an individual can only studies for a higher educational level, we need to weight the relative share of the college versus university enrolment. We use data from Statistics Canada about the number of students enrolled in each establishment[19]. With data from 1993 to 1999, we then calculate a medium ratio between the two and apply this ratio to our calculations. The ratio is 0.65 for university and 0.35 for professional colleges. Thus, for the education-work period for individuals with a high school degree, the school enrolment rate is weighted with this ratio. To complete the calculations, we have to proceed by backward induction, beginning with the 65 years old graduate individuals and then going backward to the 15 years old unqualified one.

[18] They are quite arbitrary decided by us. However, theses lengths represents the standards for a full time student as described by the various schooling institutions, thus in line with our choice to take account of only full time students. Nevertheless, changing study length does not matter very much as pointed out by Le, Gibson & Oxley for New-Zeeland in 2006.

[19] Statistics Canada CANSIM 477-0006 and 477-0013.

4) Multiplying and extrapolating.

Once we have the present values for every province/sex/age/education characteristics, we only need to multiply theses present-values by the corresponding number of individuals in our database (depending of what we want to compute: total human capital by province or only the value of the internal migrants). We then need to extrapolate our results. Because the micro-data is a sample of 2.7% of the population, the easiest way to do it would be to multiply our results by 100/2.7. However, for the 2001 census, because of the sampling method from Statistics Canada, the weight attributed to every observation is not the same and actually vary between 35.55 and 39.46[20]. We had to choose how to weight our calculations, knowing that no matter what we do, errors will still be present because we rely on sample data. We decided to proceed at the provincial level. Thus, once we have the value of human capital for a province, we extrapolate the result using the right coefficient from Statistics Canada. Theses coefficients don't vary very much between the 10 provinces (the lowest being Alberta with 36.77, the highest is Saskatchewan with a coefficient of 37.69) and we are then confident about the validity of our results. Details can be found in Appendix A.

Additional precisions.

When estimating the value of human capital flows, outgoing migrants are estimated in their origin province as well as in their destination one. Thus, the human capital balance of one province is the difference between the value of the outflows and the inflows, both estimated in that province. The balance for the entire Canada is not necessarily zero because migrants do not have the same value in their origin and destination province.

Hypothesis.

In our methodology, we have explicit and implicit hypothesis that can potentially bias our results. In addition to the ones already mentioned above, here are the remaining assumptions:

- All rates and/or ratio are supposed to be constant over time. This is an important assumption that could bias our estimations. For example, the employment rates have evolved during the last decades and are likely to evolve again. However, because most of

[20] Statistics Canada, 2001 Microdata's user guide, p. 173.

our rates are calculated through data collected for many years, we hope to reduce this bias.

- Income varies with the gender, the age, the province and the educational level of the individual only. We don't account for skills or tenure. We are well aware that income depends on a very large set of factors but we can't take account of all of them. We already divide the database in multiple cohorts.

- An individual with characteristics p, s and e at age a will have in x years the same income as an individual with the same characteristics and age a+x, adjusting for real income growth. This doesn't allow for any generational or cohort effect that could exist in real life. The estimation of the lifetime-age-profile with only cross-sectional data is possibly the main source of error. Panel data would be more appropriate but more difficult to use.

- Full integration of internal migrants. This applies to the income-age-profile as well as the other provincial characteristics (employment rate, etc). There could be an integration factor in real life but we don't account for this, even for linguistic characteristics. Actually, when we include an internal migrant dummy in the Mincer regression[21], we find a positive and significant relationship between being an internal migrant and labour income, thus indicating some king of premium or gain to move across provinces. Nevertheless, because we do not intend to estimate an income regression function that would account for every factor affecting income, we neglect the dummy. We have to mention that this dummy doesn't seem to be very robust once we include interaction term (with the others variables, Age and Age^2) or if we regress using only Canadian-born individuals. This assumption is in line with the results from Ross Finnie, from Statistics Canada who found no significant differences between migrants and non-migrants (Finnie 2001, 22).

- Internal migrations are final. Because we don't have good enough data in order to estimate the propensity to migrate, we don't consider return migration, or moving again in

[21] Defined as currently working in a different province than the one of birth.

our calculations, except of course if an individual moved twice or more during the five years period covered by the 2001 census. We could use the propensity for the whole population (number of internal migrants / total of the population), but this wouldn't really reflect the propensity of internal migrants to move again. We would need panel data in order to estimate such a propensity by age, province and educational level but this would be another study in itself.

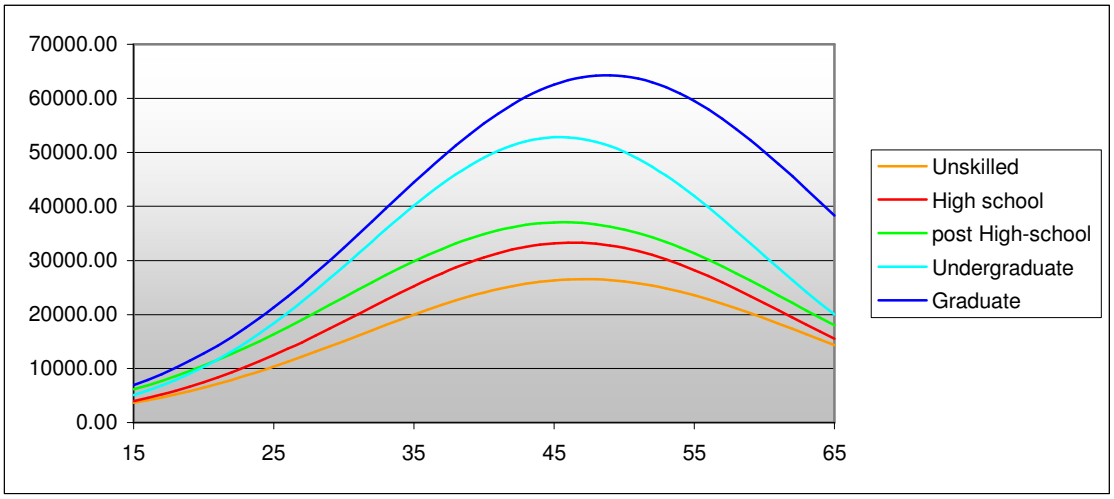
4. Results and analysis.

This section is divided as follow: First, we present some results regarding the estimation of the lifetime-income-profile as well as the calculation of the present value for selected provinces. Secondly, we calculate the stock of human capital in 2001 for every province. This will allow us to make subsequent analysis. Thirdly, we estimate the value of human capital flows across provinces between 1996 and 2001. For every province, we calculate the value of in- and outgoing migrants. We can then calculate a net gain/loss result for every province as well as for the Canada as a whole. Finally, we discuss our results by analyzing and comparing them to relevant studies.

Lifetime-income profile.

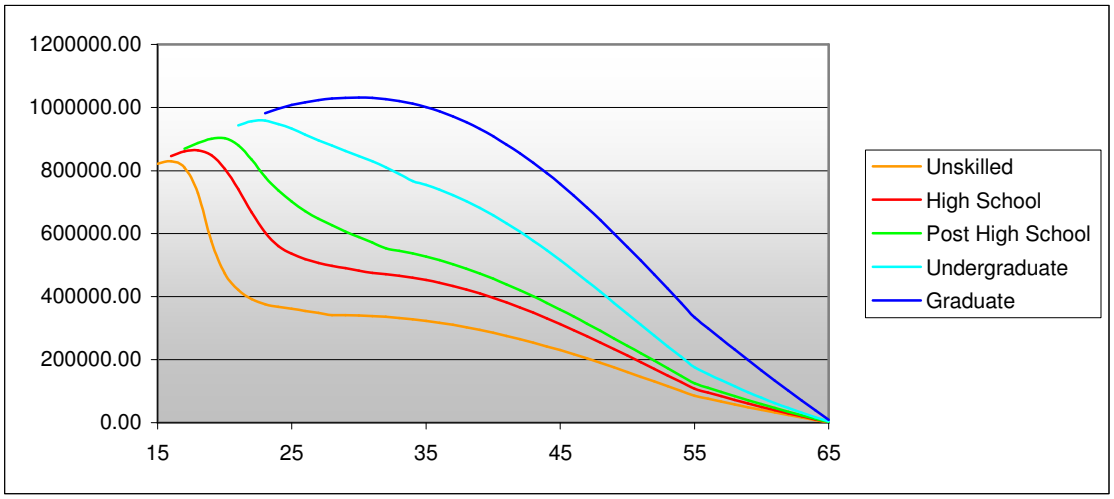
In order to illustrate the methodology of the previous section, we now present some results of the estimation of the lifetime income profile for selected provinces. We begin with the province of Quebec. Let's remember that these profiles have been estimated through a Mincerian regression. Once we have the coefficients, we calculate the labour income for each age.

Figure 3: Estimated annual income for employed men in Quebec, by ages, in 2001 Canadian $.



Source: our calculations using regression estimated with the micro-data of Statistics Canada 2001 census.

Figure 4: Present value of lifetime-income for men in Quebec, by ages, in 2001 Canadian $.



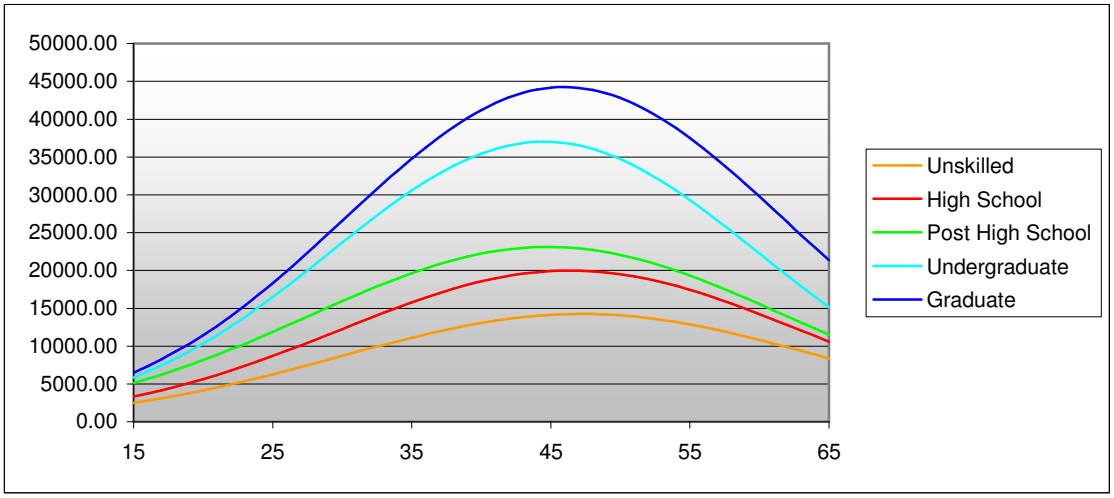
Source: own calculation.

The first figure is easily understandable and we will thus concentrate on the second one. Figure 4 displays the present value of the sum of estimated annual income, from the age of the person to 65. The concave form for graduates could appear as a little bit strange, especially the initial rise in the present value between the age of 25 to around a peak at 33. After all, because the present value is the sum of all future incomes, we could think that this present value would decline as age rises. But this rise occurs from the use of a discount rate (the highest incomes are too far from the original year when an individual is aged 25 and are thus highly discounted). With a discount rate set to zero, all curves decline for all ages. The three lowest educational level curves falls sharply between 15 and 25 because of the fast decline in enrolment rate. For example, if a unskilled 15-years old is very likely to continue to study for a higher grade, this probability is quite lower after the age of 21. At 15, a men in Quebec has a potential value of around 800'000$. This value then quickly falls or rises until age 30, depending of the study profile this individual chooses.

Regarding internal migration, from the point of view of the recipient government, it's better to "attract" an unskilled individual at 15, whereas a graduate is worth the most at 30, some time after having completed the degree and at a time where his/her annual income quickly rises. At 30, there is a huge difference between the worth of an unskilled person and a graduate one with a gap of almost 700'000$ in present value.

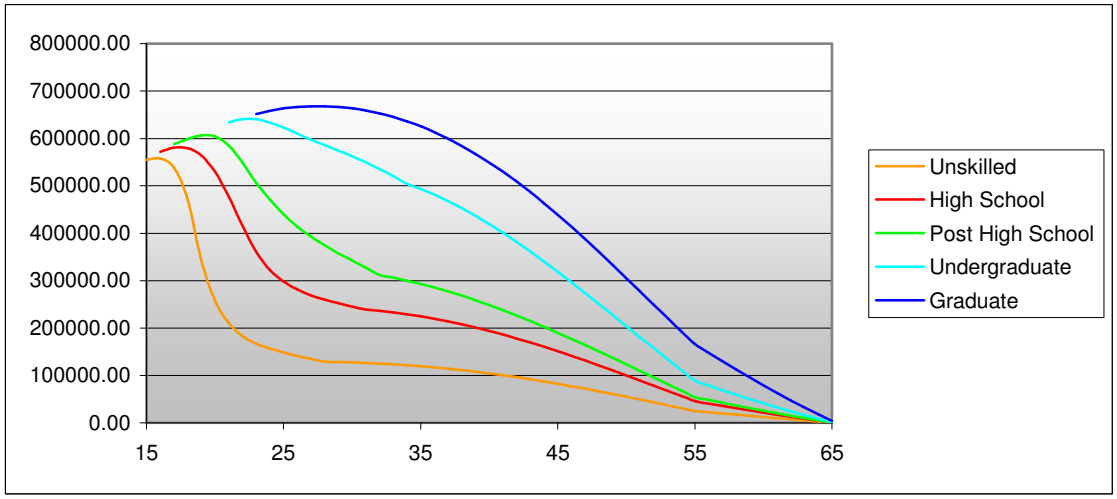
Because our methodology treats men and women differently, we display the same two figures for women in Quebec.

Figure 5: Estimated annual income for occupied women in Quebec, by ages, in 2001 Canadian $.



Source: our calculations using regression estimated with the micro-data of Statistics Canada 2001 census.

Figure 6: Present value of lifetime-income for women in Quebec, by ages, in 2001 Canadian $.

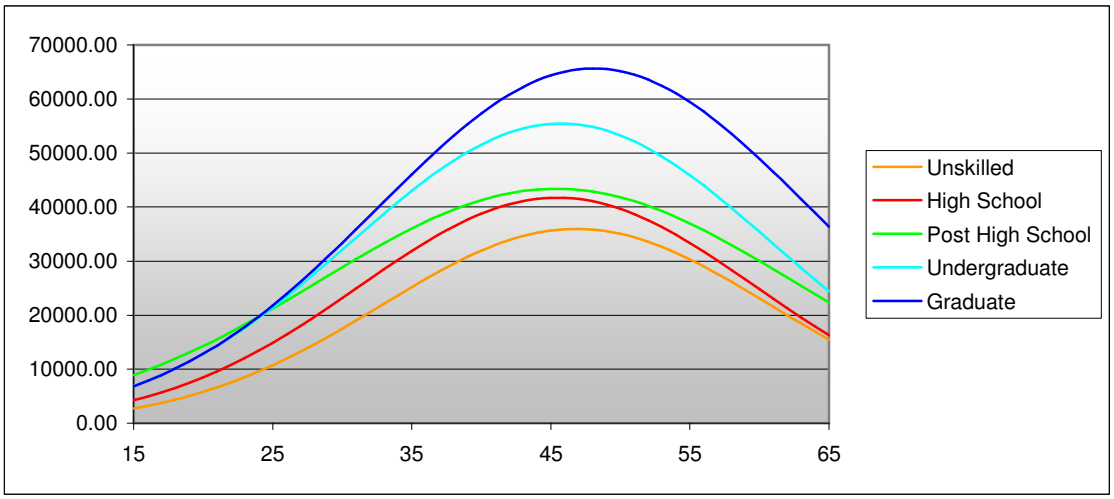


Source: own calculations.

Men and women in Quebec, as elsewhere in Canada, don't have the same income-age-profile. Theses differences, coupled with lower employment rates (but higher survival rates, however, theses differences are to small to account significantly in the calculation), lead to lower present value for every education levels for women than for men.. Such results apply for every province, despite some quantitative variations.

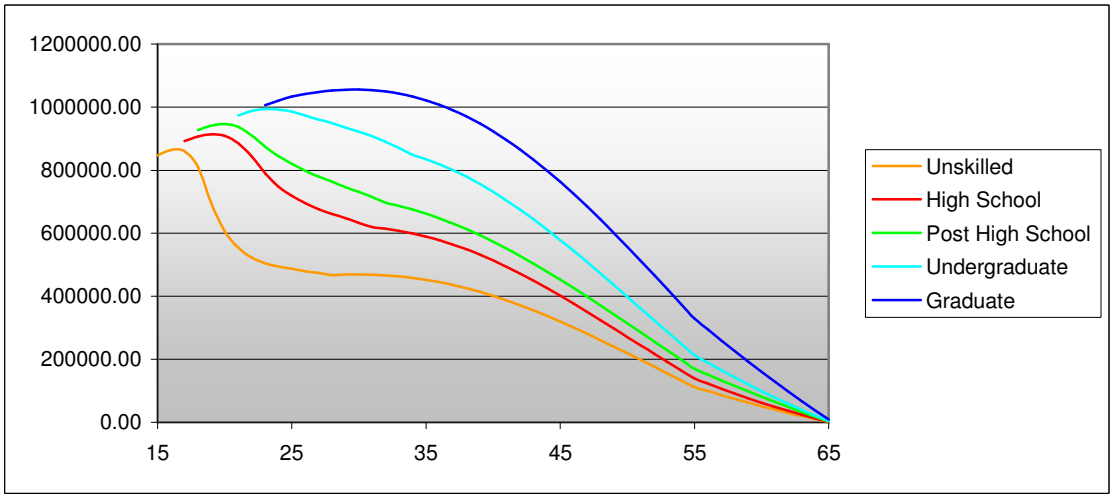
We now compare theses results with the biggest province in Canada: Ontario. We do not intend to make comparisons between all the provinces because of the lack of interest of such comparisons. Nevertheless, we find it relevant to show the differences between the two biggest provinces.

Figure 7: Estimated annual income for occupied men in Ontario, in 2001 Canadian $.



Source: our calculations using regression estimated with the micro-data of Statistics Canada 2001 census.

Figure 8: Present value of lifetime-income for men in Ontario, by ages, in 2001 Canadian $.



Source: own calculation.

As we can see, because of higher income and employment rates, Ontario residents have a greater present value for every age and educational level. However, the difference is particularly important for the three lowest educational levels. At 25, a men in Quebec with only a high school diploma has a present value of around 520'000$, whereas a Ontario resident has a value of more than 680'000$. The gap between Quebecers and Ontario residents narrows as their educational levels rise. As we have seen in section 1, migrants tend to be more educated compared to the entire population. Consequently, this increased mobility not surprisingly equalizes in part incomes for more educated people across Canada. On the opposite, regional disparities among less educated people are quite huge, especially when we compare Atlantic Provinces and Quebec with Ontario and Alberta. Complete figures for every province and gender can be found in appendix B.

We already mentioned there is an optimal moment in their lifes to attract various kinds of migrants. But with these regional disparities, we can expect a net gain for Canada as a whole from migrations. Because an individual with a post high-school diploma is worth less in Quebec than in Alberta, such a reallocation would improve human capital for Canada (such an increase could also be due to higher employment rates). Actually, if the labour market in this country is efficient and without important mobility barriers, such an improvement should occur. Indeed, because migrant's flows are highly concentrated towards Ontario and Alberta, the two richest provinces, this should lead to an improvement of the value of human capital stock.

Another interesting result is the possibility that a province faces a net gain in term of the number of migrants but a net loss in term of their values. This could happen if outgoing migrants from this province are younger or more educated than the incoming ones.

Human capital stock in Canada in 2001.

Before evaluating the value of the human capital transfers across provinces, it is useful to first estimate the total stock of human capital for every province. Using data of the micro-data file and then extrapolating the result for the whole population aged between 15 and 65, we obtain the following table:

Table 3: Human capital stock in 2001, by province and by gender, in 2001 billions Canadian $.

Provinces	Men	Women	Total	% of Canada
Newfoundland	63.08	40.56	103.64	1.33%
IPE	17.67	11.75	29.42	0.38%
Nova-Scotia	118.97	74.66	193.63	2.48%
New-Brunswick	95.52	59.61	155.13	1.99%
Quebec	1088.20	647.25	1735.46	22.25%
Ontario	2039.78	1203.85	3243.63	41.59%
Manitoba	168.98	97.66	266.64	3.42%
Saskatchewan	143.15	82.46	225.62	2.89%
Alberta	581.15	304.10	885.24	11.35%
British-Columbia	608.17	353.21	961.38	12.33%
Canada[22]	4924.67	2875.12	7799.79	

Source: own calculations

The total stock of human capital for Canada in 2001 was around 7800 G$. This represents about seven times the GDP[23] and around twice the stock of physical capital[24]. Men account for 63% of the total stock, thus illustrating again the difference between the two genders, as already shown with the income profiles above. With the rise of employment rate for women and their highest school enrolment rates, this share is likely to decline over the next decades. Our results are mostly in line with the others studies using the JF method, especially the one from Wei (Australia, 2004) once we take account the difference in population or specific choices of the study (definition of income, retirement's age, discount rate, etc).

[22] Canada is here defined as the sum of the 10 provinces, thus neglecting the territories.
[23] Statistics Canada CANSIM 384-0002; GDP equals 1'108'048 millions C$ in 2001.
[24] Statistics Canada CANSIM 378-0004; Stock equals 3'737'307 millions C$ in 2001; Physical capital defined as the total non-financial assets .

If we neglect the school enrolment rates, the aggregate value of the stock of human capital falls to 6516 G$, a 20% drop. This change is the same as the one obtained by Jorgenson & Raumeni but much more than the slight 1.65% drop from Le, Gibson & Oxley. This may due to differences in the period covered by the calculations. For example, while we include every individual since the age of 15, Le and al. only begin at 18. Our 20% increase with the inclusion of school enrollment is naturally not evenly distributed across all ages. The increase is 82% for the 15-24 age group, 3% for the 25-44 group and of course 0% for the 45-65 one. Thus, theses results illustrate the importance of taking account for the school enrolment rate if we want to include individuals under 18. The other way would be to neglect it but to begin the calculation at 25 for example, when most investments in human capital are already done.

We can compare the distribution of human capital across provinces to that of population and of the GDP:

Table 4: Share of every province of the population, GDP and human capital stock of Canada, in 2001.

Provinces	% Population	% GDP	% Human Capital
Newfoundland	1.71%	1.29%	1.33%
IPE	0.45%	0.31%	0.38%
Nova-Scotia	3.04%	2.35%	2.48%
New-Brunswick	2.44%	1.88%	1.99%
Quebec	24.19%	21.01%	22.25%
Ontario	38.14%	41.15%	41.59%
Manitoba	3.74%	3.19%	3.42%
Saskatchewan	3.27%	3.00%	2.89%
Alberta	9.94%	13.72%	11.35%
British-Columbia	13.06%	12.11%	12.33%

Sources: Population is derived from census data on CANSIM. GDP data come from CANSIM 384-0002 and own calculations for human capital stock.

If human capital shares closely match the shares of population in general, two provinces do have a greater share than their population one. These are Ontario and Alberta, the two richest provinces. Consequently, to the extent that human capital matters as much as some theories suggest for economic growth, as seen in the section 2 of this paper, a convergence between theses two provinces and the others is unlikely to happen. We will come back to this issue after having presented the value of human capital flows.

Human capital flows between 1996 and 2001.

We use data from the micro-file of the 2001 census. Coupling the place of residence 5 years ago and mobility in the five years preceding the census, (MOB5P, with entry 5 denoting internal migrants), we can then obtain the data concerning internal migrants from and to every province. We cannot make calculation further than 2001 because the micro-data from the 2006 census are not yet available. Statistics Canada's CANSIM does provide us with complete data about internal migrants, but only by age and gender and not by educational level. Our calculations are made for a 5 year period in order to obtain results closer to those resembling a long term equilibrium outcome than we would obtain using migration over a one year, which is the other possibility using Census data. Because some internal flows are too small (for example between Atlantic provinces) our 2.7% sample does not provide us with data reliable enough to present a 10x10 origin-destination matrix that would present gross and net flows from and to every province. We thus only present calculations of total out and incoming migrants from every province. Table 5 presents the value of theses flows:

Table 5: Human capital flows between 1996 and 2001, by provinces, in 2001 billions of C$.

Provinces	Outgoing	Incoming	Net gain/loss
Newfoundland	17.80	4.02	-13.78
IPE	3.14	2.20	-0.94
Nova-Scotia	19.98	17.77	-2.22
New-Brunswick	15.39	10.16	-5.23
Quebec	42.96	23.34	-19.62
Ontario	75.95	101.08	25.13
Manitoba	21.27	15.05	-6.22
Saskatchewan	25.53	13.87	-11.66
Alberta	45.39	99.92	54.54
British-Columbia	60.11	50.36	-9.74
Canada	327.53	337.78	10.25

Source: own calculations.

Internal migrations represents flows of around 68 G$ per years[25]. Thus, even in the number of migrants is relatively small compared to the entire population, human capital flows from these migrants can't be seen as negligible. They represent important sources of potential revenues for governments.

Table 5 shows interesting information regarding theses flows. First of all, of the ten Canadian provinces, only 2 experienced a net gain during the 1996-2001 period. These are again Alberta and Ontario. Thus, the only two provinces that already have a larger share of human capital than their population share, are the only two to gain from internal migrations. If such a trend should go on, theses provinces will become richer and richer within the Canadian federation. One stunning result is the huge lost of Newfoundland. To better illustrate this, the following table compare the net gain/loss to the stock of human capital in 2001.

[25] Based on the value of the inflows.

Table 6: Net gain/loss of human capital as a percentage of the 2001 human capital stock, by provinces.

Provinces	% of 2001 human capital stock
Newfoundland	-13.30%
IPE	-3.19%
Nova-Scotia	-1.14%
New-Brunswick	-3.37%
Quebec	-1.13%
Ontario	0.78%
Manitoba	-2.33%
Saskatchewan	-5.17%
Alberta	6.16%
British-Columbia	-1.01%
Canada	0.13%

Source: own calculations.

The province of Newfoundland experienced a huge loss during the 1996-2001, losing the equivalent of 13.55% of its 2001 human capital stock. How can we explain this? First, this province lost population during this period. According to official census data, Newfoundland went from 551'792 residents in 1996 to only 512'930 in 2001, a 7.6% loss compared to the 2001 population. This fall is due almost exclusively, we presume, to negative internal migration balance. This 7.6% lost was composed essentially of young individuals; that explains why they account for more than 13% of the human capital stock. In the micro-data sample, 57.5% of the outgoing migrants were aged between 15 and 30. Hence they moved when they had the greatest present values.

Nova-Scotia represents an interesting case in that its internal migration balance is almost zero. Indeed, in the micro-data file, there are 1165 incoming and 1176 outgoing individuals. But even if the outgoing migrants represents only 1.009 times the incoming, the value of outgoing migrants is 1.12 times the value of outgoing one. This happens because outgoing migrants were younger (around three years), but slightly more educated (on our five-scales education variable).

The province of Quebec experienced the largest loss in absolute terms, 19.62 G$. As we have seen in section 3, Quebec has always a negative internal migration balance. Nevertheless, because of the lack of mobility of its francophone residents, the 19.62 G$ only accounts for 1.13% and consequently, Quebec is not the province with the biggest relative loss. This is best illustrated by the share of human capital flows: only 6.91% of the incoming flows for the entire Canada and 13.12% of the outgoing flows. Both shares are substantially lower than it should be if Quebec residents had the same mobility than other Canadians. To illustrate this, we calculate the share of outgoing migrants that are francophone[26]. Only around 36% of the value of the outflows is made of francophone migrants.

The gains of Alberta and Ontario are important, especially for the former. With the arrival of so many internal migrants, Alberta gained as much as 55 G$ of human capital in five years. Higher earnings perspectives (see Appendix B) obviously attract a lot of migrants.

For the two gaining provinces, Alberta and Ontario, we breakdown the incoming flows by province of origin. The purpose of doing this is to have a better understanding of which provinces lost the most to the benefit of each of theses two provinces.

[26] Defined as having French as their mother tongue.

Table 7: Sources of migrants inflows between 1996 and 2001, by provinces, in 2001 G$.

Provinces	To Ontario	% of the inflows	To Alberta	% of the inflows
Newfoundland	9.49	9.39%	6.85	6.86%
PEI	1.10	1.09%	0.72	0.72%
Nova-Scotia	10.56	10.45%	4.65	4.65%
New-Brunswick	6.53	6.46%	2.92	2.92%
Quebec	31.57	31.24%	5.18	5.18%
Ontario			19.22	19.23%
Manitoba	5.70	5.64%	8.70	8.70%
Saskatchewan	3.70	3.66%	16.12	16.13%
Alberta	12.35	12.21%		
British-Columbia	20.08	19.86%	35.57	35.60%
Total	101.09	100%	99.92	100%

Source: own calculations.

We can observe the trend to move to closer provinces, as seen in the previous section. Indeed, more than half of the inflows to Alberta come from the two adjacent provinces, BC and Saskatchewan, while Ontario receives more than 30% from Quebec only. It is quite surprising that Alberta attracts internal migrant's flows almost as much as Ontario, a so bigger province.

Two provinces from the Prairies, Manitoba and Saskatchewan, lost human capital. The relative loss of Saskatchewan is even the second largest one amongst all provinces. Theses losses were essentially to the benefit of Alberta.

Finally, British-Columbia experienced a loss for the period studied. As seen in section 3, BC generally has a positive net migration balance and it's possible that calculations made for other periods, especially the recent one (2001-2006), could lead to reverse results. Nevertheless, the relative loss of BC is the smallest one.

To conclude, we can observe the gain for Canada as a whole. As previously explained, because internal migrants tend to move from poor to rich provinces (or more productive), internal migrations should increase the stock of human capital of the country. This is what we observe

with a net gain of around 10 G$, or 0.13% of the stock. In 2001. This increase is for a 5 years period, thus internal migrations only increased the human capital stock by 0.028% per year on average. While any improvement of human capital can't be seen as negligible, internal migrations do not contribute so much to human capital stock. Moreover, if we would account for moving costs (such as costs incurred by people in order to move their furniture), internal migrations would be even less attractive from a cost-benefit analysis.

We can compare our results with those from Sharpe & Ershov (2007) for Canada. For the 96-2000 period, they estimated that internal migration was responsible for an average annual net gain in total output of 458.7 M$ or 0.05% of the GDP (2007, 30). Even if they focus on the GDP rather than on human capital, their average percentages increases are close to ours. The difference could come from the fact that GDP include other returns than those to human capital. Additionally, because they don't take account of the heterogeneity of the population and only used an average production per person by province, they tend to overestimate the gains from internal migrations. Indeed, because migrants tend to be more educated and provincial differences in earnings are mostly important for lower educational level, treating all migrants as producing the average output per worker of each province lead to overestimations of the gains resulting from the migrations. For a greater increase, unskilled people or those with only a high-school diploma should move more than they currently do.

Conclusion and limitations.

With this paper, we estimate the value of the human capital flows across Canadian province in monetary terms. We have shown that theses flows represent an important amount of resources. For provincial governments, a negative net balance of internal migrants corresponds to a loss of taxable income while provinces with positive balance will enjoy great gains. To the extent that some federal programs are financed on a population-based method, this could lead to inequities. This is especially the case for the financing of the post-secondary education. If federal government attributes the funds based on the population of each provinces, this would not reflect the real net costs incurred by every provinces. Moreover, because a loss of internal migrants represents, for the government, a loss of future taxable income and incurred costs, one could imagine some system of compensation. Two methods are essentially possible. The first one implies an involvement of the federal government through redistributive programs or specific policies designed to compensate provinces with negative balances. The second solution could be a compensating transfers between provinces themselves. However, such a system could possibly obstruct the mobility of individuals within the federation and thus raises some issues regarding economic efficiency or fundamentals rights.

Our study has of course some limitations. Theses issues could be addressed by further studies. First, the main source of errors is the estimation of the lifetime income with only cross-sectional data. This doesn't allow for cohort or generational effects. Moreover, if the economy was not in a steady state when the census has been made, this could lead to over- or underestimations. Longitudinal data would be more suited for a precise estimation.

Others sources of errors come from various rates used in our calculations. If the employment and survival rates are likely to be correct enough, this is not the case for the school enrolment rate. Because of the lack of data provided by Statistics Canada, we have been forced to make important assumptions in order to calculate the rates.

Finally, a more precise study of internal migrant's behaviors regarding moving again or returning to the province of origin would be quite useful. Someone who decides to move for a short period and then returns home does not have the economic impacts as does a final migrant.

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Appendix A – Calculations details

School enrolment rate.

We use the microdata file of the 2001 official census in order to calculate the rates. Because of measurement issues, we only calculate it for the Canada as a whole with no distinction between province or gender. We use and combine the variables SCHATTP and DEGREEP from the database. The rate is defined as the ratio of full time students on the total population, for every age and educational level. We assume that people can only study for a higher degree. For the calculations of the present value of lifetime income, we define the school-work period for every educational level as long as the school enrolment rate is at least 5%. By doing so, we differ from previous studies such as Wei (2004) who defined the school-period with arbitrary ages.

Table A-1: School enrolment rates, for every educational level except the highest, by ages, in 2001 for Canada. School-Work period highlighted in grey.

Age	Unskilled	High School	Post-High School	Undergraduate
15	82.7%			
16	80.1%	88.0%		
17	74.7%	83.5%	66.7%	
18	62.4%	71.4%	78.8%	
19	34.7%	66.0%	76.3%	
20	19.7%	60.3%	64.4%	
21	13.9%	54.1%	51.2%	88.7%
22	10.3%	44.3%	39.1%	78.6%
23	8.0%	30.2%	26.3%	61.3%
24	7.0%	20.1%	19.8%	40.6%
25	6.0%	14.4%	15.0%	28.9%
26	4.6%	11.5%	11.1%	20.9%
27	4.7%	8.1%	8.8%	14.6%
28	3.9%	6.9%	7.7%	12.0%
29	3.3%	6.6%	5.9%	8.6%
30	2.3%	5.0%	5.3%	7.5%
31	2.0%	4.2%	5.2%	6.9%
32	1.9%	3.4%	4.5%	6.1%
33	1.8%	2.8%	4.4%	5.4%
34	1.8%	2.6%	3.7%	4.2%

Source: own calculations with the microdata file of the 2001 official census.

Even if the sample file actually contains some individuals with a bachelor degree at only the age 15 for example, we neglect this kind of observations because they were too few to be reliable. We set the age for the obtainment of every diploma or degree at 17 for the high school diploma (16 in Quebec), 18 for the post-high-school (17), 21 for the undergraduate degree and 23 for the graduate degree. Theses numbers should not be considered as the average obtainment ages but rather as the first age where the obtainment is possible.

Extrapolation process.

Because of the sampling method of Statistics Canada, the microdata file of 2001 contains weights in order to extrapolate the results from this 2.7% sample. The observations have thus a weight between 35.55 and 39.46. However, an important share has a standard weight of 37. Because we divide the file into 10 provinces, 2 genders, 5 educational levels and 51 ages (15-65), this leads to not least than 5100 cohorts. The correct extrapolation process would require the extraction of 5100 sum of weight factors. We thus only proceed by province. For every province, we calculate the average weight of the observations between age 15 and 65. Here are the results.

Table A-2: Average weight for observations, by provinces.

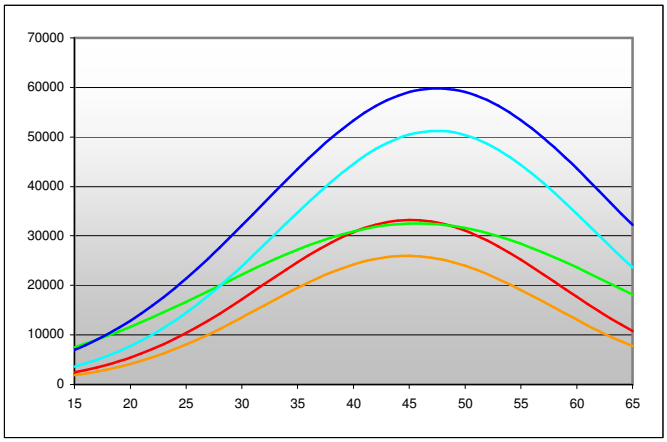
Provinces	**Average weight**
Newfoundland	37.13
PEI	37.31
Nova-Scotia	36.98
New-Brunswick	37.02
Quebec	37.02
Ontario	37.02
Manitoba	36.96
Saskatchewan	37.69
Alberta	36.77
British-Columbia	37.01

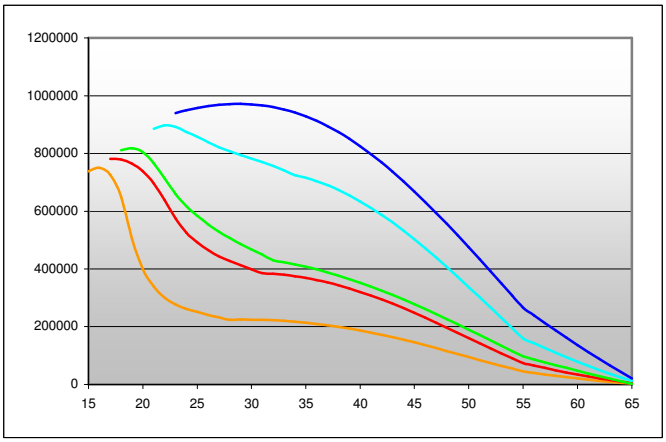
Appendix B – Complete figures

Here are the complete figures for every province, sex and educational level. The left figure displays the estimated annual income of occupied people, by ages and educational levels, in 2001 Canadian $. Estimations has been made through a Mincer regression. The right one displays the present value of the lifetime-income, by ages and educational levels, in 2001 Canadian $. Sometimes, we have been forced to merge some groups because there were too few observations for the regression. When this is the case, we indicate it. The merging process applies only to annual income and differences can still exist in the present value because of differences in employment or survival rates.

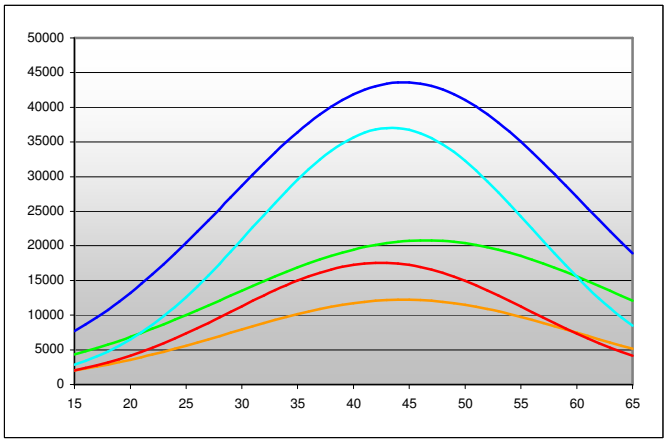
Legend:
- Unskilled
- High School
- Post High School
- Undergraduate
- Graduate

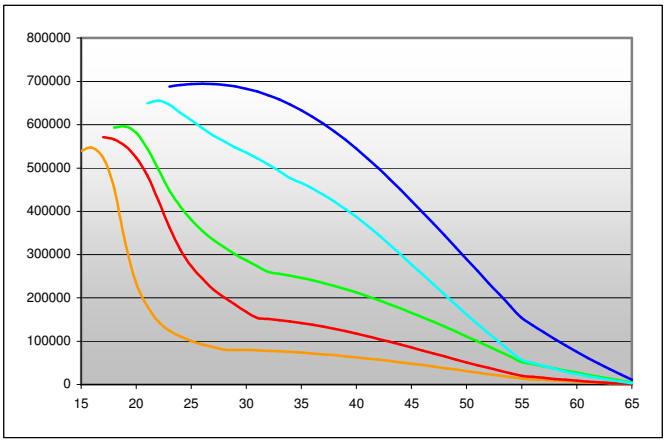
Newfoundland (Graduates are estimated in common with Nova-Scotia's Graduates)
Men





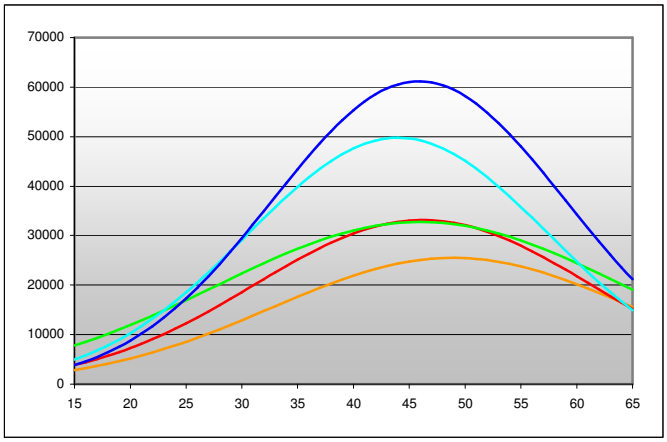
Women

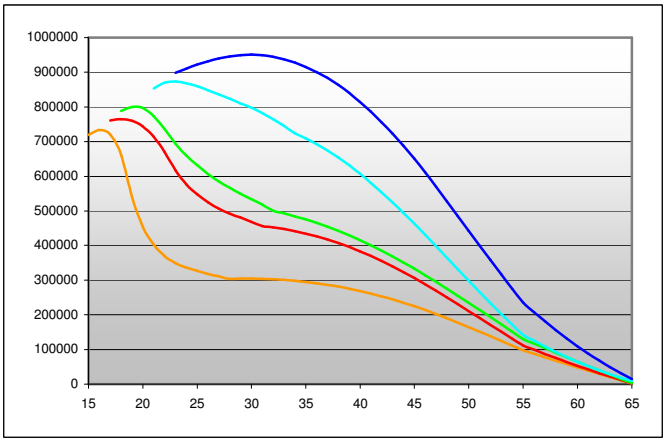




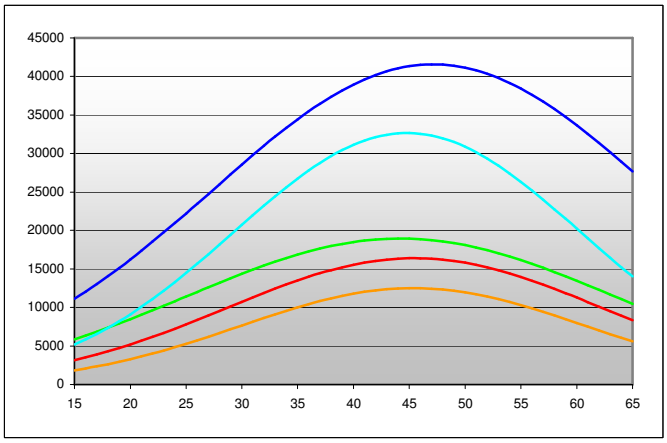
Prince-Edward-Island (estimated in common with New-Brunswick)

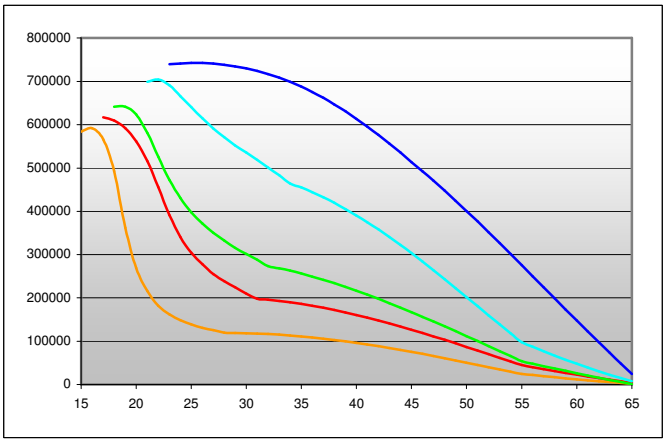
Men





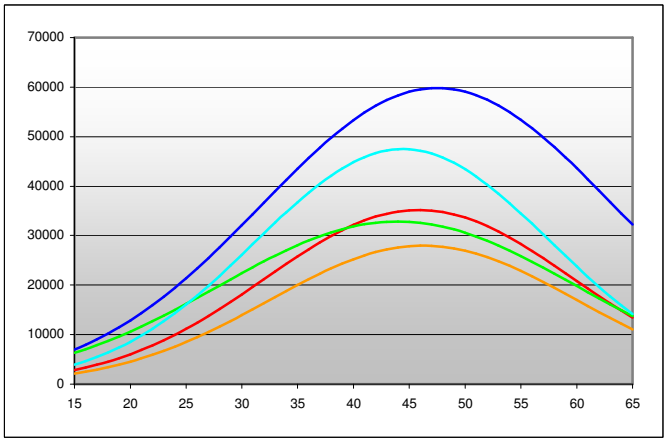
Women

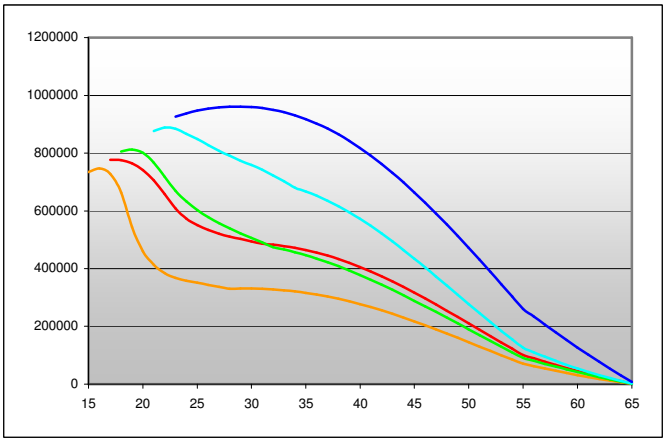




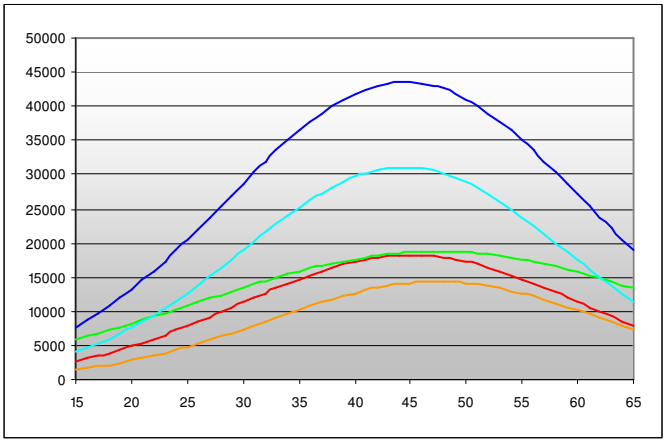
Nova-Scotia (Graduates are estimated in common with Newfoundland's graduates)

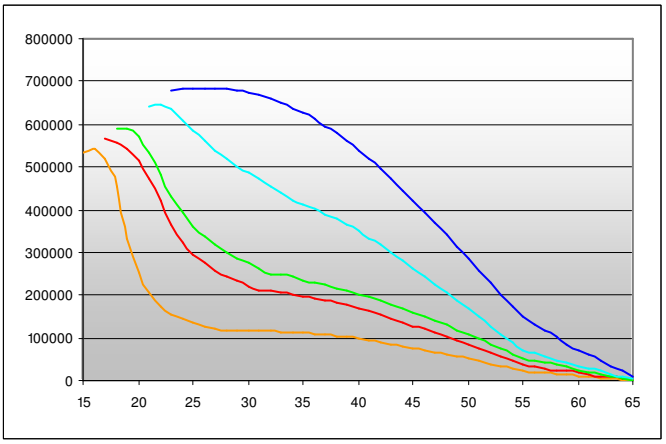
Men





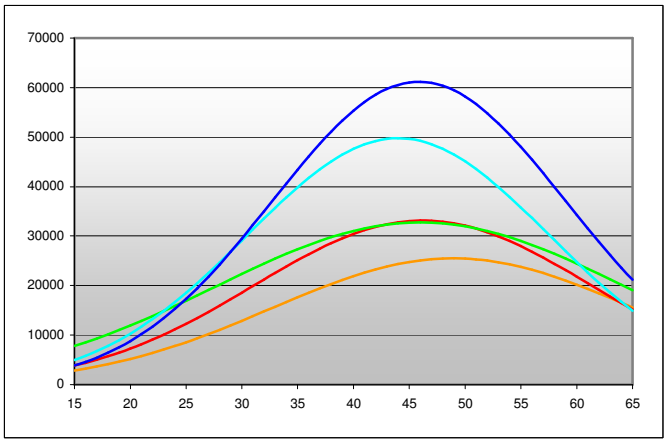
Women

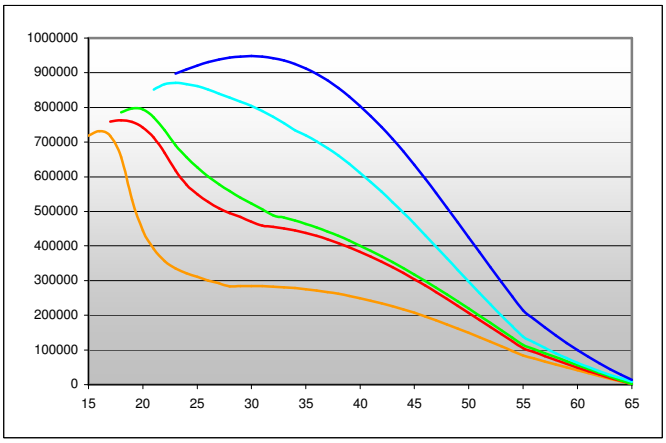




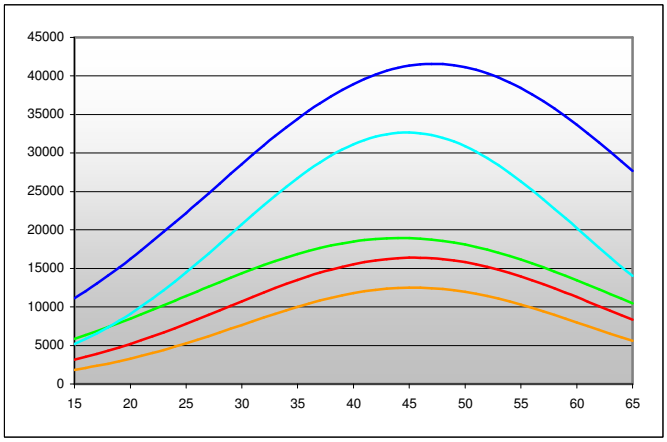
New-Brunswick (estimated in common with PEI)

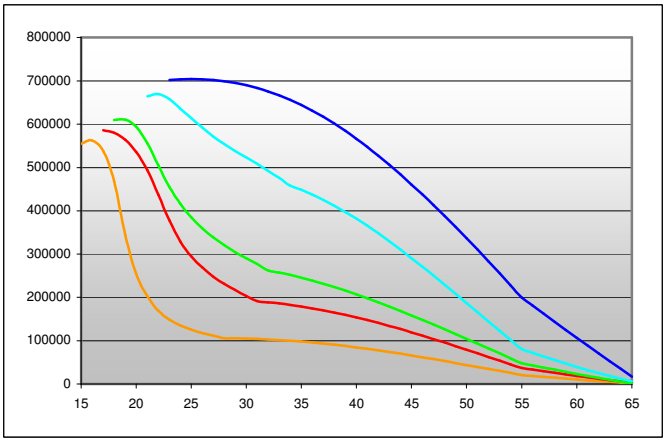
Men





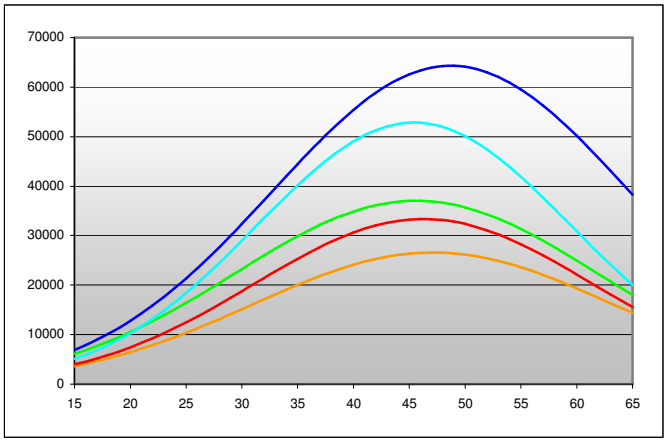
Women

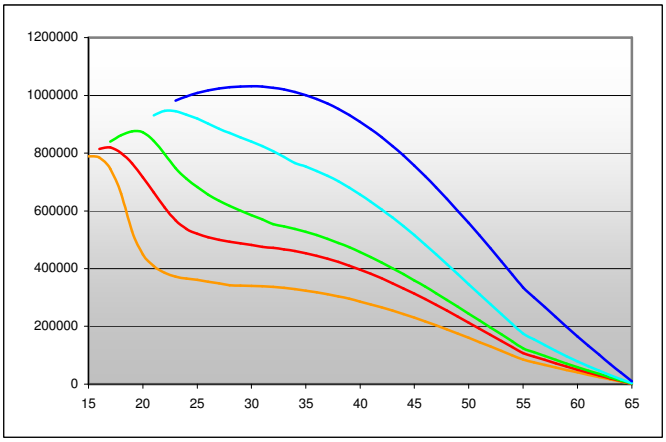




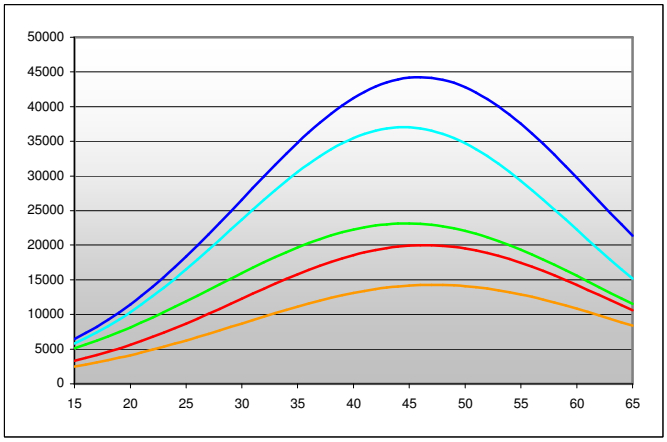
Quebec

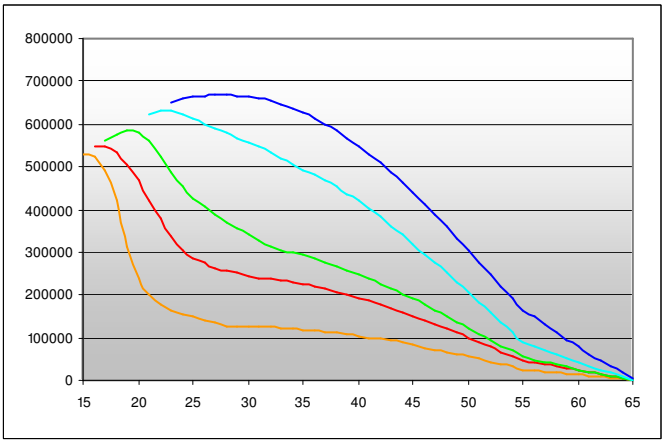
Men





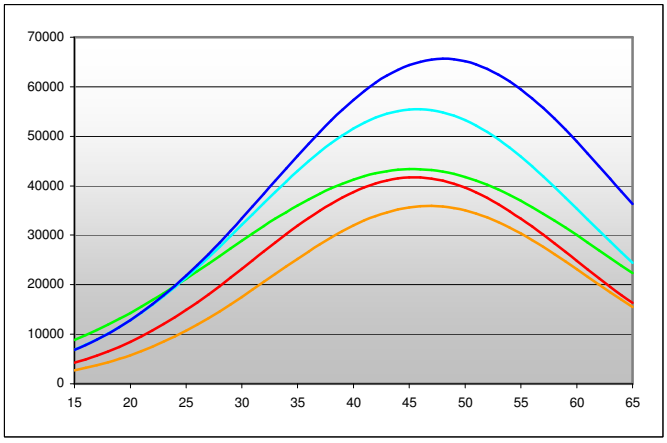
Women

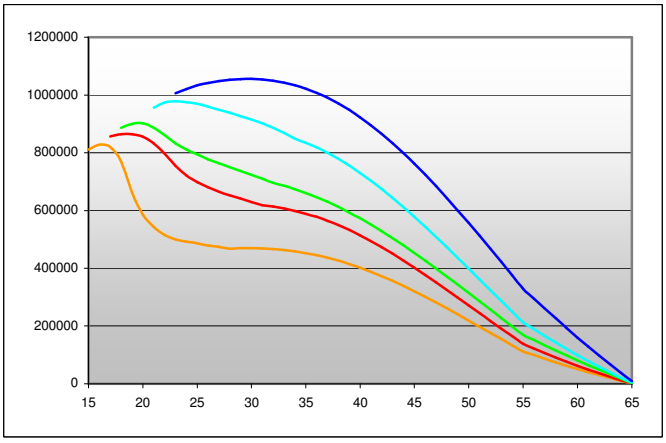




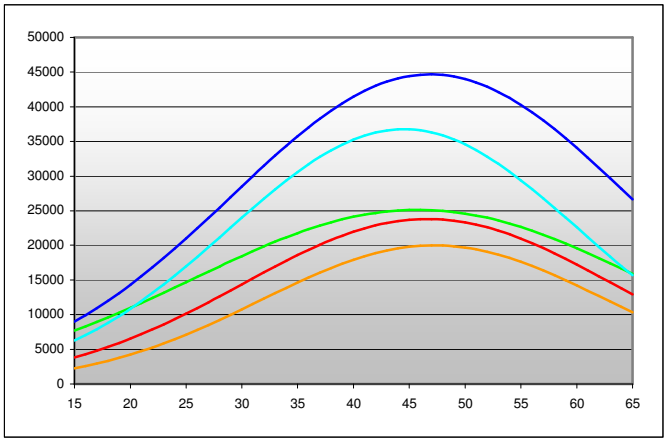
Ontario

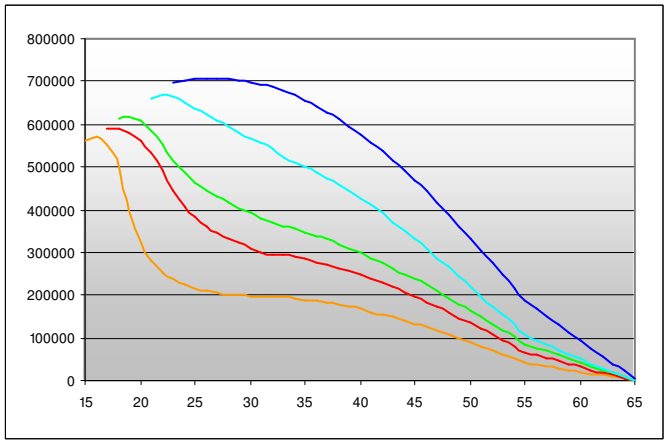
Men



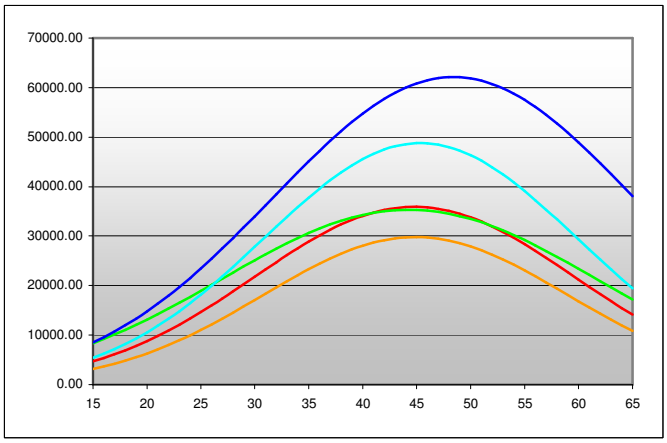


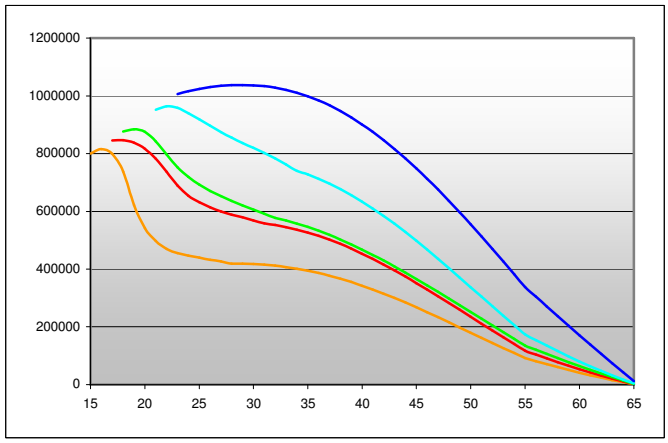
Women



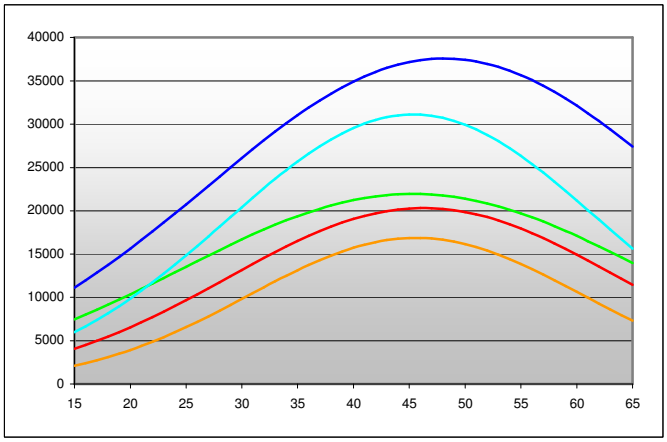


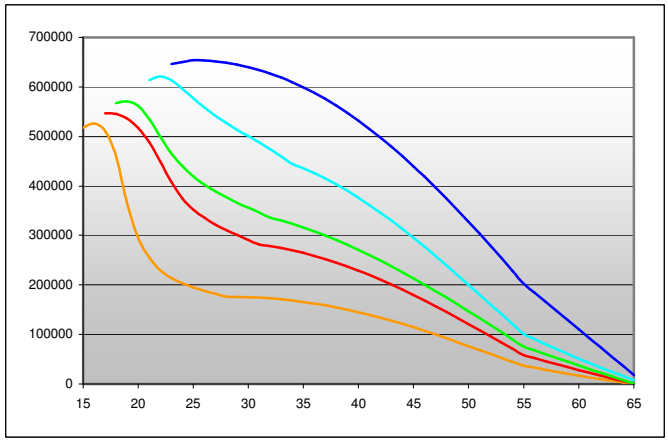
Manitoba (Graduates are estimated in common with Saskatchewan's graduates)
Men





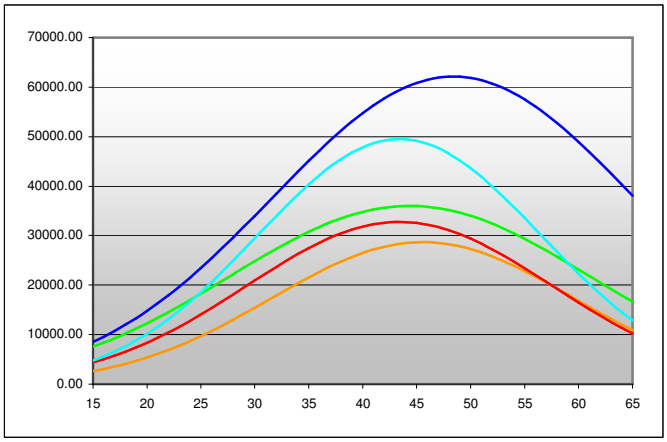
Women

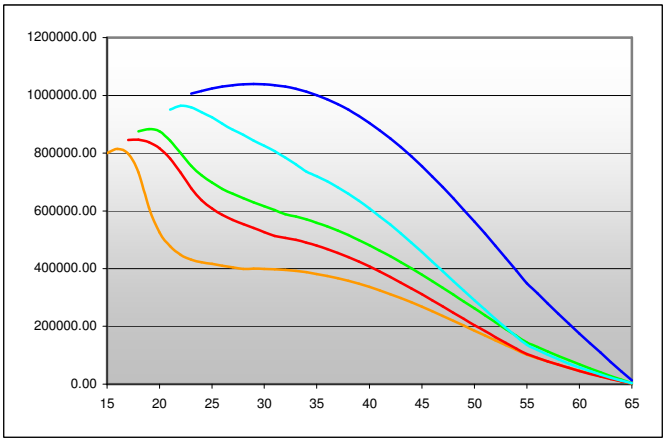




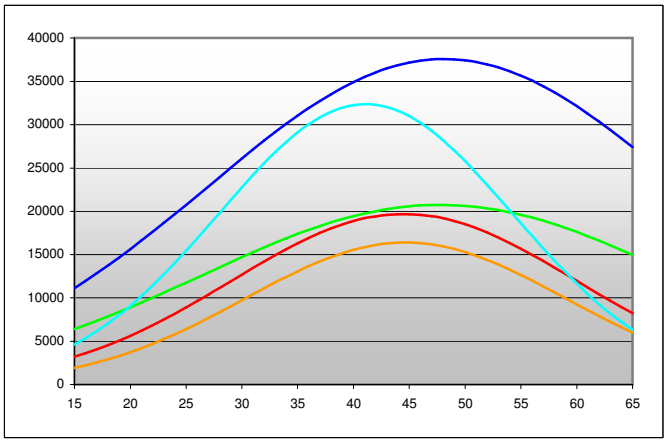
Saskatchewan (Graduates are estimated in common with Manitoba's graduates)

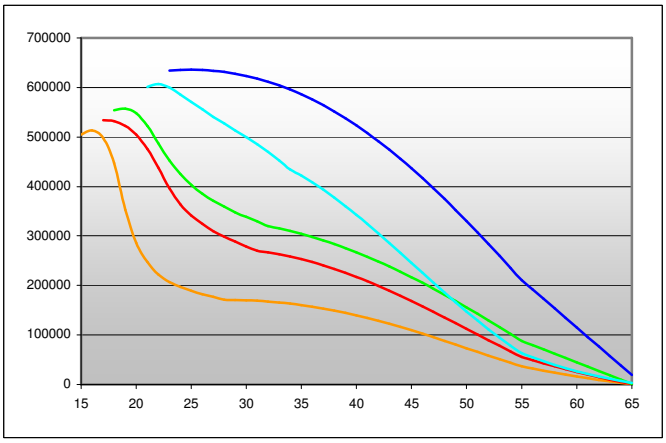
Men





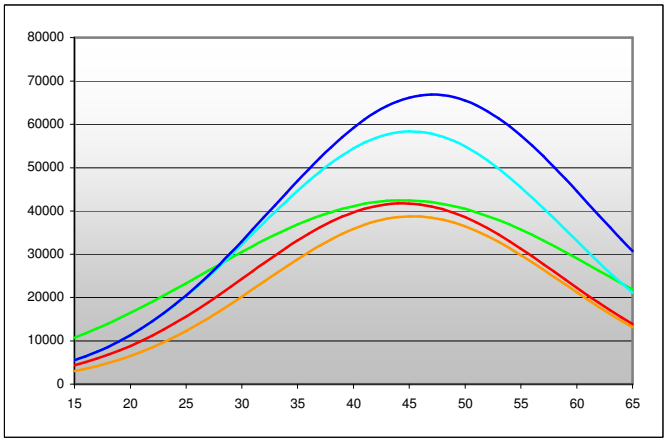
Women

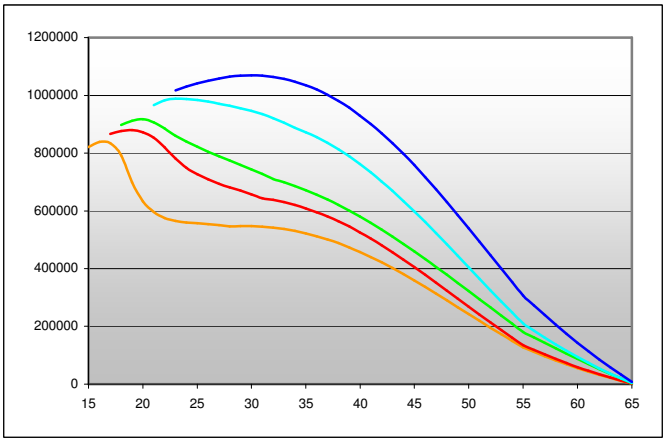




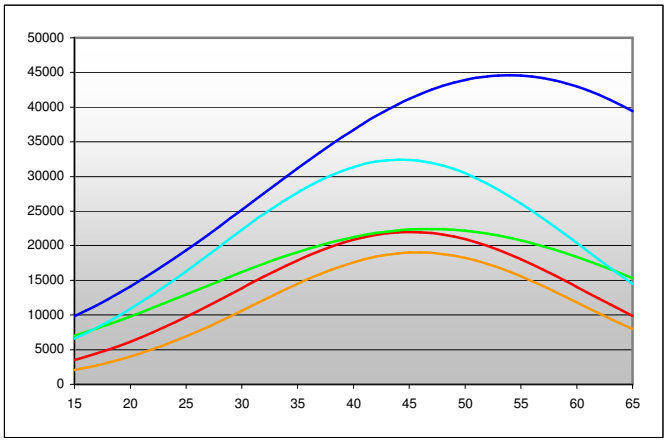
Alberta

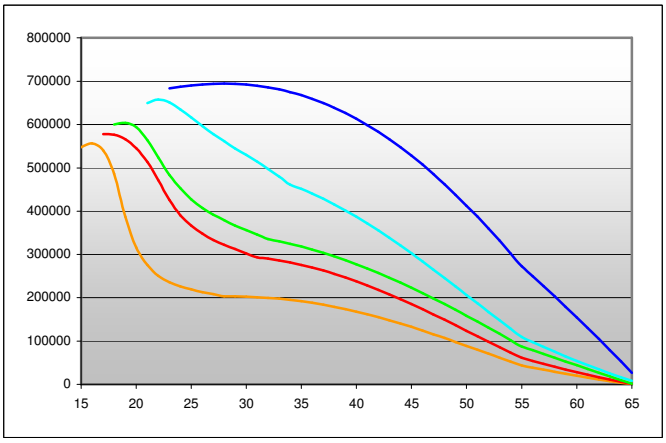
Men





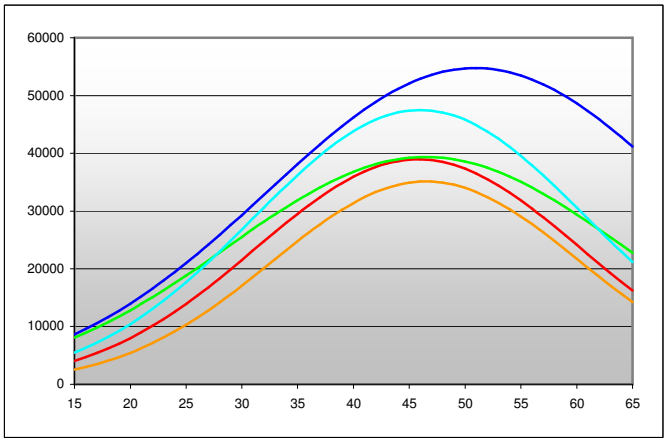
Women

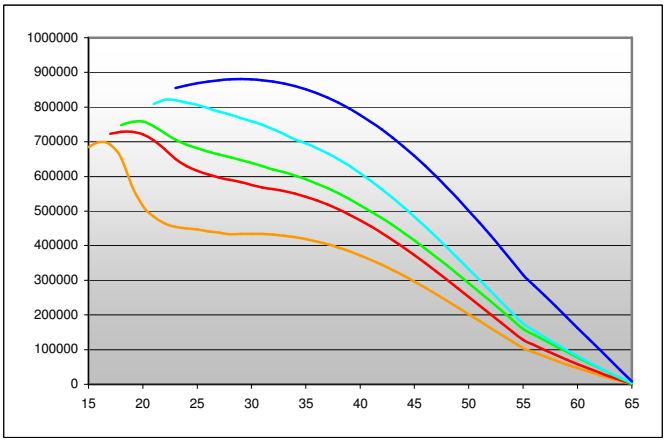




British-Columbia

Men





Women