

Measuring Human Capital in Canada by Gender

By

Qiong Zhu

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Student number: 2918454

Supervisor: Professor Marcel Mérette

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### ABSTRACT

This paper presents a labor income based measure of human capital stock in Canada for the time period 1971 to 2001. This measure is based on the completion of education levels and the number of years of working experience. Comparing this measure with other measures of human capital stock such as enrollment ratios, adult literacy rates and educational attainment, I consider this measure as a prior method to compute the human capital stock. This paper presents the changes of Canada's human capital stock based on the completion of educational levels and years of working experience over years. It also presents the difference of human capital stock for men and women.

## ***I. INTRODUCTION***

Individuals and governments invest a lot of resources in education. The facts prove that it is a worthwhile investment. For individual, the higher is the education level that a person obtained, the greater the wage is. It is also known that the richer countries have higher average level of education than poor countries. Rapid economic growth is often linked to large investment in education.<sup>1</sup> Education is also often associated with human capital, so the latter has been considered an important factor in economic development for a long time. In this paper, I will introduce an approach to measure the human capital stock in Canada. There are many dimensions attached to human capital. So there are many ways of measuring human capital.

In fact, human capital is not a new concept. About 200 years ago, Adam Smith (1776) considered human capital as an important contributor of individual and nation wealth. Then in 1960s Schultz (1961) extended the concept of human capital first developed by Smith. In his paper, human capital is defined as: "the aggregation of investments in activities, such as education, health, on-the-job training, and migration that enhance an individual's productivity in the labor market."<sup>2</sup> Other researchers in 1960s such as Becker (1964), Kiker (1966) also define the human capital in terms of economic activity.

The concept has been investigated again recently. The Organization for Economic Cooperation and Development (OECD, 1996) defines human capital as "the knowledge that individuals acquire during their life and use to produce goods, services or ideas in market or

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<sup>1</sup> Mankiw, Romer, and Weil (1992) and Barro (2001)

<sup>2</sup> See Theodore W. Schultz (1961) page 9

non-market circumstances"<sup>3</sup>. This definition emphasizes the "acquired knowledge." According to a more recent report, OECD (1998), the organization defines human capital as the knowledge, skills, competences and other attributes embodied in individuals that are relevant to economic activity. This definition broadens the previous one as human capital does not just define individual's knowledge but also the ability pertaining to individual.

Laroche, Mérette and Ruggeri (1999) define human capital as "the aggregation of the innate abilities and the knowledge and skills that individuals acquire and develop throughout their lifetime". This definition combines the definitions of OECD (1996) and OECD (1998). It also refers to both market and non-market activities and includes both acquired knowledge and the attributes embodied in individuals. But this definition further suggests that human capital should be measured by following the acquisition and development of skill activities over the entire lifetime.

The most recent contribution to the definition of human capital is Ruggeri and Yu (2000). They argue that human capital is a multi-faceted and dynamic process. The analysis of human capital should be placed within a dynamic framework that covers a variety of time horizons. To this end, they suggest that human capital be expanded to include four dimensions: (a) potential, (b) acquisition, (c) availability and (d) effectiveness. The first two points indicate that the potential intelligence, ability and knowledge, skills that are acquired through schooling, training are all attributes of human capital. The third point emphasizes the difference between the part of human capital which is available for productive activities and the part that is used for non-market

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<sup>3</sup> See OECD (1996) page 22

activities. These three points covered the crucial factors of human capital that the previous researchers have already mentioned. The difference of definition between Ruggeri and Yu (2000) and previous ones is the last dimension "effectiveness". Effectiveness refers to the demand side of human capital as it depends on the labor market performance. It refers more precisely to indicators such as unemployment rate and the absence rates of full-time workers. The returns on investment in human capital are also part of the effectiveness dimension of human capital.

This paper attempts to estimate Canada's human capital stock from 1971 to 2001 based on the education levels and the number of years of working experience. The estimation thus refers to the first three dimensions of the definition of Ruggeri and Yu (2000). It is an update and an extension of Laroche and Mérette (2000). An update because their analysis covered the period 1971-1996 only. It is an extension because I measure human capital by gender.

A proper measure of human capital helps us to better understand the role of human capital in economic activity. It may provide information helpful to policy makers regarding future economic development. In Canada, for instance, an important demographic shift is expected as the population is getting older. In a context of an ageing population, it may become important to improve the quality of workers to compensate for the decline in the number of workers. A proper measure of human capital may be useful to assess the role and the need of economic policy regarding human capital.

This paper is organized into five sections. The following section reviews the literature on measuring human capital. Section III describes the methodology and the data used to measure

Canada's human capital stock. Section IV presents the results. Section V provides a conclusion.

## ***II. LITERATURE REVIEW***

There are several ways to measure human capital. Each approach has its own advantages and disadvantages. The most widely used ways to measure human capital are enrollment ratios, adult literacy rates, educational attainment and labor-income-based measure. In the following, I discuss the different approaches.

### ***Enrollment ratios***

Enrollment ratio is one of the commonly used proxies of human capital stock, as it is available in most countries and used extensively in empirical studies<sup>4</sup>. Current enrollment in formal schooling determines the human capital stock of labor force in the future. So enrollment ratio is associated with the educational investment in human capital.

There exists two ways of measuring enrollment ratio: gross enrollment ratio relates to the total number of students at a given level of education that national regulation or custom indicates would be enrolled at that level divided by the population of the age group. Net enrollment ratios modify the numerator of the ratio to count only the students enrolled within the designed age group.<sup>5</sup> For instance, in a country the children start primary school at six and the primary school has six grades. Thus the gross and net enrollment ratio for primary education are given by:

$$\text{Gross enrollment ratio} = \frac{\text{total enrollment in primary school}}{\text{total population aged 6 to 11 years}}$$

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<sup>4</sup> see Barro (1991); Mankiw, Romer, and Weil (1992)

<sup>5</sup> See Barro and Lee (1993)

$$\text{Net enrollment ratio} = \frac{\text{total enrollment aged 6 to 11 years in primary school}}{\text{total population aged 6 to 11 years}}$$

Net enrollment is a more appropriate indicator of the human capital stock. But gross enrollment ratio is also used widely, because it is easier to find it in most developing countries.

There are several drawbacks of using enrollment ratio to measure human capital. Enrollment ratio is a flow variable. A greater current enrollment ratio does not guarantee an increase in the stock of human capital in the future labor force. It also depends on the participation rate of the graduates (the ratio of graduates who enter the labor market after graduation), and the ratio of courses not failed by the students. The enrollment ratios measure the flow of education or the access to education. It does not show the cumulated education attainment, a better proxy for the stock of human capital. It is known that education takes many years, flow and stock do not have a stable relationship. The gross enrollment does not capture migration, mortality, repetition of grades and dropouts. The enrollment ratio gives us the information about how many individuals enroll at the educational level. But whether they can obtain the educational level also depends on other factors. For instance, with the presence of dropouts, the gross enrollment ratio tends to overestimate human capital.

Moreover, the data about enrollment ratio may not be accurate. The data is mostly collected annually by UNESCO, and comes from surveys of education institutions in every country. The presidents of education institution may inflate the enrollment ratio to attract the students or obtain supplies and funds from government or sponsors. Sometimes they take the registration number as enrollment number, which is often a greater number in developing countries. Many individuals

may not attend school after they registered due to financial reasons. Despite this, enrollment ratio has been commonly used especially in cross-country comparisons, because the data is more readily available.

The last but not the least, enrollment ratio may not even accurately represent changes in the human capital stock, especially during periods of rapid educational and demographic transition (Hanushek and Kimko 2000). Enrollment ratio is not a proper proxy for growth of human capital. The current enrollment ratios accurately represent a country's human capital stock only if the enrollment ratio is constant over time. This is may challenged by the rapid expansion of schooling in developing countries. It is not proper to assume the enrollment ratio is constant over time as Schultz (1988) finds out that the correlation of growth of human capital and secondary enrollment ratio is negative at -0.41. This indicates that the human capital stock declines even though the enrollment ratio goes up. This is because the changes in human capital stock do not only depend on the current enrollment ratio but also depend on the difference between the cohorts leaving the labor market and the cohorts entering the labor force. This is also the evidence that enrollment ratio is a flow variable, which may not measure the human capital stock appropriately.

#### *Adult literacy rates*

A second common measure of human capital is adult literacy rates. Azariadis and Drazen (1990) and Romer (1990) use the adult literacy rate to measure human capital. Literacy is the ability to read and write with understanding a simple statement related to one's daily life. According to this definition it is not easy to tell whether a person is literate. Generally people do

not have a formal test or evaluations to get the information of a person's literacy. Hence, a bias may exist as literacy data may not be collected in the same way within different countries. The adult literacy rate measures the number of adult literates as a percentage of the population in the designed age group. Comparing with enrollment ratio, literacy rates measure the stock of human capital not the flow. But literacy is the very first step of accumulation of human capital. Using literacy rate as an indicator of human capital misses most of the human capital concept. There are many different sets of skills and knowledge besides literacy that are part of human capital. And these aspects of human capital are crucial to economic activity.

Another disadvantage of literacy rate is that data is difficult to find. It generally comes from the population surveys and censuses. Literacy has been found correlated with school attainment. Barro and Lee (1993), using 158 observations on countries, get a correlation between the non-schooling value reported by a survey or census and the adult illiteracy rate equals to 0.95. Given this high correlation, the no-school percentage is considered a proxy for adult illiteracy rates.

#### *Levels of educational attainment and average years of schooling*

The drawbacks of enrollment ratios and adult literacy rates motivate the researchers to search for a superior measure of the stock of human capital. The first of these attempts is Psacharopoulos and Ariagada (1986) who suggest as a proper indicator of human capital the stock of educational attainment defined as average years of schooling. They use the census and survey data of 99 countries to calculate the educational attainment of the labor force. Educational

attainment was divided into several levels of education: no education, incomplete primary, complete primary, incomplete secondary, complete secondary, and higher education. Average years of schooling is estimated by the formula:

$$\text{Average years of schooling} = \sum_i LF_i Y_i, \quad (1)$$

where  $i$  is the schooling level,  $Y_i$  is the number of years of schooling at the  $i$ th level of education, and  $LF_i$  represents the proportion of the labor force that has the  $i$ th level of education.

The drawback of this measure is that the coverage of their data set is too small. Most countries have only one year observation, and only 34 out of 99 countries have more than one observation. Moreover the year covered and the definition of labor force used is different across countries. For instance, Psacharopoulos and Arigada use the population of adult male instead of the labor force in some countries due to the unavailability of some data. It is also important to notice that not all individuals studying become eventually involved in the formal labor force. It is well known, for instance, that women have a lower participation rate in the labor market than men due to the reasons such as raising children.

The limitation of measuring the educational attainment of the labor force motivates researchers to also consider the population outside the formal labor force. They provide a broader data set, such as Kaneko (1986) collect the data of educational attainment of adult population by sex and age for 78 countries and the UNESCO provides similar data sets for 149 countries and territories.

Given the shortcoming of using census and survey data to measure human capital, some researchers tried some alternative estimates of human capital. Lau, Jamison and Louat (1991) use annual data on enrollment rates and the perpetual inventory method to estimate the educational attainment for the working-age population. They first compile data on gross enrollment ratios from 1950 to 1980 for 58 developing countries. Then they use a perpetual inventory method to set up time series of educational attainment and assume that there is no mortality, migration and depreciation during the working life of individuals. But it seems that they are not capable of correcting enrollment ratios for repetitions and dropouts. The key drawback of this procedure is that it does not exploit the available statistics on benchmark stocks of educational attainment. This is why it is said that the results of this study are not highly correlated with the census figures provided by Psacharopoulos and Arigada (1986).

Kyricou (1991) estimates human capital using the relationship of census data on educational attainment and the data on enrollment ratios. His data covers the period 1965-1985 at a five-year interval for a sample of 111 countries. He first regresses the educational attainment on the lagged gross enrollment ratios using data from Psacharopoulos and Arigada (1986) for 42 countries in the mid 1970s. Then using this relationship he estimates the educational attainment of other countries and other time periods. In this procedure, he assumes that the relationship of educational attainment and enrollment ratios is stable over time. That is he assumes that the time of completing an education level, the dropout rates and the repeater rates are the same over time and across countries. However, UNESCO (1978) cautioned that projections of educational

attainment based on the relationship between educational attainment and enrollments are not reliable, as this relationship was not stable over time.

Barro and Lee (1993) use a similar methodology to measure the educational attainment of adult population of 129 countries. They link the census/survey data on educational attainment to the data on enrollment ratios. The coverage of their data sets is much greater by focusing on the data of adult population instead of labor force. The levels of educational attainment are based on the UNESCO's International Standard Classification of Education. They are: no schooling, incomplete first level, complete first level, entered first cycle of second level, entered second cycle of second level, and entered higher level. The data is mainly from UNESCO's Statistical Yearbook, Kaneko (1986), and the United Nation's Demographic Yearbook. But there are still some missing data. Barro and Lee apply some method to fill in the gaps where the data is unavailable. Firstly, for the data of no schooling, they use adult literacy rates to estimate the data on no schooling for part of working-age population, for which the no schooling data cannot directly get from the censuses of surveys. For the remaining missed data they use a perpetual inventory method based on the Census data of gross enrollment ratios to estimate the changes from the benchmark observations.

The different level of education is estimated by regressing the completion ratio for primary education (fraction of individuals who completed primary school, but did not go to secondary school, divided by the fraction of individuals who entered primary school, but did not advance to secondary school) on five-year and ten-year lagged values and on regional dummies. Estimated

coefficients were then used in a perpetual inventory method to estimate the missing observations.

Once these computed, it is possible to calculate average years of schooling ( $\bar{H}_{BL}$ ) as:

$$\begin{aligned} \bar{H}_{BL} = & DUR_p \cdot \left(\frac{1}{2}h_{ip} + h_{cp}\right) + (DUR_p + DUR_{s1}) \cdot h_{is} + (DUR_p + DUR_{s1} + DUR_{s2}) \cdot h_{cs} \\ & (DUR_p + DUR_{s1} + DUR_{s2} + \frac{1}{2}DUR_h) \cdot h_{ih} + (DUR_p + DUR_{s1} + DUR_{s2} + DUR_h) \cdot h_{ch} \end{aligned} \quad (2)$$

where  $h_i$  represents the fraction of the adult population whose highest level of schooling is  $j$ :  $j=ip$  for incomplete primary education,  $cp$  for complete primary education,  $is$  for first cycle secondary education,  $cs$  for second cycle secondary education,  $ih$  for incomplete higher education, and  $ch$  for complete higher education. The variable  $DUR_i$  indicates the number of years required to obtain the  $i$ th level of education, and  $i$  indexes primary (p), first cycle secondary (s1), secondary cycle secondary (s2), and higher education (h).

Nehru, Swanson and Dubey (1995) improve the procedure developed by Lau, Jamison and Louat(1991) to estimate the educational attainment in two ways. First they collect the amount of data on enrollment ratios prior to 1960 and thus do not need to rely on the extrapolated data. Second, they make the adjustments for repetitions and dropouts according to the available information to get a more reliable result. They use only enrollment ratios to estimate the educational attainment. It is different from Kyriacou (1991) and Barro and Lee (1993) who use the census data and then use the enrollment ratio to fill up the missing observations. Nehru et al. ignore the census data on educational attainment levels. The reason is they find out that census data does not provide the actual years of schooling but whether a level is completed or not. Also

it often provides the information about the people at age of 25 and over only. The omission of the younger proportion of the population may bias the results, particularly when this age group is large and more educated than the previous cohort.

Thus, Barro and Lee (1996) improve their 1993 study by estimating the school attainment for the population aged 15 and over and by following the same procedure as in Nehru et al. to calculate the net and not the gross enrollment data. Net enrollment is calculated by subtracting the number of dropouts and grade repetitions from the gross enrollment. The coverage of the data set is from 1960 to 1990 whereas the previous study was covering the period 1960 to 1985. They also add some new countries such as China, which was omitted in their previous study due to the missing data. To calculate the stock of human capital created in primary education for instance, they stipulated that the oldest cohort in the labor force started primary school in the year  $T-64+6$  where 64 refer to age of the individual and 6 to the assumption that children start school at 6, while the youngest started primary school in  $T-15+6$ . Total net enrollments of the 50 cohorts who started primary school between  $T-58$  and  $T-9$  were computed as follows (assuming 6 grades for primary education):

$$H_{N,T}^P = \sum_{T-58}^{T-9} \sum_{i=1}^6 \theta_{i,T-i-1} E_{i,T-g-1}^N \quad , \quad (3)$$

where  $\theta_{iT}$  indicates the probability that each enrollee in grade  $i$  survives in the year  $T$ . Assuming constant dropout ( $d$ ) and retention rates ( $r$ ) for all years and grades, the measure of the primary education stock can be written as:

$$H_{N,T}^P = \sum_{T-58}^{T-9} \sum_{i=1}^6 \theta_{i,T-i-1} E_{i,T-i-1}^N (1-r-d) \quad (4)$$

For secondary and higher education levels, the stock of human capital has a similar expression. Average years of schooling are then obtained by the normalization of these education stocks by the working age population.

Barro and Lee (1996) measure years of schooling but do not consider the quality of each year of schooling. It is difficult to compare the educational attainment across countries since the quality of schooling differs. The main constraint to measure the quality of schooling is to get reasonable and accurate information on these. Barro and Lee try several proxies such as the percentage of repeaters and dropouts. A more elaborate way would be to make a comparable international test of science, reading comprehension and mathematics, then compare the scores of the tests across countries.

Recently, Cohen and Soto (2001) apply a similar procedure as Barro and Lee (1996) to set up the time series of schooling for 96 countries and the period 1960-1990 at 10 year interval. They first get the census data from national agencies and survey data from UNESCO, the national statistical agency of each country and the OECD's in-house educational data base. Then they also apply the perpetual inventory method and other procedures to fill in the missing observations. They use enrollment ratios and other available information to extrapolate backward or forward from the benchmarks, and to estimate the missing data of educational attainment levels.

Fuente and Doménech (2002) construct an improved dataset for educational attainment for

21 OECD countries in order to get more precise estimates of schooling coefficients in growth regressions. They use unexploited sources such as unpublished data supplied by OECD and by some national statistical agencies to set up new educational attainment data series of 21 OECD countries. They follow a heuristic approach to obtain plausible time profiles for educational attainment data by removing sharp breaks which seems to reflect changes in classification criteria.

Educational attainment is a useful indicator of the stock of human capital in a cross-country comparison. But educational attainment measure defined as average years of schooling has also several shortcomings. First, the measure neglects experience as a component of human capital. Second, as I mentioned above, average years of schooling ignore the quality of schooling. The authors who use this measure have to assume that the quality is the same across countries and over time. Third, most of the research is based on Census data, and the Censuses generally are updated only every five or ten years. The authors usually use the enrollment ratio to fill up the missing observations to get the time series of human capital stock. The problem is that the enrollment ratio is a flow variable. Using this variable to estimate the educational attainment involves measurement errors as these two variables are correlated with each other.

#### *Labor-income-based measure*

Given the drawbacks of average years of schooling, researchers work on a more appropriate measure of human capital stock. Mulligan and Sala-i-Martin (1995) introduce a

labor-income-based measure. The theoretical basis of this procedure is that the accumulated value of human capital is the ratio of total labor income per capita to the labor income of a person who is not educated. This is because total labor income is the result not only of the human capital, but also of the presence of other factors of production such as physical capital. For example, a region with a higher physical capital would be able to offer higher wages to workers. This is why there may be wage differences across regions even if the stock of human capital is the same. To net out this kind of effect, the authors divide the labor income by the wage of a non-schooling worker.

In a first step, the authors define human capital in an economy as the quality-adjusted sum of the labor of its citizen with the formula:

$$H_i(t) = \int_0^{\infty} \theta_i(t,s) N_i(t,s) ds \quad , \quad (5)$$

where  $N_i$  represents the number of people with  $s$  years of schooling at time  $t$  in the economy  $i$ . Each category of worker with different number years of schooling contributes to the aggregate human capital according to its efficiency parameter  $\theta_i(t,s)$ . Under the assumption that a worker's marginal product is equal to his wage, the efficiency parameter is defined as:

$$\theta_i(t,s) = \frac{w_i(t,s)}{w_i(t,0)} \quad (6)$$

This formula implies that a worker's income can be separated into two parts. The first part refers to education. The second part is the improved marginal productivity due to the presence of physical capital in the production function.

Then the authors calculate the average stock of human capital at time  $t$  in economy  $i$  as:

$$\bar{H}_i(t) = \int \theta_i(t,s)\eta_i(t,s)ds \quad (7)$$

The parameter  $\eta_i(t,s)$  is equal to  $\frac{N_i(t,s)}{N_i(t)}$ , which is the proportion of people with  $s$  years of schooling in economy  $i$  at time  $t$ .

Then substituting  $\theta_i(t,s)$  from equation (6), I can rewrite equation (7) as follows:

$$\bar{H}_i(t) = \left[ \int w_i(t,s)\eta_i(t,s)ds \right] / w_i(t,0) \quad (7')$$

The term inside the bracket is the average labor income of economy  $i$ , when abstracting from differences in the participation rates across schooling groups. It can be found in the national accounts. The wage rate of a zero-skilled worker is estimated by the constant term from a Mincer wage equation.

Average years of schooling is computed by adding the product of the number of years of schooling times the number of people in each category of schooling across schooling categories:

$$\bar{H}_i(t) = \int_0^{\infty} s\eta_i(t,s)ds \quad (8)$$

Parameter  $s$  is a constant in equation (8). In the approach of average years of schooling, the level  $s$  is a constant over time and across countries. It is different from the efficiency coefficient of the labor-income-based measure which is based on wages. But there are also drawbacks. For

instance, changes in wages may be due to reasons other than changes in the marginal product of a worker, such as technological shocks and fiscal or monetary shocks.

Koman and Marin (1997) build time series data on educational attainment for Germany and Austria over the period 1960-1997. They use the census data as benchmarks for human capital stocks. Then use school completion data to estimate the changes from the benchmarks. The number of people aged  $i$  with level of schooling attainment  $j$  at time  $t$  is:

$$H_{i,j,t} = H_{i-1,j,t-1}(1 - \delta_{i,t}) + H_{i,j,t}^+ - H_{i,j,t}^- \quad , \quad (9)$$

where  $H_{i,j,t}^+$  is the number of persons of age  $i$  who have completed the level  $j$  of schooling at time  $t$ . And  $H_{i,j,t}^-$  is the number of persons of age  $i$  who have completed level  $j$  at time  $t-1$ , and completed a higher level of schooling at time  $t$ . And  $\delta_{i,t,j}$  is the proportion of people of age  $i-1$  in year  $t-1$  who did not survive to year  $t$ . It is defined as:

$$1 - \delta_{i,t,j} = z_{i,j} \left( \frac{L_{i,t}}{L_{i-1,t-1}} \right) \quad , \quad (10)$$

where  $z_{i,j}$  is a factor that permits education-specific survival probabilities and  $L_{i,t}$  is the population of age  $i$  at time  $t$ . The authors normalize the survival rate of each level of schooling so that the sum over age-cohorts equal to 1. The productivity of a person is based on the wage income. A person who is more productive has a greater weight to avoid assuming the proportional relationship between years of schooling and the productivity of a person. They also allow for a non-linear relationship between different levels of schooling and human capital. Then they use a

Cobb-Douglas aggregator to link different educational levels of workers to human capital. Taking logs, they get a specific relationship of human capital and the labor inputs as:

$$\ln H = \sum_s w_s \ln[(\rho(s)L)] \quad , \quad (11)$$

$$\text{where } w_s = \frac{e^{\gamma s} L(s)}{\sum_s e^{\gamma s} L(s)} \quad (12)$$

The term  $\rho(s)$  is equal to  $\frac{L(s)}{L}$ , which is the proportion of the working age group with  $s$  years of schooling and  $w_s$  is the efficiency parameter of a worker with years of schooling. The parameter  $w_s$  links the worker's years of schooling to his human capital. It is the proportion of wage income in the total income. This efficiency parameter is obtained from a Mincer regression:

$$W_s = e^{\alpha} e^{\gamma s} \quad , \quad (13)$$

where  $\gamma$  is the estimated parameter to get the relationship of wage and years of schooling. The parameter  $\alpha$  is a constant term that indicates the wage of workers with non-schooling. I next use the same methodology to measure the human capital stock of Canada. The measure of years of schooling by the equation (9) nets out the effects of dropouts, grade repetition, migration and mortality. This method provides an proper proxy for years of schooling. It is important to the next step in which I link the years of schooling to the human capital by equation (11). As I use the equation (11) to measure the human capital, I also use the parameter  $w_s$  which is an efficiency parameter derived from Mincer wage equation.

### III. METHODOLOGY AND DATA

In this paper, the measure of human capital stock is based on Laroche and Mérette (2000), which was inspired by the work of Koman and Marin (1997). My measure takes into account the educational attainment as well as potential working experience. I first describe the measurement of human capital based on education by using time series of educational attainment over the period 1971 to 2001 for the working-age groups 15 to 64. First, I take the census data on Canadian's highest degree, certificate or diploma obtained as the benchmarks. The census data are for 1971, 1976, 1981, 1986, 1991, 1996, and 2001. That is, I use yearly data on inflows of degree, certificate or diploma granted and the educational attainment of the incoming immigrants to fill up the gaps between the census years using a perpetual inventory method.

With this approach three dimensions are associated with human capital: the time  $t$ , the age  $a$  and the educational level  $j$ . As mentioned above, period  $t$  goes from 1971 to 2001. Individuals are divided into 6 age groups: 15 to 19, 20 to 24, 25 to 34, 35 to 44, 45 to 54 and 55 to 64. Educational levels can take 7 categories: no degree, certificate or diploma, high school graduation certificate, college diploma, undergraduate certificate, Bachelor's and first professional degree, and graduate studies which include graduate certificate or diploma, Master's degree and Doctoral degree. Consequently, the number of individuals with educational level  $j$  at the age  $a$  at time  $t$ ,  $H(t, j, a)$  is calculated as:

$$H(t, j, a) = H(t-1, j, a) \cdot (1 - \delta(t, a)) \cdot (1 - \gamma(t, a)) + H(t-1, j, a-1) \cdot (1 - \delta(t, a-1)) \cdot \gamma(t, a-1) + HP(t, j, a) - HM(t, j, a) + EX(j, a), \quad (14)$$

where  $H(t-1, j, a)$  is the number of individuals of age  $a$  with educational level  $j$  at time  $t-1$ ,  $\delta(t, a)$  presents the mortality rate at time  $t$ ;  $\gamma(t, a)$  is the proportion of the population who change his age group at time  $t$ ;  $H(t-1, j, a-1)$  is the number of individuals aged  $a-1$  with educational level  $j$  at time  $t-1$ ;  $HP(t, j, a)$  is the inflow variable of educational level  $j$  at time  $t$ , that is, the number of individuals obtaining the educational level  $j$  at time  $t$ . In contrast,  $HM(t, j, a)$  represents the outflow variable of educational level  $j$ , that is the numbers of individuals who get a higher level of education.  $EX(j, a)$  is residual term, that takes a non zero value to ensure an equality between  $H(\cdot)$  and observations at census years.

$HP(t, j, a)$  and  $HM(t, j, a)$  are estimated by using equations (15) and (16).

$$HP(t, j, a) = \lambda_p(j, a) \cdot (NDP(t, j) + IM(t, j)) \quad (15)$$

$$HM(t, j, a) = \lambda_m(j, a) \cdot NDM(t, j) \quad (16)$$

$NDP(t, j)$  is the number of new individuals (inflows) who get the educational level  $j$  at time  $t$ .  $IM(t, j)$  is the new immigrants with the level  $j$  of educational attainment at time  $t$ .  $NDM(t, j)$  represents the number of individuals who get a higher level of educational attainment at time  $t$  (outflows).

As I mentioned in the previous paragraph, the number of individuals who complete the educational level  $j$  at time  $t$  is calculated by adding the new immigrants who have similar educational level  $j$  at time  $t$ .  $\lambda_p$  and  $\lambda_m$  are calculated endogenously in the model. The sum over age of  $\lambda_p$  and  $\lambda_m$  equals to 1:

$$\sum_a \lambda_i(j, a) = 1 \text{ and } i=p, m \quad (17)$$

In many cases the outflow equals the inflow as educational levels are often linked, for instance, only the individuals who have the Bachelor's degree are qualified to pursue a higher level of education, the graduate studies. Given the structure of the Canadian educational system, I thus have the following relationships:

$$NDM(t, no \text{ deg}) = NDP(t, sec o) \quad (18)$$

$$NDM(t, sec o) = NDP(t, colle) + NDP(t, undergradcert) + NDP(t, bachelor) \quad (19)$$

$$NDM(t, colle) = 0 \quad (20)$$

$$NDM(t, undergradcert) = 0 \quad (21)$$

$$NDM(t, bachelor) = NDP(t, grad) \quad (22)$$

$$NDM(t, grad) = 0 \quad (23)$$

Given the equations (18) to (23), some of the  $\lambda$  can be pre-specified. For instance, I assume that no degree is obtained only by age group 15-19, so  $\lambda_m(no \text{ deg}, a1519) = 1$ . Using the above procedure, I obtain the number of individuals for each educational level. I can interpret the educational level into years of schooling by assuming that no degree is 9 years of schooling, secondary diploma is 12 years of schooling, college diploma and undergraduate certificate are 15 years of schooling, Bachelor's degree is 16 years of schooling, and graduate degree is 20 years of schooling. Average year of schooling as a measure of human capital is calculated by the formula:

$$H = \sum_s s \rho(s) L \quad , \quad (24)$$

where  $\rho(s)$  is the share of the people with  $s$  years of schooling in the total population. Then using an aggregator of Cobb-Douglas type to link the years of schooling to the human capital stock and taking logs, I have the formula of the human capital stock for each year:

$$\ln\left(\frac{H}{L}\right) = \sum_s w_s \ln(\rho_s), \quad (11a)$$

$$\text{where } w_s = \frac{e^{\sum_i (\gamma_i s) \varphi_i} L(s)}{\sum_s e^{\sum_i (\gamma_i s) \varphi_i} L(s)}, \quad (12a)$$

where  $w_s$  is the efficiency parameter which measures the share of wage income of the individuals with  $s$  years of schooling in the total wage income for an economy. Index  $i$  represents the sex,  $\varphi_i$  represents the share of men and women in the population. In contrast to Laroche and Mérette (2000), I investigate the difference between men and women. The term  $\gamma$  represents how wages change with years of schooling which is from Mincer wage equation.

Recall that the measure considers the working experience as well. The labor-income-based measure I use in this paper implies that I measure human capital based on the individual's wage income. People are paid for their productivity, and the productivity is produced by their skills, knowledge, and experience. Individuals obtain the skills partly by education. I consider that working experience is important enough to be included in the measurement of human capital stock. Here I use age minus years of schooling, then minus 6, that is  $x = a - s - 6$ , as a proxy for

working experience. The shortcoming of this proxy is that the years of working experience may be overestimated. Women, for instance, may quit work for several years for reasons such as raising children. Taking into account years of working experience, the annual human capital stock becomes:

$$\ln\left(\frac{H}{L}\right) = \sum_s \sum_a \omega_{s,a} \ln(\rho_{s,a}) \quad (11b)$$

$$\omega_{s,a} = \frac{e^{\sum_i (\gamma_i s + \beta_i x - \alpha_i x^2) \varphi_{i,a}} L_{s,a}}{\sum_s \sum_a e^{\sum_i (\gamma_i s + \beta_i x - \alpha_i x^2) \varphi_{i,a}} L_{s,a}} \quad (12b)$$

The parameter  $\omega_{s,a}$  represents the efficiency parameter that measures the share of wage income of individuals with  $s$  years of schooling and  $x$  years of working experience. The term  $\rho_{s,a} = \frac{L_{s,a}}{L}$  is the share of population with  $s$  years of schooling and  $x$  years of working experience in total population. With  $i$  indexing sex,  $\varphi_i$  measures the share of men and women in the total population.

In this paper, I measure Canada's broad stock of human capital, as the calculations of the efficiency parameters and ultimately the stock are based on the number of working-age Canadians, regardless of their status in the labor force.

#### **IV. RESULTS AND CONCLUSION**

##### **A) Results from the Perpetual Inventory Approach**

a) Population by highest degree, certificate or diploma granted over period 1971 to 2001

To calculate the human capital stock of Canada, I first use the perpetual inventory approach to obtain the educational attainment data over period 1971 to 2001 for working-age groups 15 to 64. Table 1 shows us population aged 15 to 64 by highest degree, certificate or diploma obtained over period 1971 to 2001. As shown in Table 1, population of no degree, certificate or diploma declined since 1976. Population of other degrees all increased over the years.

Then I study the population by highest degree, certificate of diploma at different age group over the period 1971 to 2001 (See Table 9 in Appendix). Figure 1 presents population aged 15 to 19 by highest degree, certificate of diploma obtained. Population with bachelor degree, graduate degree and undergraduate certificate is close to zero in absolute value. At age group 15 to 19, it is highly impossible to obtain such a high degree. Notice that the population with no degree declines over the years. Population with a college degree increases rapidly over the period 1976 to 1981. But it declines thereafter. Since 1987, the population with a college degree granted has changed only slightly.

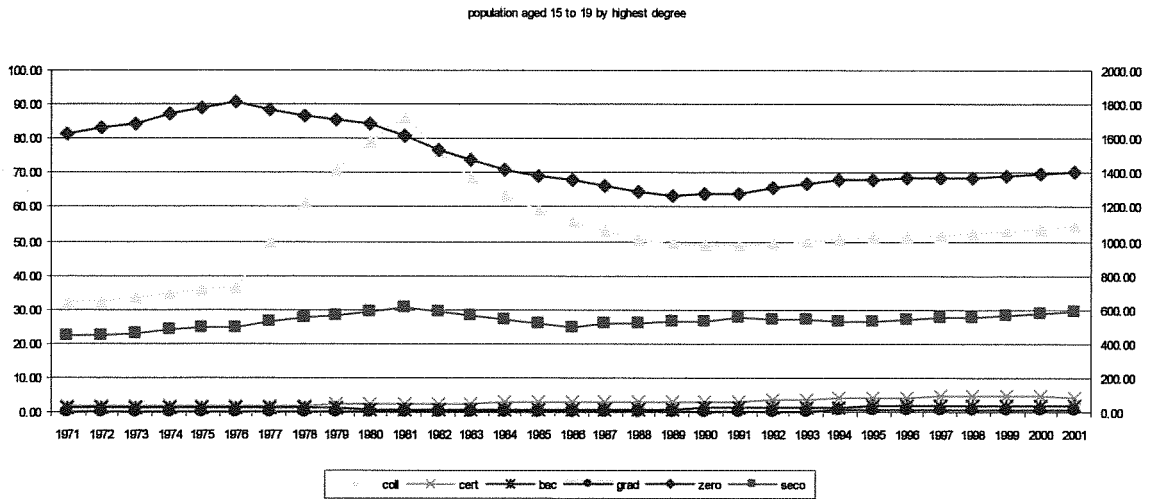
Figure 2 presents population aged 20 to 24 by highest degree, certificate of diploma granted over period 1971 to 2001. Population with no degree declines over the years. Population with other degrees increases slightly over the years.

**Table 1. Population aged 15 to 64 by highest degree, certificate of diploma obtained,**

**1971-2001**

	Zero '000	Seco '000	Coll '000	Cert '000	Bach '000	Grad '000
1971	7819.40	3195.80	1350.55	201.13	644.81	169.28
1972	7988.30	3259.70	1375.32	205.41	656.61	171.74
1973	8137.60	3344.20	1410.11	210.50	669.83	175.82
1974	8324.00	3437.90	1450.84	215.11	688.80	180.01
1975	8502.90	3521.20	1487.96	218.94	710.68	184.39
1976	8666.40	3600.20	1523.05	225.17	732.49	188.81
1977	8523.10	3683.10	1788.61	235.93	783.91	235.90
1978	8371.30	3755.20	2052.65	249.53	834.57	282.93
1979	8222.40	3829.10	2320.31	262.83	884.89	329.30
1980	8067.10	3915.70	2588.62	275.77	935.91	375.94
1981	7859.30	4002.50	2856.30	290.80	991.90	422.84
1982	7796.90	4093.70	2921.46	300.33	1045.19	440.30
1983	7733.70	4154.50	2983.77	309.20	1095.55	457.71
1984	7663.40	4201.30	3057.24	318.08	1146.76	475.38
1985	7612.40	4231.60	3127.82	327.08	1201.89	493.43
1986	7567.70	4261.20	3197.20	337.80	1261.86	512.53
1987	7366.00	4482.20	3294.17	344.69	1318.47	545.76
1988	7172.50	4690.80	3390.01	353.21	1377.31	579.35
1989	6990.60	4897.90	3491.38	362.39	1439.60	614.10
1990	6830.40	5107.70	3596.15	372.34	1509.19	650.55
1991	6673.70	5322.10	3702.75	383.00	1583.02	688.37
1992	6594.10	5358.90	3836.81	398.04	1655.50	717.12
1993	6510.10	5393.40	3975.12	413.61	1731.77	747.42
1994	6429.70	5405.90	4108.19	429.12	1809.80	778.99
1995	6332.40	5430.90	4243.65	443.47	1890.12	811.83
1996	6240.00	5477.10	4371.46	456.23	1962.80	842.14
1997	6140.80	5587.50	4415.73	472.47	2041.05	881.50
1998	6041.50	5678.60	4462.77	486.00	2111.08	917.89
1999	5948.70	5771.60	4507.67	497.83	2188.02	958.26
2000	5859.70	5861.40	4555.77	508.74	2280.60	1003.46
2001	5774.40	5951.10	4607.73	518.07	2375.98	1048.97

**Figure 1 Population aged 15 to 19 by highest degree**



**Figure 2 Population aged 20 to 24 by highest degree**

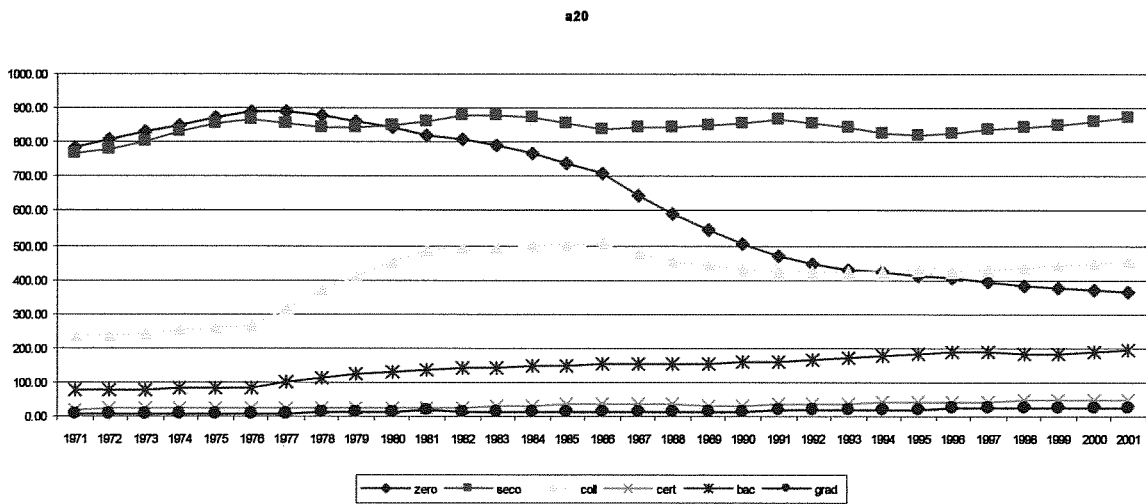


Figure 3 shows population aged 25 to 34 by highest degree, certificate of diploma granted over the period 1971 to 2001. Populations with a bachelor degree, graduate degree and undergraduate certificate all increase over the years. In the case of college degree and secondary degree, they both increase at first and then decline slightly.

**Figure 3 Population aged 25 to 34 by highest degree**

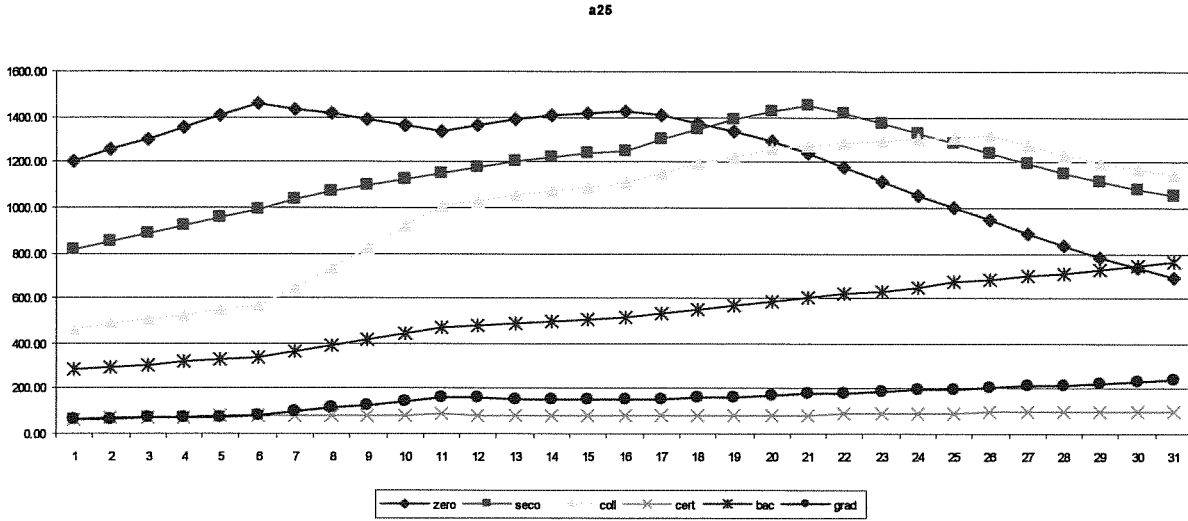


Figure 4 presents the population aged 35 to 44 by highest degree, certificate or diploma obtained over the period 1971 to 2001. Population with no degree declines over the years. Population with other degrees all increase over the years.

**Figure 4 Population aged 35 to 44 by highest degree**

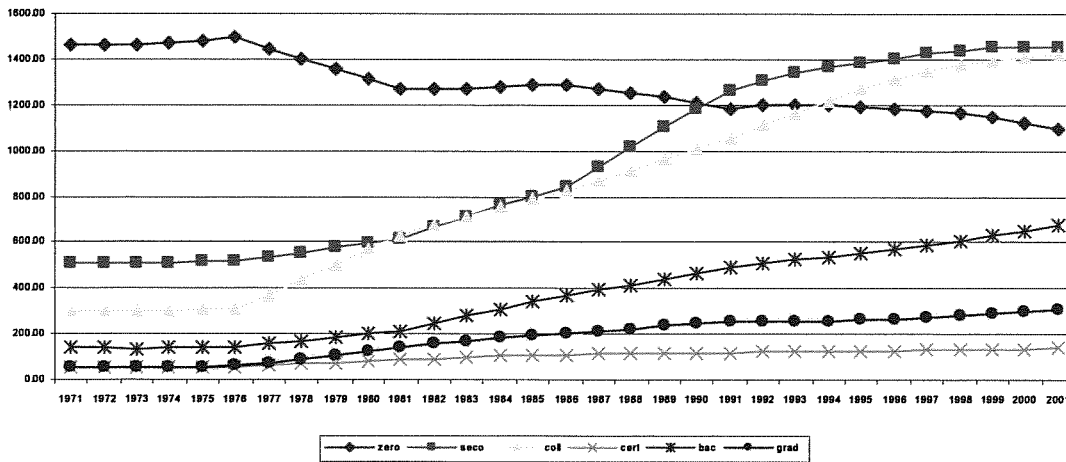


Figure 5 presents population aged 45 to 54 by highest degree, certificate of diploma obtained

over the period 1971 to 2001. It has the similar trend as for age group 35 to 44.

**Figure 5 Population aged 45 to 54 by highest degree**

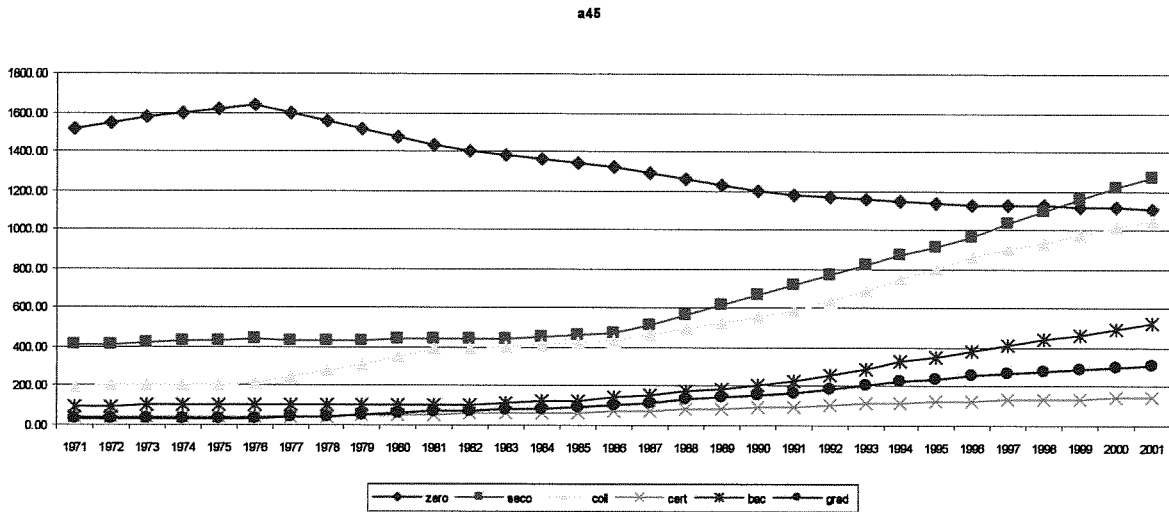
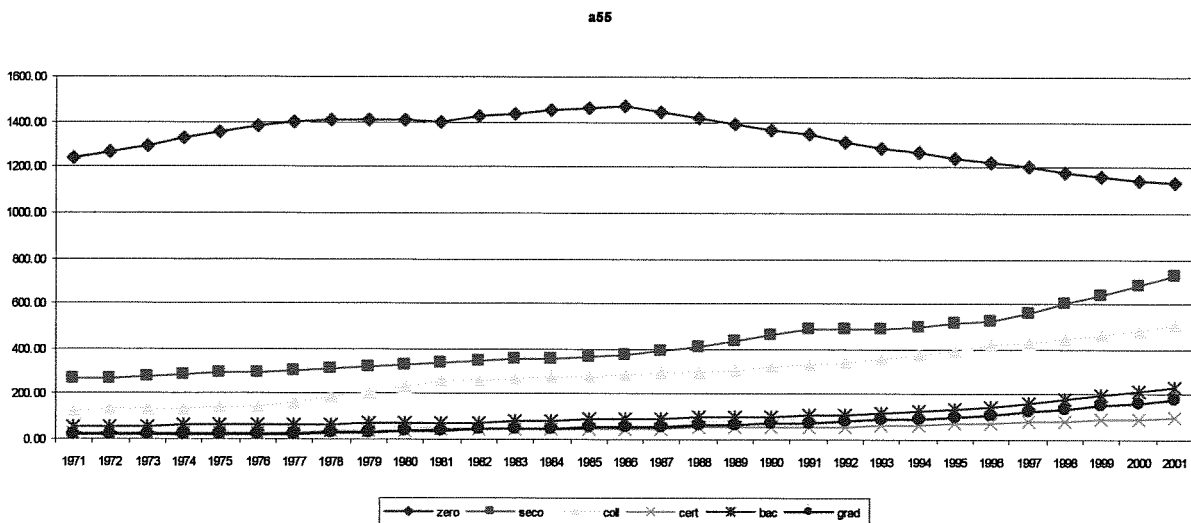


Figure 6 presents population aged 45 to 55 by highest degree, certificate of diploma obtained over the period 1971 to 2001. For this age group, I get that for all the degree categories the population changed slightly.

**Figure 6 Population aged 55 to 64 by highest degree**



b)  $H(t, j, a)$ , the number of individuals at time  $t$  with educational level  $j$  of age  $a$ .

Using perpetual inventory approach, I calculate the number of individuals at time  $t$  with educational level  $j$  of age  $a$ ,  $H(t, j, a)$ , by equation (14):

$$H(t, j, a) = H(t-1, j, a) \cdot (1 - \delta(t, a)) \cdot (1 - \gamma(t, a)) + H(t-1, j, a-1) \cdot (1 - \delta(t, a-1)) \cdot \gamma(t, a-1) + HP(t, j, a) - HM(t, j, a) + EX(j, a) \quad (14)$$

Table 9 in Appendix shows the values of  $H(t, j, a)$  by age group and by educational levels over period 1971 to 2001.

As I mentioned in Section III, the terms  $HP(t, j, a)$  and  $HM(t, j, a)$  are calculated by equations (15) and (16)

$$HP(t, j, a) = \lambda_p(j, a) \cdot (NDP(t, j) + IM(t, j)) \quad (15)$$

$$HM(t, j, a) = \lambda_m(j, a) \cdot NDM(t, j) \quad (16)$$

Table 2 presents the values of Lambdas ( $\lambda_p$  and  $\lambda_m$ ). The value of parameter  $\lambda_p$  split the data that new graduates and new immigrants with  $j$  level of education at time  $t$  into different age group. For example,  $\lambda_p(\text{seco}|a20)$  equals to 0.53. That means 53% of the total number of new secondary diploma graduates and new immigrants with secondary diploma at time period 1971 to 1976 is at the age group 20 to 24.  $\lambda_p(\text{no}|a15)=1$  is the assumption that I impose and means that all newcomers with zero level of education are considered to be in the 15 to 19 age group. Also recall that by equation (17), that sum of the  $\lambda_p$  and  $\lambda_m$  must equal to 1.

**Table 2. Values of Lambdas ( $\lambda_p$  and  $\lambda_m$ )**

Lambdas		lempzero	lemmzero	lempseco	lemmseco	lempcoll	lemmcoll
71-76	a15	1.00	0.65	0.45	0.25	0.10	0.00
	a20	0.00	0.35	0.53	0.40	0.75	0.00
	a25	0.00	0.00	0.02	0.20	0.15	0.00
	a35	0.00	0.00	0.00	0.15	0.00	0.00
	a45	0.00	0.00	0.00	0.00	0.00	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00
76-81	a15	1.00	0.67	0.52	0.25	0.12	0.00
	a20	0.00	0.33	0.37	0.40	0.65	0.00
	a25	0.00	0.00	0.11	0.35	0.15	0.00
	a35	0.00	0.00	0.00	0.00	0.08	0.00
	a45	0.00	0.00	0.00	0.00	0.00	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00
81-86	a15	1.00	0.55	0.46	0.25	0.09	0.00
	a20	0.00	0.45	0.40	0.40	0.75	0.00
	a25	0.00	0.00	0.14	0.35	0.12	0.00
	a35	0.00	0.00	0.00	0.00	0.04	0.00
	a45	0.00	0.00	0.00	0.00	0.00	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00
86-91	a15	1.00	0.63	0.54	0.25	0.08	0.00
	a20	0.00	0.37	0.46	0.40	0.62	0.00
	a25	0.00	0.00	0.00	0.35	0.12	0.00
	a35	0.00	0.00	0.00	0.00	0.11	0.00
	a45	0.00	0.00	0.00	0.00	0.06	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00
91-96	a15	1.00	0.51	0.46	0.25	0.09	0.00
	a20	0.00	0.49	0.54	0.40	0.62	0.00
	a25	0.00	0.00	0.00	0.35	0.12	0.00
	a35	0.00	0.00	0.00	0.00	0.11	0.00
	a45	0.00	0.00	0.00	0.00	0.07	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00
96-01	a15	1.00	0.49	0.51	0.25	0.08	0.00
	a20	0.00	0.51	0.48	0.40	0.59	0.00
	a25	0.00	0.00	0.01	0.35	0.11	0.00
	a35	0.00	0.00	0.00	0.00	0.11	0.00
	a45	0.00	0.00	0.00	0.00	0.10	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00

**Table 2. Values of Lambdas ( $\lambda_p$  and  $\lambda_m$ ) (Continued)**

Lambdas		lempcert	lemmcert	lempbach	lemmbach	lempgrad	lemmgrad
71-76	a15	0.04	0.00	0.00	0.00	0.00	0.00
	a20	0.35	0.00	0.32	0.70	0.04	0.00
	a25	0.35	0.00	0.30	0.28	0.48	0.00
	a35	0.26	0.00	0.38	0.02	0.43	0.00
	a45	0.00	0.00	0.00	0.00	0.05	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00
76-81	a15	0.04	0.00	0.00	0.00	0.00	0.00
	a20	0.30	0.00	0.43	0.65	0.21	0.00
	a25	0.30	0.00	0.43	0.29	0.53	0.00
	a35	0.20	0.00	0.14	0.06	0.25	0.00
	a45	0.16	0.00	0.00	0.00	0.00	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00
81-86	a15	0.04	0.00	0.00	0.00	0.00	0.00
	a20	0.44	0.00	0.42	0.65	0.11	0.00
	a25	0.22	0.00	0.33	0.29	0.47	0.00
	a35	0.31	0.00	0.25	0.06	0.42	0.00
	a45	0.00	0.00	0.00	0.00	0.00	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00
86-91	a15	0.03	0.00	0.00	0.00	0.00	0.00
	a20	0.29	0.00	0.36	0.61	0.12	0.00
	a25	0.22	0.00	0.33	0.29	0.65	0.00
	a35	0.36	0.00	0.20	0.09	0.23	0.00
	a45	0.10	0.00	0.11	0.01	0.00	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00
91-96	a15	0.04	0.00	0.00	0.00	0.00	0.00
	a20	0.35	0.00	0.37	0.61	0.14	0.00
	a25	0.30	0.00	0.34	0.29	0.58	0.00
	a35	0.20	0.00	0.18	0.09	0.22	0.00
	a45	0.11	0.00	0.10	0.01	0.06	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00
96-01	a15	0.05	0.00	0.00	0.00	0.003	0.00
	a20	0.50	0.00	0.32	0.61	0.10	0.00
	a25	0.14	0.00	0.38	0.29	0.59	0.00
	a35	0.19	0.00	0.20	0.09	0.20	0.00
	a45	0.11	0.00	0.10	0.01	0.10	0.00
	a55	0.00	0.00	0.00	0.00	0.00	0.00

**Table 3. Value of  $EX(j,a)$**

EX		exczero	excseco	exccoll	exccert	excbach	excgrad
71-76	a15	0.0	0.0	0.0	0.0	0.0	0.0
	a20	-40.5	0.0	5.4	-3.3	0.0	0.0
	a25	-5.0	-30.9	5.9	-3.3	0.0	0.0
	a35	42.8	-0.9	-11.4	-7.1	-43.5	-7.1
	a45	21.1	-5.9	-8.0	-0.8	-3.2	-2.9
	a55	19.4	-3.1	-1.7	-0.2	-1.6	-0.8
76-81	a15	0.0	0.0	13.2	0.0	0.0	0.0
	a20	-94.6	0.0	55.4	-2.8	0.0	0.0
	a25	-74.1	-18.8	70.2	-3.0	0.0	14.3
	a35	-19.2	-11.6	42.8	2.1	-12.8	12.2
	a45	-19.1	-8.6	21.4	-2.7	-6.0	2.9
	a55	-7.6	-2.7	14.3	1.4	-1.1	2.5
81-86	a15	0.0	0.0	0.0	0.0	0.0	0.0
	a20	-49.2	0.0	21.4	0.0	0.0	0.0
	a25	-0.4	-12.8	14.2	-5.1	0.0	0.0
	a35	-20.5	-9.9	-4.3	-7.6	-16.5	3.0
	a45	11.1	-9.0	-10.3	0.3	-4.8	0.1
	a55	13.2	-3.1	-8.1	-0.5	-0.4	-1.0
86-91	a15	0.0	0.0	0.0	0.0	0.0	0.0
	a20	-98.4	11.5	0.0	0.0	0.0	0.0
	a25	-36.7	61.9	34.5	-2.9	0.0	0.0
	a35	-41.2	46.8	1.3	-3.3	0.0	8.9
	a45	-3.6	25.2	-2.1	2.1	-11.4	8.8
	a55	-2.0	9.7	-8.5	-1.1	-18.9	-2.2
91-96	a15	0.0	0.0	0.0	0.0	0.0	0.0
	a20	-52.7	-45.10	0.0	0.0	-52.7	0.00
	a25	-36.2	7.13	35.8	-3.6	-36.2	0.00
	a35	3.7	19.42	22.4	-0.5	3.7	0.00
	a45	-23.1	-7.43	-4.0	1.6	-23.1	9.62
	a55	13.9	-8.56	-3.0	0.5	13.9	-1.73
96-01	a15	0.0	0.0	0.0	0.0	0.0	0.0
	a20	-45.1	0.0	0.0	0.0	0.0	0.0
	a25	-35.3	10.0	0.0	0.0	0.0	0.0
	a35	6.8	11.2	-10.2	0.0	-36.9	0.0
	a45	-15.4	24.7	-20.6	0.7	-7.1	3.0
	a55	13.8	14.9	-10.5	3.0	0.7	5.3

Equation (17) holds for the values in Table 2. The values of lemmcoll, lemmcert and lemmgrad equal to zero. Those values are reasonable due to the educational system. That is the outflows for college degree, undergraduate certificate and graduate degree at each age group are zero.

Then Table 3 shows the value of residual term  $EX(j,a)$ . Recall that I get the data from different sources, so some incompatibilities are likely to occur. I introduce a residual term in the model to measure the size of the incompatibilities. Fortunately the values of the residual term in the table are quite small.

#### *B) Parameters Values*

The results of the model are driven by two important parameters. The first is the share of each educational level for men and women. It refers to  $\phi$  in the model. Table 4 reports the percentage for each degree obtained by men. The share by women equals 1 minus the share by men.

**Table 4. Percentage of Diplomas obtained by Men**

	1971	1976	1981	1986	1991	1996	2001
zero	45	46	47	47.93	48.4	48.61	48.89
seco	50	49	48.5	47.96	47.8	48.11	49.8
coll	52	51	50	48.99	49	48.13	46.29
cert	46	44	42	40.95	38.7	40.79	40.26
bach	62	60	58	55.23	52.9	50.46	48.56
grad	72	68	65	63.89	60.5	57.22	54.97

The numbers in Table 4 are calculated from the initial data on educational attainment. The numbers before 1986 are extrapolations of percentage trends between 1986 and 2001. From this table I obtain that the shares of the educational level for men all have decreased since 1971

except for zero (no degree). This implies that the share for women has increased over time.

The second important parameter is the education returns by degree and gender (see Table 5).

It refers to the parameter  $w$  in the model.

**Table 5. Education returns by degree and gender**

	1971	1976	1981	1986	1991	1996	2001
zero.men	0.459	0.459	0.432	0.495	0.495	0.495	0.495
zero.women	0.576	0.576	0.603	0.693	0.693	0.693	0.693
seco.men	0.654	0.654	0.627	0.699	0.693	0.669	0.655
seco.women	0.798	0.798	0.825	0.957	0.948	0.934	0.927
coll.men	0.692	0.692	0.665	0.742	0.779	0.787	0.795
coll.women	0.901	0.901	0.928	1.058	1.087	1.104	1.103
cert.men	0.692	0.692	0.665	0.742	0.779	0.787	0.795
cert.women	0.901	0.901	0.928	1.058	1.087	1.104	1.103
bach.men	1.059	1.059	1.032	1.146	1.164	1.184	1.204
bach.women	1.292	1.292	1.319	1.506	1.522	1.57	1.585
grad.men	1.186	1.186	1.161	1.27	1.254	1.299	1.302
grad.women	1.521	1.521	1.548	1.673	1.735	1.735	1.734

In this table, at the year 1971, the value of education returns for seco.men equals to 0.654.

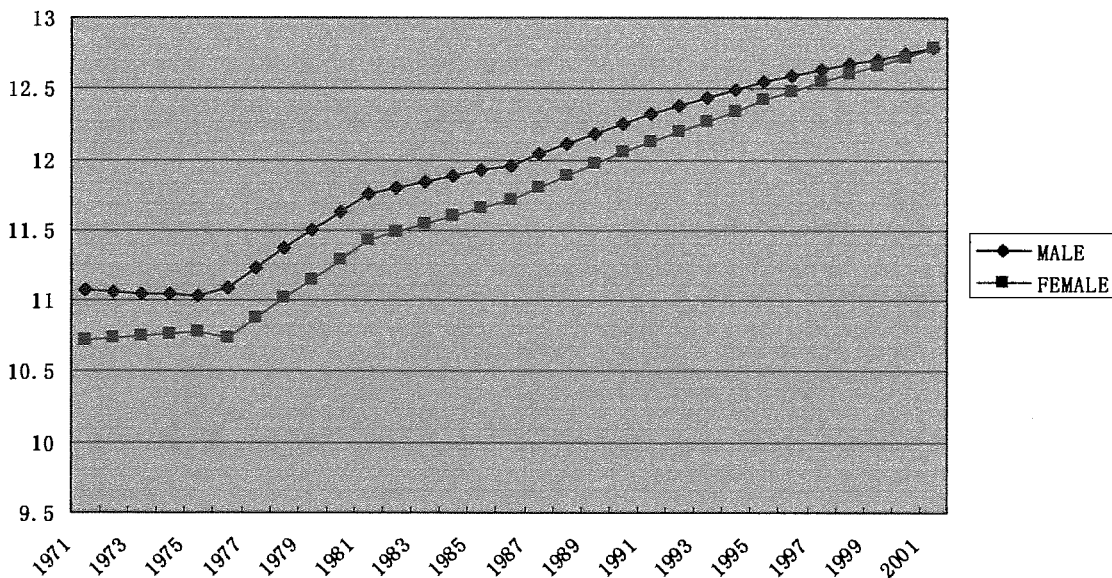
That means the returns to the wage rate of a man with a secondary diploma is 0.654. Comparing the seco.men (0.654) and bach.men (1.059), it shows that a man with a bachelor degree will have 62 percent greater returns to wages than a man with a secondary diploma. From this table, it is obvious that the education returns for women is quite higher than that for men at each level of schooling. Moreover, the returns have increased over time for both men and women.

### *C) Total and average years of schooling*

Figure 7 reports total and average years of schooling. I see in both cases an increasing trend from 1971 to 2001. Figure 7 shows that men have higher average years of schooling than women,

but women are catching up men as for 2001 their average years of schooling was 12.784 which is very close to the men's average years of schooling of 12.7896 (see Table 1 in Appendix). As the share of degree obtained for women increase during the period 1971-2001, the average years of schooling for women have grown at a faster rate than that for men. The total years of schooling also increase over time for both men and women (see Figure 1 and Table 2 in Appendix). I now report the evolution of human capital. First I report results when human capital is defined only through the accumulation of education. Second, I report human capital when define only in terms of experience, third, human capital is finally based on both education and experience.

**Figure7. Average years of schooling, 1971-2001**

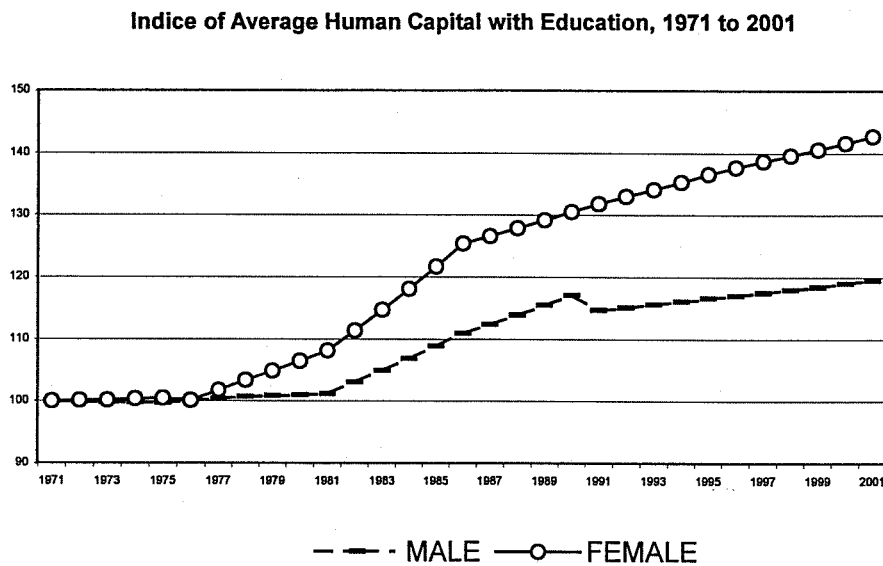


*D) Human capital based on education*

Figure 8 shows that the average human capital for both men and women has increased over time. In the early 1970s, the average human capital for men is close to that for women (see Table

6 in Appendix). Then the average human capital for women grows more rapidly than for men. Total human capital has the same trend as the average human capital (see also Table 3 in Appendix). But the difference between men and women is smaller for total human capital than that for average human capital.

**Figure 8. Average human capital based on education, 1971-2001**



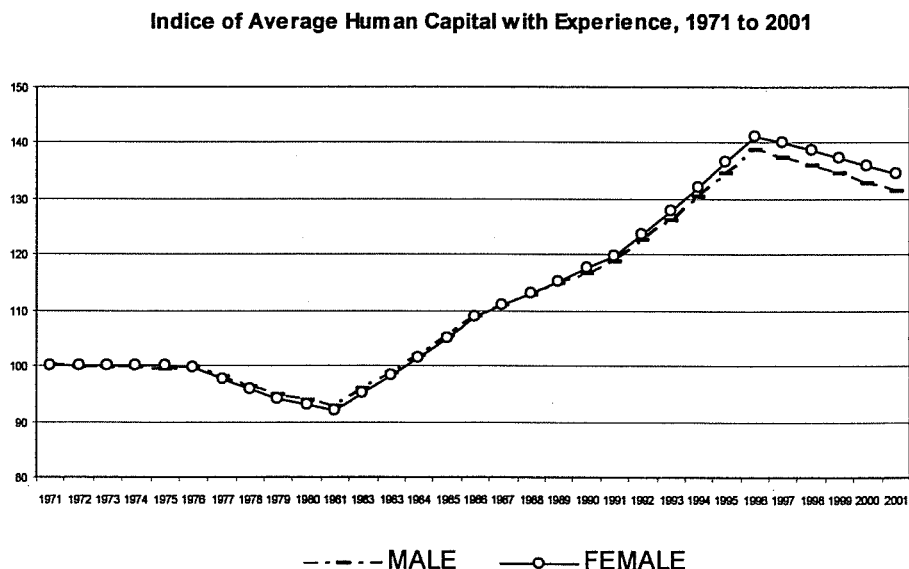
Human capital based on education for both women and men have increased during the period covered as the education returns have increased for most of the degrees over time. Women benefit from greater growth rate than men because their education returns have improved rapidly. Moreover, the education returns for each education level is greater for women than for men (see Table 2). The education returns for women have been greater so far because they started to become educated more recently than men. It is likely that in the future the education returns of women will decline to the men levels. Another factor that contributes to this result is the fact that

the share of degree obtained for women has increased over time (see Table 1).

*E) Human capital based on experience*

I now turn to the human capital based on experience. Figure 9 shows that the average human capital based on experience for both men and women decreased in late 1970s. But it is increasing since 1980. The decline in the 1970s is probably due to the economic recessions of the 1970s. Since the demand for labor went down, so its price (wage). Moreover, the massive entry on the labor market of young generations at that period implies a natural reduction of the accumulation of experience on average. Difference between men and women in absolute terms is small. This is different with the human capital measured by education. Total human capital based on experience has the same trend as for the average human capital (see Table 4 and Figure 3 in Appendix).

**Figure 9. Average human capital based on experience, 1971-2001**



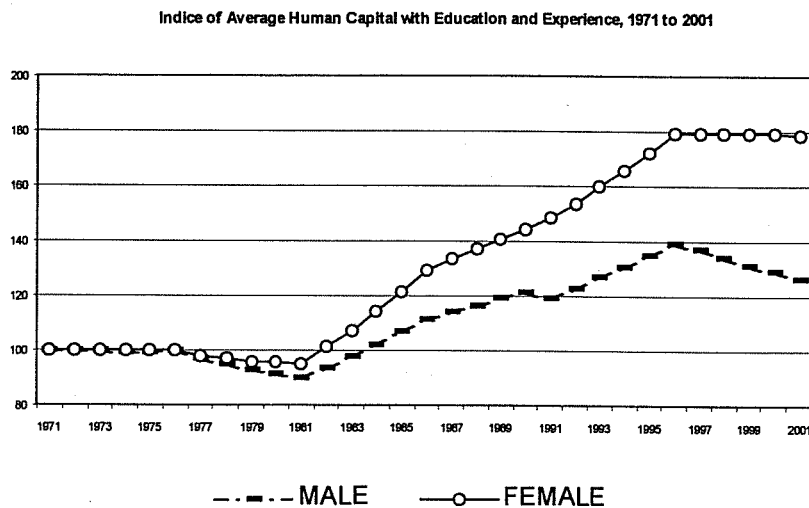
Notice that the growth rate of human capital based on experience for men is greater than

when based on education. The growth rate between 1971 and 2001 for men in the experience-based case is about 31.2 percent, whereas in the education-based case, the growth rate was about 19.5 percent (the results are from Table 4 and Table 7). This probably reflects demographic factors. As the baby-boomers are becoming older, experience takes a larger share of human capital. For women, the opposite conclusion applies as they started to study more recently than men. As discussed it is likely that the proxy for experience overestimates the real working experience for women.

*F) Human capital based on education and experience*

Figure 10 shows that the average human capital based on education and experience for both men and women decline slightly in late 1970s. Then it goes up in 1980s for both men and women. In late 1990s, the average human capital for men declines again, but not for women. Total has a similar trend as the average human capital (see Table 8 in Appendix).

**Figure 10. Average human capital based on education and experience, 1971-2001**



### *G) Conclusion*

In this paper, I use the labor-income-based approach to measure the human capital stock in Canada for men and women. This measure is based on the completion of educational levels and the accumulation of working experience. The results show that the total and average human capital both go up over years for men and women. This is an important factor that will be helpful to understand the economic growth.

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## Appendix

**Table 1. Average years of schooling, 1971-2001**

	MALE	FEMALE
1971	11.07004	10.72031
1972	11.05436	10.72837
1973	11.04818	10.74508
1974	11.04173	10.76122
1975	11.03532	10.77671
1976	11.09006	10.73848
1977	11.23572	10.87798
1978	11.37394	11.01504
1979	11.50457	11.14915
1980	11.63019	11.282
1981	11.7596	11.42105
1983	11.80144	11.47942
1983	11.84044	11.53515
1984	11.88155	11.59331
1985	11.91934	11.64833
1986	11.95705	11.70355
1987	12.03494	11.7918
1988	12.11003	11.87798
1989	12.18302	11.96281
1990	12.25297	12.04506
1991	12.32143	12.12646
1992	12.37617	12.19675
1993	12.43173	12.26837
1994	12.48601	12.33908
1995	12.54269	12.41275
1996	12.59244	12.48054
1997	12.63333	12.54175
1998	12.6711	12.6007
1999	12.7092	12.66009
2000	12.74964	12.72197
2001	12.78956	12.784

**Table 2. Total years of schooling, 1971-2001**

	MALE	FEMALE
1971	7.13E+04	7.44E+04
1972	7.27E+04	7.60E+04
1973	7.42E+04	7.77E+04
1974	7.61E+04	7.97E+04
1975	7.78E+04	8.16E+04
1976	7.98E+04	8.31E+04
1977	8.29E+04	8.57E+04
1978	8.58E+04	8.81E+04
1979	8.88E+04	9.07E+04
1980	9.17E+04	9.33E+04
1981	9.45E+04	9.58E+04
1983	9.59E+04	9.73E+04
1983	9.71E+04	9.85E+04
1984	9.82E+04	9.97E+04
1985	9.93E+04	1.01E+05
1986	1.00E+05	1.02E+05
1987	1.02E+05	1.04E+05
1988	1.04E+05	1.06E+05
1989	1.06E+05	1.09E+05
1990	1.09E+05	1.11E+05
1991	1.11E+05	1.14E+05
1992	1.12E+05	1.16E+05
1993	1.14E+05	1.18E+05
1994	1.16E+05	1.20E+05
1995	1.17E+05	1.22E+05
1996	1.19E+05	1.24E+05
1997	1.20E+05	1.26E+05
1998	1.22E+05	1.27E+05
1999	1.23E+05	1.29E+05
2000	1.25E+05	1.31E+05
2001	1.26E+05	1.33E+05

**Table 3. The sum of human capital based on education, 1971-2001**

	MALE	FEMALE
1971	1.00E+02	1.00E+02
1972	1.02E+02	1.02E+02
1973	1.04E+02	1.04E+02
1974	1.07E+02	1.07E+02
1975	1.09E+02	1.10E+02
1976	1.12E+02	1.12E+02
1977	1.15E+02	1.16E+02
1978	1.18E+02	1.19E+02
1979	1.21E+02	1.23E+02
1980	1.24E+02	1.27E+02
1981	1.26E+02	1.31E+02
1983	1.30E+02	1.36E+02
1983	1.34E+02	1.41E+02
1984	1.37E+02	1.46E+02
1985	1.41E+02	1.52E+02
1986	1.45E+02	1.58E+02
1987	1.48E+02	1.61E+02
1988	1.52E+02	1.65E+02
1989	1.56E+02	1.69E+02
1990	1.61E+02	1.73E+02
1991	1.60E+02	1.78E+02
1992	1.62E+02	1.82E+02
1993	1.65E+02	1.85E+02
1994	1.67E+02	1.89E+02
1995	1.69E+02	1.93E+02
1996	1.71E+02	1.97E+02
1997	1.74E+02	2.00E+02
1998	1.76E+02	2.03E+02
1999	1.78E+02	2.07E+02
2000	1.80E+02	2.10E+02
2001	1.83E+02	2.14E+02

**Table 4. The sum of human capital based on experience, 1971-2001**

	MALE	FEMALE
1971	1.00E+02	1.00E+02
1972	1.02E+02	1.02E+02
1973	1.04E+02	1.04E+02
1974	1.07E+02	1.07E+02
1975	1.09E+02	1.09E+02
1976	1.11E+02	1.11E+02
1977	1.12E+02	1.11E+02
1978	1.13E+02	1.10E+02
1979	1.14E+02	1.10E+02
1980	1.15E+02	1.11E+02
1981	1.16E+02	1.11E+02
1983	1.21E+02	1.16E+02
1983	1.26E+02	1.21E+02
1984	1.31E+02	1.26E+02
1985	1.36E+02	1.31E+02
1986	1.42E+02	1.37E+02
1987	1.46E+02	1.42E+02
1988	1.51E+02	1.46E+02
1989	1.55E+02	1.51E+02
1990	1.60E+02	1.56E+02
1991	1.66E+02	1.61E+02
1992	1.73E+02	1.69E+02
1993	1.80E+02	1.77E+02
1994	1.87E+02	1.85E+02
1995	1.95E+02	1.93E+02
1996	2.03E+02	2.02E+02
1997	2.03E+02	2.02E+02
1998	2.02E+02	2.02E+02
1999	2.02E+02	2.02E+02
2000	2.01E+02	2.02E+02
2001	2.01E+02	2.02E+02

**Table 5. The sum of human capital based on education and experience, 1971-2001**

	MALE	FEMALE
1971	1.00E+02	1.00E+02
1972	1.02E+02	1.02E+02
1973	1.04E+02	1.04E+02
1974	1.06E+02	1.07E+02
1975	1.09E+02	1.10E+02
1976	1.11E+02	1.12E+02
1977	1.11E+02	1.11E+02
1978	1.11E+02	1.12E+02
1979	1.12E+02	1.13E+02
1980	1.12E+02	1.14E+02
1981	1.12E+02	1.15E+02
1983	1.18E+02	1.24E+02
1983	1.25E+02	1.32E+02
1984	1.31E+02	1.42E+02
1985	1.38E+02	1.52E+02
1986	1.46E+02	1.63E+02
1987	1.51E+02	1.70E+02
1988	1.56E+02	1.77E+02
1989	1.61E+02	1.84E+02
1990	1.67E+02	1.92E+02
1991	1.67E+02	2.00E+02
1992	1.74E+02	2.10E+02
1993	1.81E+02	2.21E+02
1994	1.88E+02	2.32E+02
1995	1.96E+02	2.44E+02
1996	2.04E+02	2.56E+02
1997	2.02E+02	2.59E+02
1998	2.00E+02	2.61E+02
1999	1.98E+02	2.63E+02
2000	1.96E+02	2.66E+02
2001	1.94E+02	2.69E+02

**Table 6. Average human capital based on education, 1971-2001**

	MALE	FEMALE
1971	1.00E+02	1.00E+02
1972	99.89118	1.00E+02
1973	99.83676	1.00E+02
1974	99.78768	1.00E+02
1975	99.75088	1.01E+02
1976	1.00E+02	1.00E+02
1977	1.00E+02	1.02E+02
1978	1.01E+02	1.03E+02
1979	1.01E+02	1.05E+02
1980	1.01E+02	1.07E+02
1981	1.01E+02	1.08E+02
1983	1.03E+02	1.11E+02
1983	1.05E+02	1.15E+02
1984	1.07E+02	1.18E+02
1985	1.09E+02	1.22E+02
1986	1.11E+02	1.25E+02
1987	1.12E+02	1.27E+02
1988	1.14E+02	1.28E+02
1989	1.16E+02	1.29E+02
1990	1.17E+02	1.31E+02
1991	1.15E+02	1.32E+02
1992	1.15E+02	1.33E+02
1993	1.16E+02	1.34E+02
1994	1.16E+02	1.35E+02
1995	1.17E+02	1.37E+02
1996	1.17E+02	1.38E+02
1997	1.18E+02	1.39E+02
1998	1.18E+02	1.40E+02
1999	1.18E+02	1.41E+02
2000	1.19E+02	1.42E+02
2001	1.20E+02	1.43E+02

**Table 7. Average human capital based on experience, 1971-2001**

	MALE	FEMALE
1971	1.00E+02	1.00E+02
1972	99.84093	1.00E+02
1973	99.72883	1.00E+02
1974	99.57174	1.00E+02
1975	99.48078	1.00E+02
1976	99.80241	99.80664
1977	97.80685	97.57309
1978	96.15538	95.72941
1979	94.76727	94.20086
1980	93.62291	92.96472
1981	92.76064	92.04709
1983	95.67095	95.09908
1983	98.7139	98.29407
1984	1.02E+02	1.02E+02
1985	1.05E+02	1.05E+02
1986	1.09E+02	1.09E+02
1987	1.11E+02	1.11E+02
1988	1.13E+02	1.13E+02
1989	1.15E+02	1.15E+02
1990	1.17E+02	1.18E+02
1991	1.19E+02	1.20E+02
1992	1.22E+02	1.24E+02
1993	1.26E+02	1.28E+02
1994	1.30E+02	1.32E+02
1995	1.35E+02	1.37E+02
1996	1.39E+02	1.41E+02
1997	1.37E+02	1.40E+02
1998	1.36E+02	1.39E+02
1999	1.34E+02	1.37E+02
2000	1.33E+02	1.36E+02
2001	1.31E+02	1.35E+02

**Table 8. Average human capital based on education and experience, 1971-2001**

	MALE	FEMALE
1971	1.00E+02	1.00E+02
1972	99.82369	1.00E+02
1973	99.6832	1.00E+02
1974	99.47697	1.00E+02
1975	99.35355	1.00E+02
1976	99.65123	99.949
1977	97.23073	98.19798
1978	95.08954	96.91559
1979	93.15119	96.02246
1980	91.40796	95.48351
1981	89.92054	95.30167
1983	93.83237	1.01E+02
1983	97.96798	1.08E+02
1984	1.02E+02	1.14E+02
1985	1.07E+02	1.22E+02
1986	1.12E+02	1.30E+02
1987	1.14E+02	1.33E+02
1988	1.17E+02	1.37E+02
1989	1.19E+02	1.41E+02
1990	1.21E+02	1.45E+02
1991	1.20E+02	1.48E+02
1992	1.23E+02	1.54E+02
1993	1.27E+02	1.60E+02
1994	1.31E+02	1.66E+02
1995	1.35E+02	1.72E+02
1996	1.39E+02	1.79E+02
1997	1.37E+02	1.79E+02
1998	1.34E+02	1.79E+02
1999	1.32E+02	1.79E+02
2000	1.29E+02	1.79E+02
2001	1.26E+02	1.79E+02

**Table 9. Population by different age group and by highest degree obtained, 1971-2001**

A15	zero	seco	coll	cert	bac	grad
1971	1622.00	443.70	32.35	1.53	1.29	0.25
1972	1661.00	447.30	32.32	1.55	1.31	0.25
1973	1680.00	460.20	33.31	1.60	1.33	0.26
1974	1737.00	476.60	34.74	1.63	1.36	0.27
1975	1781.00	486.50	35.56	1.62	1.40	0.27
1976	1808.00	494.40	36.05	1.71	1.44	0.28
1977	1771.00	523.30	49.91	1.77	1.24	0.25
1978	1735.00	543.90	61.15	1.96	1.08	0.22
1979	1710.00	562.40	70.91	2.11	0.95	0.20
1980	1683.00	583.80	79.12	2.22	0.85	0.19
1981	1611.00	602.90	86.00	2.40	0.80	0.18
1982	1537.00	590.00	76.26	2.54	0.80	0.19
1983	1470.00	565.50	68.37	2.63	0.80	0.18
1984	1413.00	542.10	63.14	2.70	0.80	0.17
1985	1381.00	515.90	58.82	2.78	0.81	0.17
1986	1362.00	496.20	55.40	2.90	0.83	0.17
1987	1318.00	510.40	52.67	2.78	0.83	0.17
1988	1285.00	515.60	50.51	2.78	0.84	0.17
1989	1266.00	521.80	49.38	2.80	0.86	0.18
1990	1270.00	531.00	48.75	2.84	0.89	0.19
1991	1275.00	544.30	48.55	2.90	0.92	0.20
1992	1309.00	540.20	49.01	3.28	1.10	0.24
1993	1334.00	537.30	49.72	3.62	1.27	0.28
1994	1352.00	526.80	50.09	3.89	1.40	0.32
1995	1357.00	525.00	50.75	4.08	1.52	0.36
1996	1365.00	534.20	50.76	4.18	1.60	0.38
1997	1372.00	549.10	51.33	4.41	1.65	0.42
1998	1374.00	555.00	52.07	4.47	1.68	0.44
1999	1381.00	561.70	52.57	4.47	1.72	0.48
2000	1393.00	570.40	53.37	4.45	1.80	0.52
2001	1403.00	579.60	54.63	4.37	1.88	0.57
A20	zero	seco	coll	cert	bac	grad
1971	784.40	764.00	231.90	20.03	74.37	2.98
1972	806.30	778.80	232.50	20.56	75.43	3.03
1973	828.60	802.80	240.80	21.29	76.56	3.14
1974	846.00	830.40	252.40	21.73	79.46	3.23
1975	868.90	850.90	259.20	21.83	82.40	3.31

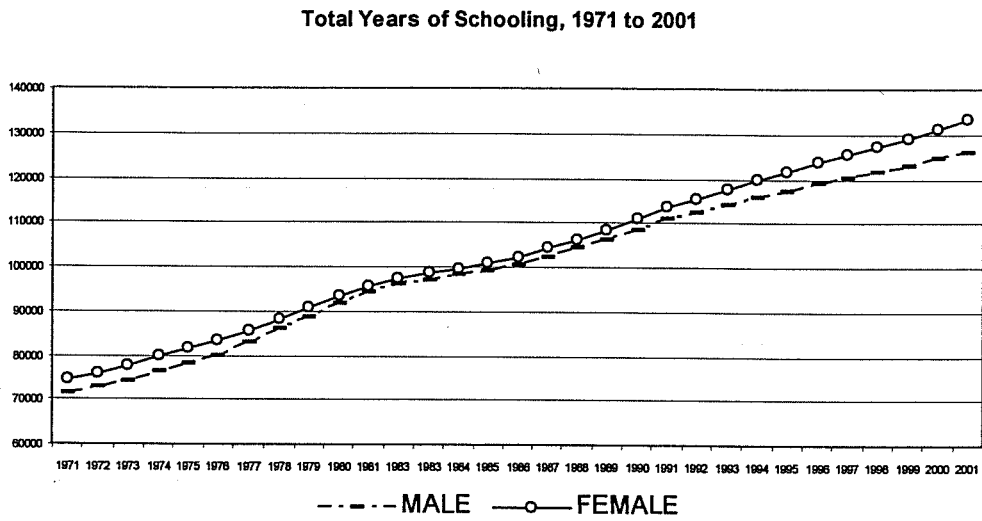
1976	891.40	868.20	263.50	22.76	84.51	3.39
1977	888.10	853.90	318.00	21.76	99.23	6.51
1978	876.30	844.10	365.50	21.89	110.80	9.13
1979	860.40	841.40	410.20	22.02	120.10	11.23
1980	841.10	847.70	450.40	22.13	128.10	13.06
1981	817.30	856.80	486.10	22.90	136.60	14.71
1982	806.90	876.40	490.20	26.20	140.10	13.99
1983	790.70	879.00	490.00	28.62	142.20	13.41
1984	763.40	872.10	496.50	30.62	144.40	13.02
1985	735.40	855.80	499.00	32.39	147.70	12.75
1986	706.70	837.40	500.20	34.60	152.30	12.69
1987	646.00	841.80	473.30	33.12	151.10	13.06
1988	592.50	843.00	451.30	32.44	151.00	13.43
1989	544.60	846.10	437.90	32.11	151.90	13.90
1990	501.40	852.30	428.90	32.11	155.20	14.57
1991	466.70	863.10	423.80	32.40	159.30	15.33
1992	444.10	853.60	422.00	34.49	165.80	16.43
1993	429.10	844.60	423.10	36.48	172.00	17.60
1994	422.70	826.50	422.80	38.24	177.70	18.79
1995	410.80	817.60	425.20	39.39	183.50	20.01
1996	401.00	822.20	423.50	39.93	185.50	20.76
1997	390.40	835.10	427.30	42.93	184.50	20.79
1998	381.90	841.90	432.60	44.21	181.40	20.65
1999	373.30	850.20	436.40	44.70	181.40	21.08
2000	365.50	860.40	442.30	44.88	186.70	22.04
2001	360.70	871.60	451.90	44.48	192.10	23.00
A25	zero	seco	coll	cert	bac	grad
1971	1198.00	812.50	463.70	65.07	279.20	62.72
1972	1251.00	846.80	483.40	67.96	290.90	65.16
1973	1303.00	881.20	503.10	71.01	302.30	68.20
1974	1356.00	916.50	523.80	73.80	314.70	71.07
1975	1408.00	953.10	544.60	76.19	327.60	73.81
1976	1459.00	989.40	564.70	79.25	340.00	76.38
1977	1434.00	1033.00	648.20	79.70	364.10	94.36
1978	1410.00	1067.00	735.30	80.87	388.90	111.70
1979	1385.00	1096.00	825.10	81.95	413.80	128.00
1980	1360.00	1124.00	916.50	82.94	438.70	143.80
1981	1333.00	1150.00	1008.00	84.60	465.40	159.00
1982	1362.00	1179.00	1029.00	81.63	475.20	155.80
1983	1387.00	1205.00	1048.00	79.46	483.30	152.80

1984	1406.00	1224.00	1067.00	78.00	491.30	150.20
1985	1418.00	1238.00	1085.00	77.14	500.50	148.10
1986	1423.00	1246.00	1101.00	77.10	511.30	146.80
1987	1403.00	1296.00	1152.00	78.17	529.20	151.60
1988	1372.00	1343.00	1192.00	79.22	545.90	156.50
1989	1333.00	1384.00	1224.00	80.19	562.40	162.00
1990	1287.00	1420.00	1252.00	81.19	580.10	168.50
1991	1237.00	1452.00	1275.00	82.32	598.50	175.80
1992	1173.00	1410.00	1285.00	84.17	614.60	179.60
1993	1110.00	1367.00	1294.00	86.48	632.00	184.40
1994	1051.00	1325.00	1302.00	89.05	649.70	190.10
1995	996.60	1282.00	1310.00	91.48	668.00	196.60
1996	945.00	1241.00	1317.00	93.54	683.40	201.80
1997	884.40	1192.00	1269.00	93.98	698.80	208.00
1998	828.60	1150.00	1228.00	94.67	709.80	212.50
1999	777.40	1114.00	1193.00	95.38	722.30	219.70
2000	730.20	1081.00	1163.00	96.06	740.10	229.80
2001	686.70	1053.00	1138.00	96.54	758.90	240.00
A35	zero	seco	coll	cert	bac	grad
1971	1462.00	508.40	300.40	51.19	141.10	56.16
1972	1459.00	506.00	298.20	50.72	136.80	55.22
1973	1461.00	506.50	297.80	50.78	134.70	55.31
1974	1468.00	508.80	299.10	50.97	135.90	55.72
1975	1478.00	513.10	302.10	51.20	139.40	56.41
1976	1492.00	518.90	306.60	52.25	144.00	57.31
1977	1442.00	535.90	369.90	59.35	156.40	74.30
1978	1396.00	554.70	433.70	66.40	169.50	91.17
1979	1352.00	574.40	498.70	72.84	183.30	107.70
1980	1310.00	594.60	564.80	78.71	197.90	124.10
1981	1271.00	615.10	632.00	84.50	213.80	140.40
1982	1270.00	664.70	672.70	90.72	248.00	155.00
1983	1272.00	711.70	712.00	95.95	280.10	168.10
1984	1276.00	756.80	750.20	100.60	310.30	180.00
1985	1281.00	799.40	786.90	104.70	339.10	190.90
1986	1288.00	839.80	822.20	109.00	366.80	201.20
1987	1269.00	929.70	866.50	110.00	390.90	212.20
1988	1250.00	1017.00	911.80	111.50	415.20	222.90
1989	1229.00	1101.00	957.70	113.30	439.80	233.50
1990	1207.00	1182.00	1003.00	115.40	465.50	244.20
1991	1182.00	1259.00	1048.00	117.70	491.80	255.10

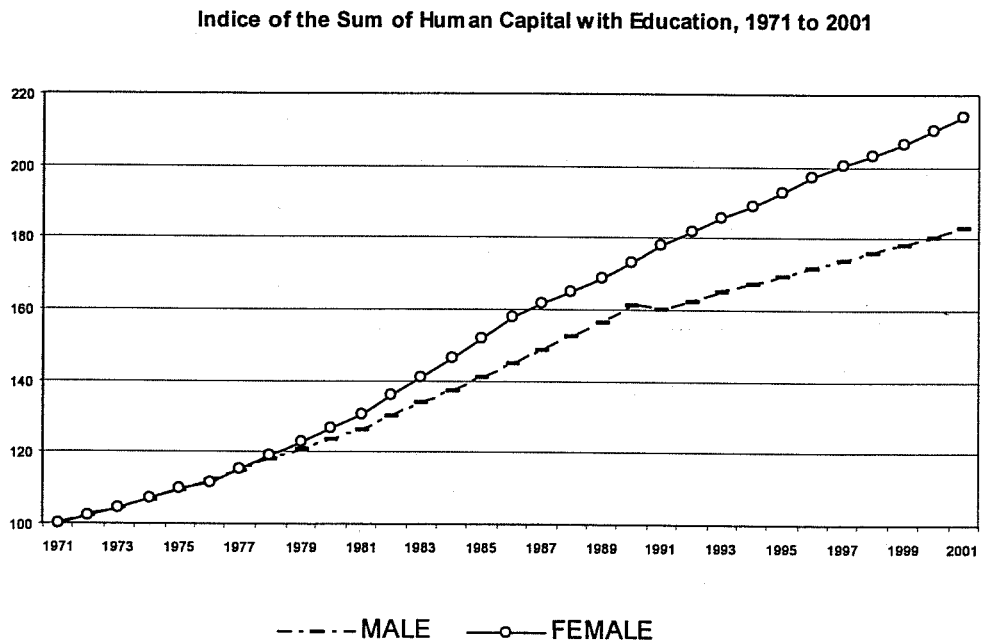
1992	1195.00	1301.00	1109.00	118.60	505.90	254.90
1993	1200.00	1336.00	1167.00	119.80	521.20	255.60
1994	1199.00	1362.00	1219.00	121.10	537.30	257.10
1995	1192.00	1382.00	1267.00	122.40	554.10	259.50
1996	1180.00	1396.00	1311.00	123.60	570.00	261.90
1997	1172.00	1421.00	1345.00	126.90	589.10	269.30
1998	1159.00	1437.00	1371.00	129.60	607.00	276.50
1999	1141.00	1448.00	1390.00	131.80	626.40	284.60
2000	1118.00	1453.00	1404.00	133.90	649.00	294.10
2001	1093.00	1455.00	1414.00	135.60	672.70	304.20
A45	zero	seco	coll	cert	bac	grad
1971	1517.00	404.60	196.40	38.16	94.75	31.46
1972	1545.00	412.00	200.10	38.89	96.85	31.99
1973	1570.00	418.50	203.30	39.50	98.33	32.47
1974	1593.00	424.50	206.10	40.06	99.48	32.92
1975	1614.00	430.30	208.80	40.60	100.70	33.39
1976	1635.00	435.90	211.60	41.12	102.10	33.89
1977	1594.00	433.30	241.30	42.67	99.70	38.89
1978	1552.00	432.70	274.10	45.24	98.77	45.04
1979	1510.00	434.00	309.80	48.24	99.23	52.21
1980	1469.00	437.10	348.30	51.55	101.00	60.27
1981	1427.00	442.00	389.30	55.50	104.10	69.13
1982	1401.00	439.90	392.80	57.32	106.40	74.01
1983	1378.00	442.40	399.40	59.49	111.20	79.66
1984	1357.00	448.50	408.80	61.90	118.40	85.86
1985	1339.00	457.90	420.40	64.45	127.80	92.45
1986	1323.00	470.00	434.00	67.10	139.20	99.29
1987	1290.00	515.40	461.00	72.99	154.90	114.30
1988	1258.00	563.60	489.10	78.55	171.20	128.60
1989	1228.00	614.00	518.40	83.76	188.40	142.40
1990	1200.00	666.20	548.80	88.68	206.80	155.70
1991	1173.00	719.70	580.00	93.37	226.00	168.50
1992	1161.00	769.30	633.40	100.60	259.00	187.60
1993	1151.00	818.70	688.50	107.40	291.10	205.20
1994	1142.00	867.20	744.00	113.80	322.20	221.50
1995	1135.00	914.10	800.10	119.70	352.50	236.70
1996	1127.00	958.90	855.60	125.00	381.10	250.60
1997	1123.00	1029.00	895.10	128.60	409.60	261.90
1998	1120.00	1095.00	934.90	132.00	437.00	272.80
1999	1116.00	1158.00	973.70	135.30	464.70	284.00

2000	1110.00	1216.00	1012.00	138.40	493.70	295.70
2001	1103.00	1270.00	1048.00	141.40	522.90	307.40
A55	zero	seco	coll	cert	bac	grad
1971	1236.00	262.60	125.80	25.14	54.10	15.73
1972	1266.00	268.80	128.80	25.73	55.33	16.08
1973	1295.00	275.00	131.80	26.33	56.61	16.44
1974	1324.00	281.10	134.70	26.91	57.89	16.81
1975	1353.00	287.30	137.70	27.50	59.17	17.18
1976	1381.00	293.40	140.60	28.09	60.45	17.57
1977	1394.00	303.70	161.30	30.68	63.24	21.57
1978	1402.00	312.80	182.90	33.17	65.53	25.67
1979	1405.00	320.90	205.60	35.67	67.51	29.95
1980	1404.00	328.50	229.50	38.22	69.36	34.52
1981	1400.00	335.70	254.90	40.90	71.20	39.43
1982	1420.00	343.70	260.50	41.92	74.69	41.32
1983	1436.00	350.90	266.00	43.04	77.95	43.56
1984	1448.00	357.80	271.60	44.26	81.56	46.13
1985	1458.00	364.60	277.70	45.61	85.98	49.07
1986	1465.00	371.80	284.40	47.10	91.43	52.39
1987	1440.00	388.90	288.70	47.63	91.54	54.44
1988	1415.00	408.60	295.30	48.72	93.17	57.74
1989	1390.00	431.00	304.00	50.24	96.24	62.12
1990	1365.00	456.20	314.70	52.13	100.70	67.40
1991	1340.00	484.00	327.40	54.32	106.50	73.45
1992	1312.00	484.80	338.40	56.90	109.10	78.35
1993	1286.00	489.80	352.80	59.83	114.20	84.33
1994	1263.00	498.40	370.30	63.03	121.50	91.18
1995	1241.00	510.20	390.60	66.43	130.50	98.66
1996	1222.00	524.80	413.60	69.99	141.20	106.70
1997	1199.00	561.30	428.00	75.65	157.40	121.10
1998	1178.00	599.70	444.20	81.04	174.20	135.00
1999	1160.00	639.70	462.00	86.18	191.50	148.40
2000	1143.00	680.60	481.10	91.05	209.30	161.30
2001	1128.00	721.90	501.20	95.68	227.50	173.80

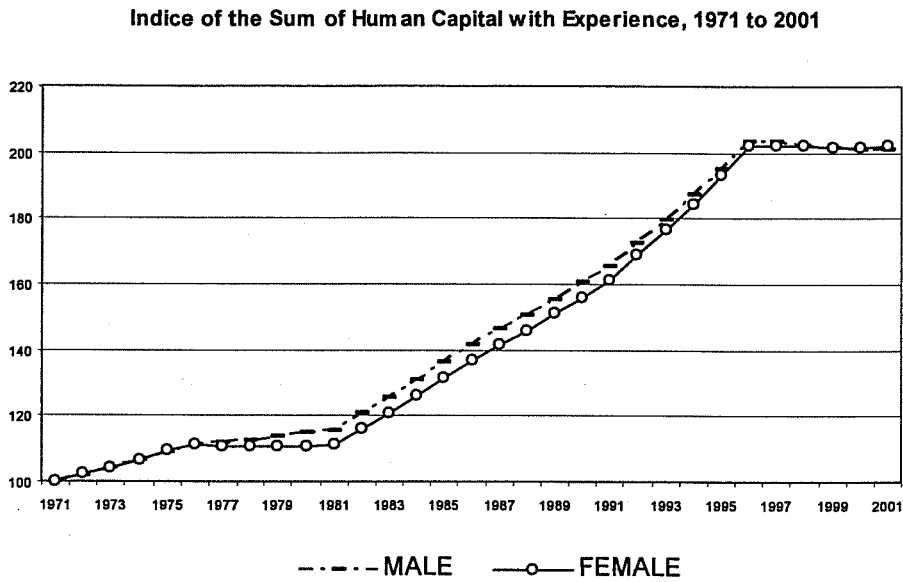
**Figure 1. Total years of schooling, 1971-2001**



**Figure 2. The sum of human capital based on education, 1971-2001**



**Figure 3. The sum of human capital based on experience, 1971-2001**



**Figure 4. The sum of human capital based on education and experience, 1971-2001**

