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The Regional Education-Based Wage Differentials: The Case of Canadian Registered Nurses

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This paper examines the monetary returns from a baccalaureate degree for the nursing education compared to a diploma across five regions in Canada. It engages me in employing benefit-cost analysis to assess whether the evidence is consistent with implications of human capital theory. Depending on the assumed discount rate and retirement age, the estimated baccalaureate-diploma wage differentials vary in each Canadian region. In this study, I conclude that the decision to invest in one more year of nursing education is economically rational only for the registered nurses who work in Eastern Canada.

JEL Classification: I11, I23, J24, J31
Keywords: Human capital, Present value, Internal rate of return

1. Introduction

With an aging population, the continuing nursing shortage and initial education in nursing are two of the most growing concerns for the health care system in North America. Jones and Gates (2004) pointed out that nursing shortage causes a vicious cycle by a decrease in nurses' job satisfaction and an increase in nursing turnover. The awareness of nursing shortage in turn brings a decrease in nursing school enrollments (McCloskey, 1995). Although increasing numbers of registered nurses (RNs) to meet the ever-growing challenge to nursing resources is a serious matter, a four-year baccalaureate degree will be required in most Canadian provinces as an initial education for entry to the practice of nursing by 2010 (See Table 1).

Basic nursing education is available either at community colleges or at universities throughout Canada. They offer an initial program, which prepares candidates to write the Canadian Nursing Registration Exams (CNRE) that qualifies them to enter Canadian nursing workforce with the competence required to practice safely (CNA, 2007). Canadian Nurses Association (CNA, 2003a) announced that students in the provinces of British Columbia, Alberta, Ontario, Quebec, and the territories still have a choice of a diploma or a baccalaureate degree in nursing as the initial nursing education in the year 2001. In all other provinces, candidates are required to have a baccalaureate degree in nursing as the educational program. While degree programs take four years, diploma

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programs take only three years.

Based on this latest education trend of Canadian RNs, the main purpose of this study is to find the monetary returns from a baccalaureate degree compared to a diploma across five traditionally recognized regions of Canada.[1] Empirical evidence is presented by sizable differentials in rates of return to schooling, which translate into substantial differences between regions in discounted lifetime earnings.

Even though previous studies on returns to education based on the Canadian nursing workforce are scarce, there are still a number of empirical findings on earnings and nursing education with the U.S. survey data. In the United States, a RN license can be achieved with a 4-year baccalaureate degree; a 3-year diploma degree; or a 2-year associate degree, whereas the American Nurses' Association (ANA) has encouraged nursing students to study for a baccalaureate degree (Bayer and Schoenfeldt, 1970; Mennemeyer and Gaumer, 1983; Booten and Lane, 1985). Although ANA has long advocated the baccalaureate degree by nurses, several studies have found that there is no financial gain from obtaining the baccalaureate degree in nursing (Booten and Lane, 1985; Lehrer et al., 1991; Botelho et al., 1998; Spetz, 2002). However, other studies have suggested 6-7 percent of wage premiums for the baccalaureate RNs over less educated RNs by exploring wage-experience profiles (Mennemeyer and Gaumer, 1983; Link, 1988).

To yield the conclusions, two main criteria of making choices are considered in this paper with respect to human capital investments (Cohn and Geske, 1990). The first is the net present value rule: "Select all projects where the present value of benefits exceeds the present value of costs" (Prest and Turvey, 1965). The second is the internal rate of return rule: "Select all projects where the internal rate of return exceeds the chosen rate of discount" (Prest and Turvey, 1965).

The remainder of this paper is as follows: Section 2 discusses nursing in Canada and human capital investment to Canadian nursing education. In Section 3, I present the regional wage disparities among RNs in Canada using the 2001 Canadian Census Individual Microdata File. The analytical framework with the conception of human capital is described in Section 4. Section 5 develops the model and summarizes the regression results. In Section 6, the empirical results of returns to nursing education and their regional patterns in Canada are presented. Section 7 contains discussion and conclusion.

2. Nursing in Canada and Human Capital

The nursing workforce consists of three regulated professions in Cana-

[1] Five regions of Canada are Atlantic Canada, Quebec, Ontario, Prairies, and British Columbia. Northern territories have been excluded in this study. Atlantic Canada includes the four provinces of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland & Labrador. Prairies region is the three prairie provinces of Alberta, Saskatchewan, and Manitoba. Northern territories are the northernmost region of Canada which includes Yukon, Northwest territories, and Nunavut.

da: registered nurses (RNs), licensed practical nurses (LPNs), and registered psychiatric nurses (RPNs).[2] Members of these distinct professions work in a variety of roles and settings across the continuum of health services. According to the Canadian Institute for Health Information (2006a) annual report, the regulated nursing workforce in 2005 included 268,376 RNs representing 77.6% of the total, 72,419 LPNs representing 20.9% and 5,027 (1.5%) RPNs. Among those three groupings of the regulated nursing workforce, the RNs make up majority of the nursing workforce and require the highest level of education.

During the latest decade, Canada is facing severe RN shortage. Spurgeon (2000) warned that the shortage will grow worse as the day progress because the country's nursing workforce is growing older. In 1998, the RNs aged over 50 represent 25% of the total employed RNs which is increased by 19% compared with in 1993. On the other hand, the RNs aged under 29 account for only 10% of the total which is declined by 32% over the same period.

With the anticipated shortage of RNs, it is not surprising that the RNs' job dissatisfaction escalated and thus enrolment in nursing schools began to decline in Canada (Sibbald, 1999). Aiken et al. (2001) noted that the percentage for dissatisfied nurses with their present jobs (working at the hospitals in Canada) was 32% and what is worse, 29% of nurses under 30 are planning to leave in the next year on their 1998 and 1999 surveys.

Even with the current severe shortage of RNs and efforts to recruit or retain students of nursing schools, it is ironic that the most provinces in Canada recently require a baccalaureate degree in nursing (BN or BScN), which takes longer and costs more than a diploma, to enter the profession. However, a prospective nurse's choice of education depends on the relative values of his or her options. Human capital theory supports the monetary value among those relative values by predicting that nurses with more education will receive higher wages (Spetz, 2001).

Human Capital Investment and Canadian Nursing Education

In Canada, degree (BN or BScN) programs take four years while diploma programs take only three years. Both programs basically offer teaching social science, physical science, and nursing. However, university degree programs generally include additional studies in leadership, health teaching, research and other disciplines (CNA, 2003b). Nowadays, many college diploma courses collaborate with a university to obtain a degree by the option of continuing on after graduation. Health Canada (2006) reported that some diploma programs closed or merged with university programs owing to the change in nursing education that most provinces require a four-year baccalaureate degree to enter the nursing profession.

In order to explain a prospective nurse's choice of education between a

[2] The term of licensed practical nurses (LPNs) are called as registered practical nurses, registered nursing assistants, or licensed nursing assistants (LNA) in some jurisdictions. Also, registered psychiatric nurses (RPNs) are educated and regulated as a separate health profession in British Columbia, Alberta, Saskatchewan and Manitoba (Health Canada, 2006).

baccalaureate degree and a diploma in Canada, I consider the net present value rule and the internal rate of return rule among general criteria for investment decision, which were discussed by Cohn and Geske (1990). Now, the prospective nurse will face the following alternative: either getting a diploma and having a working life lasting $(n+1)$ years as a diploma RN, obtaining a wage W_t^d; or getting a baccalaureate degree with a direct monetary cost C_0 and indirect monetary cost (or opportunity cost) W_0^d to complete one extra year of courses in a baccalaureate program, and having a working life lasting n years as a baccalaureate RN for a wage W_t^b.

If i denotes the rate of discount to be used and r denotes the internal rate of return (IRR), the prospective nurse will decide to get a baccalaureate degree when either of the following conditions is satisfied as an investment in human capital:

$$\sum_{t=1}^{n}\left[\frac{W_t^b - W_t^d}{(1+i)^{t-1}}\right] > C_0 + W_0^d, \tag{1}$$

$$\sum_{t=1}^{n}\left[\frac{W_t^b - W_t^d}{(1+r)^{t-1}}\right] = C_0 + W_0^d, \quad r > i, \tag{2}$$

Equation (1) represents the net present value rule and equation (2) represents the internal rate of return rule.

3. Data and Regional Wage Disparities

The data used in this paper are from the 2001 Canadian Census Individuals Microdata File, which are available in Minnesota Population Center (Integrated Public Use Microdata Series - International: Version 4.0, Minneapolis: University of Minnesota, 2008). There are 5,051 RN observations in the data set which are over 2 percent sample of the total number of Canadian RNs employed in nursing.[3] In particular, these data do not track the earnings of specific individual RN through his or her lifetime. Rather, these cross-sectional data show the earnings of different individuals in the particular year of 2001.

Generally in Canada, Table 2 shows that the percentage of diploma RNs is increasing as the age rises, while the percentage of baccalaureate RNs is decreasing. Especially, there are dramatic differences in the percentage of RN observations between age group of 25-29 and age group of 30-34 for both diploma and baccalaureate. Throughout Canada, the percentage of diploma RNs fell from 69.26% in age group of 30-34 to 56.25% in age group of 25-29. In contrast, over the same age groups, the percentage of baccalaureate RNs rose from 27.18% to 40.95%. In Atlantic Canada and Prairies, the percentages of diploma RNs (4.53% for Atlantic Canada and 7.11% for Prairies) are even less than the percentages of baccalaureate RNs (5.17% for Atlantic Canada and 9.91% for

[3] Data for individuals whose annual wage is under $10,000 are dropped in this study. Sample sizes by sex are 4,792 female RNs and 259 male RNs.

Prairies) in the age group of 25-29. This figure contrasts with that of all other age groups and regions. It can be explained by the fact that the most provinces in those two regions completed by 2001 the transition to baccalaureate degree, which is a requirement for entry to the practice of nursing.[4] Given the change in a requirement for nursing practice in Canada, diploma RNs' inter-regional migration can be perceived by Table 2. The percentages of diploma RNs in the age group 25-29 are 8.05% in Atlantic Canada and 12.64% in Prairies among the total diploma RNs in the same age group. They are considerably less than other age groups in both regions, which might be assumed as: RNs with a diploma in Atlantic Canada and Prairies, who want to enter the nursing practice after the requirement change, should move to another region which does not require a baccalaureate degree for entry to the practice. It can be also supported by Table 3 that shows the regional percentages of baccalaureate RN observations by age groups. The percentages of Atlantic Canada (53.33%) and Prairies (56.10%) are higher than the percentages of Quebec (30.84%), Ontario (36.84%) and British Columbia (39.66%) in the age group 25-29. Therefore, it is reasonable to hypothesize that the diploma RNs' inter-regional migration can have an influence on regional wage disparities among Canadian RNs as a whole.[5]

The sample medians of annual earnings for diploma RNs, baccalaureate RNs and total RNs in each region are presented in Table 4. Atlantic Canada had the lowest values for both diploma RNs and baccalaureate RNs, not to mention total RNs. For diploma RNs, Quebec also had the lowest value ($40,000) among five Canadian regions. However, Quebec's sample median of annual earnings for baccalaureate RNs ($50,000) is higher than any other regions. In the case of diploma RNs, Ontario had the highest median value ($45,000). Table 5 presents means of the natural log of annual earnings and the regional wage disparities among sample RNs in Canada. Not surprisingly, the results of log wage differentials between each region and Canada are showing that Atlantic Canada was experiencing the largest negative regional wage differentials throughout all education groups (-0.0999 for total RNs, -0.0964 for diploma RNs and -0.1115 for baccalaureate RNs), while Ontario was facing the largest positive regional wage differentials for total RNs and diploma RNs (0.0400 for total RNs, 0.0408 for diploma RNs). It is noticeable that Quebec, which is the only region does not ask the baccalaureate requirement for entry into nursing within the next decade, was experiencing the largest positive regional wage differentials (0.0718) for baccalaureate RNs, but it is experiencing negative regional wage differentials (-0.0337) for diploma RNs.

4. Analytical Framework

The conception of a human capital investment decision in Canadian RNs workforce is portrayed graphically in Figure 1. Curve DD' represents the earnings

[4] For further information about the provincial requirement on nursing education in Canada, see Table 1.

[5] The empirical tests of this hypothesis between inter-regional migration and regional wage disparities require further research apparently.

profile if a nursing student decides not to attend 4-year baccalaureate program, but rather to enter into the labor market immediately on the completion of 3-year diploma at age 22. The BB' curve is a nursing student's cost-earnings profile if he or she decides to undertake a 4-year baccalaureate degree before entering the labor market. I note that area (a) below the horizontal axis represents the direct or out-of-pocket costs incurred in attending one more year of university program. Area (b) reflects the indirect or opportunity costs, that is, the earnings a baccalaureate student forgoes while attending the program. The sum of areas (a) and (b) shows the total cost in a 4-year baccalaureate education. Area (c) - the difference between the BB' and DD' curves over ages 23 to N - shows the gross incremental earnings which a RN will realize by obtaining a baccalaureate degree; it shows how much additional income a nurse will obtain as a baccalaureate RN over his or her work life as compared to what the nurse would have earned with a 3-year diploma.

Table 6 presents the mean annual earnings of each age group with three education categories (Master's/Doctorate, Baccalaureate, Diploma) of sample observations. It indicates that generally more-educated (Master's/Doctorate, Baccalaureate) RNs obtain higher average annual earnings than less-educated (Diploma) RNs of the same age group. If only two education categories of diploma and baccalaureate are taken into account, Figure 2 reveals the three following states: First, there is a significant wage gap between baccalaureate RNs and diploma RNs. Also, the earnings of baccalaureate RNs exceed those of diploma RNs with the same age group condition except the age group of under 24 and over 65. Second, the earnings profiles of baccalaureate RNs rise more rapidly than those of diploma RNs so that the differences in the earnings of baccalaureate RNs and diploma RNs tend to widen as RNs grow older at least until the age group of 50-54. Third, the age-earnings profiles ultimately decline after the age of 55, regardless of baccalaureate RNs or diploma RNs.[6)]

As pointed out in Section 2, the analytical framework used in this paper assumes that those Canadian prospective nurses will acquire a four-year baccalaureate degree only if the benefits of doing so are greater than the costs, in terms of the net present value of expected benefits. It suggests that attention should be paid to discount rates and retirement age because they play roles in calculating present values of age-earnings profiles which determine whether a person chooses to attend a community college (a three-year diploma) or a university (a four-year baccalaureate degree).

According to Canadian Institute for Health Information (CIHI, 2006b), there is little research has investigated the Canadian RNs' retirement age owing to the technical difficulty of calculating an accurate national retirement age.[7)]

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6) The declining incomes of older RNs after the age of 55 might be attributed to the diminished physical vigour, mental alertness, the obsolescence of medical education and skills, or the decision to work shorter hours as McConnell and Brue (1995) pointed out.

7) CIHI (2006b) introduced a study which tells that the current average age of retirement in Ontario is 55-58 years (Baumann and O'Brien-Pallas, 2001). Sibbald (1999) also mentioned that most nurses retire at age 55 in Canada.

However, it illustrated three typical ages of retirement - age 55, age 60 and age 65 - by demographic eligibility of Canadian RNs' retirement. In 2005, 19.7% of Canadian RNs were aged 55 years or greater, while 7.3% were aged 60 years or greater, and 1.7% aged 65 years or greater which tells that the highest proportion of RNs, who are eligible for retirement, currently retire at age between 55 and 60.

Based on the facts reported by CIHI (2006b) and the assumption that diploma RNs begin employment at age 22 and baccalaureate RNs begin employment at age 23, equation (1) and (2) introduced in Section 2 can be rewritten as

$$\sum_{t=23}^{N=55,60,65}\left[\frac{W_t^b - W_t^d}{(1+i)^{t-23}}\right] > C_0 + W_{22}^d, \tag{3}$$

$$\sum_{t=23}^{N=55,60,65}\left[\frac{W_t^b - W_t^d}{(1+r)^{t-23}}\right] = C_0 + W_{22}^d, \quad r > i, \tag{4}$$

where t is the individual RN's age, N is the expected retirement age, and W_{22}^d is the annual earnings of fulltime diploma RNs during first year at age 22.[8)]

5. Model and Regression Results

This study utilizes the standard human capital earnings model by Mincer (1974) to measure the wage premium received for higher nursing education in Canada. The earnings model is based on regression equations of the form:

$$ln\,Wn = f(s_n,\ x_n,\ z_n) + u_n, \qquad n = 1,2,\ldots,\ N$$

where $ln\,W_n$ is the natural log of annual earnings for the 'n'th individual, s_n is a measure of schooling or educational attainment, x_n indexes the human capital stock of experience, z_n consists of the other factors affecting earnings such as race, gender, and/or geographical region of the individual, and u_n is a random disturbance term reflecting unobserved ability characteristics and the inherent randomness of earnings statistics.[9)]

From this classic idea of human capital model, I begin with the following specification of the earnings functions.[10)]

$$\ln W_{ne} = \beta_{0e} + \beta_{1e}X_{ne} + \beta_{2e}X_{ne}^2 + \gamma_e' Z_{ne} + u_{ne}, \tag{5}$$

8) In this case, his or her work life is presumed to extend over (N-22) years from age 22 to age N for diploma RNs and (N-23) years from age 23 to age N for baccalaureate RNs.

9) In my model specifications, the years of schooling s_n is assumed to be fixed for each education group and the difference in schooling years between diploma RNs and baccalaureate RNs is only a year.

10) Normally when the human capital earnings function is estimated, since actual work experience is rarely included in data sets, it is usually approximated by potential experience, equal to (Age-schooling-5). Therefore, if I apply work experience to my models, then the experience variable for diploma RNs is equal to (Age-22) and for baccalaureate RNs, equal to (Age-23).

where lnW_{ne} is the natural logarithm of average annual earnings of individual n with educational background e; X_{ne} and X_{ne}^2 are individual's age and its square; Z_{ne} is a vector of labour market characteristics comprised of gender and geographical area; the β's represent coefficients to be estimated, and γ'_e is a vector of parameters to be estimated; and u_{ne} is a normally distributed disturbance term reflecting unobserved characteristics affecting wages. In this specification, the age-earnings profile is assumed to be concave, with a positive coefficient for the linear term and a negative coefficient for the quadratic term.[11)]

The earnings functions have been estimated with ordinary least squares for individual RNs to test whether those functions differ for Canadian nursing education groups. The regression results for each group of diploma, baccalaureate, and master's/doctorate are displayed in Table 7. Table 7 shows considerable differences among education groups in several of the coefficients. Also, the regression results in Table 7 present the regional wage differentials in the Canadian nursing workforce. It is particularly noteworthy that the RNs in Northern Territories, which has the highest GDP per capita of all regions in Canada with a geographical and demographic condition, receive notable wage premiums in both diploma and baccalaureate education groups. Table 7 also represents gender premiums that male nurses receive higher wages than female nurses throughout all education groups.

Since the principal interest in this analysis is to obtain estimated wage functions that yield the wage differentials between baccalaureate RNs and diploma RNs across regions in Canada, it is restricted to only those two education groups. Therefore, I estimate the equation (5) for each education group separately in the five Canadian regions:

$$\ln W_n^b = \beta_0^b + \beta_1^b X_n^b + \beta_2^b X_n^{b2} + u_n^b, \tag{6}$$

$$\ln W_n^d = \beta_0^d + \beta_1^d X_n^d + \beta_2^d X_n^{d2} + u_n^d, \tag{7}$$

where the b superscript indicates the baccalaureate RNs group and the d superscript indicates the diploma RNs group.[12)] Table 8 reports the coefficients β's for each region.

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11) As Benjamin et al. (1998) point out, the 'age' variable alone might be a poor proxy variable for labor market experience variable, since individuals who do not attend school can obtain additional human capital through work experience. They also mentioned that comparing earnings by education level would involve comparing individuals who differed not only by education, but also systematically by work experience. Therefore, in my specifications, the difference in earnings due to one year difference in Canadian nursing education between baccalaureate RNs and diploma RNs would be understated, since baccalaureate RNs also had lower work experience.

12) The model specifications in this study have been developed from my previous paper. See Lee (2008).

6. Returns to Nursing Education and Regional Patterns in Canada

The costs of an additional year of education for a baccalaureate in nursing are considered as an investment based on human capital theory. Now, to measure the wage premium of baccalaureate RNs using the present-value method with various interest rates, I start with following three assumed conditions:[13)]

1. Yearly direct cost for university education in nursing is calculated as $5,014 over Canada in 2001-02 and opportunity cost of the period is the income forgone during the extra year of university education which is equivalent to $26,199 of the average annual earnings of 22-year-old diploma RNs.[14)]
2. A baccalaureate RN enters the nursing profession at age 23 after 4 years of university while a diploma RN starts at age 22 after 3 years of college.
3. All nursing school students are assumed to be full-time students without any part-time earning opportunities, and RNs are assumed to retire at age $N(=55, 60, 65)$.

PDV of Benefits and Returns to a Baccalaureate Degree

Considering present discounted value (PDV), the estimating equation for net PDV of benefits, which is calculated as PDV of benefits minus PDV of costs, can be expressed in equation (8) as follows:

$$\text{Net PDV} = \underbrace{\sum_{n=23}^{55,60,65} \frac{B_n}{(1+i)^{n-23}}}_{PDV\ of\ Benefits} - \underbrace{(C_0 + E_0)}_{PDV\ of\ Costs}, \tag{8}$$

where E_0 denotes the initial earnings which is forgone for the extra year of nursing education; C_0 is direct monetary costs for the education; i is the discount rate; B_n represents the baccalaureate-diploma wage differentials in each region (Lee, 2008).[15)]

The net PDV of benefits can be rewritten as eguation (9) by obtaining the B_n from the regression results of earnings functions ($B_n = Exp(\ln \hat{W}_n^b) - Exp(\ln \hat{W}_n^d)$).

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13) In this paper, at least four different interest rates $i = 0.03, 0.05, 0.07, 0.09$ are considered based on monthly interest rates ($2.25 \leq i \leq 8.47$ from 01/1995 till 01/2005) reported by Bank of Canada (2005) without regarding inflation rate.

14) Based on the report of University of Saskatchewan (2001), I approximately calculated the direct cost equals to $5,014. The average annual tuition fee for nursing education across Canada is reported as $4,011 which is 80% of course load, and the rest of 20% which corresponds to books, supplies & student fees can be calculated as $1,003 ($1,003/($4,011 + $1,003) = 0.2).
The opportunity cost is driven by the mean of 22 year diploma RNs' annual earnings from the 2001 Canadian census microdata, which equals to $26,199 with standard deviation of $9,313.

15) To calculate the net PDV, it is necessary to define the direct cost (C_0) and the opportunity cost (E_0). By the method performed in my early paper, I found that the direct cost (C_0) equals to $5,014 and the opportunity cost (E_0) equals to $26,199 (Lee, 2008).

$$\text{Net PDV} = \sum_{n=23}^{55,60,65} \frac{\text{Exp}(\ln \hat{W}_n^b) - \text{Exp}(\ln \hat{W}_n^d)}{(1+i)^{n-23}} - (C_0 + E_0), \tag{9}$$

The numerical results of Net PDV with various interest rates for each region in Canada are displayed in Table 9. Table 9 presents noticeable results of regional patterns of wage differentials between baccalaureate RNs and diploma RNs in Canada. At the discount rates between 3% and 7%, there is an advantage to investing in a university nursing program in overall Canada. The internal rate of return (IRR) across Canada is 7.89% for the RNs with the retirement age at 55, 8.37% for the RNs with the retirement age at 60, and 8.63% for the RNs with the retirement age of 65.[16] All those cases, IRR is greater than the average interest rate (4.37%) for the last 10 years which is reported by the Bank of Canada in 2005. However, the results show that there are significant differences in the patterns of baccalaureate-diploma wage differentials between RNs in Western Canada and Eastern Canada. In Western Canada regions, which comprise Prairies and British Columbia, the wage differentials between baccalaureate RNs and diploma RNs are conspicuously lower. In both Prairies and British Columbia, the IRR with the decision of retirement age at 55 is lower than the average interest rate which tells that there is no financial gain from a university degree in nursing for the RNs employed in Western Canada regions. On the other hand, in Eastern Canada regions, which comprise Ontario, Quebec and Atlantic Canada, the wage differentials between the two RN education groups are large enough to drive the financial gains for a baccalaureate RN without regarding the retirement age. Especially, Quebec, which is the only province with a predominantly French-speaking population in Canada and still not supporting the change of educational requirement for entry to the nursing profession, has the highest level of baccalaureate-diploma wage differentials among all regions. The IRR in Quebec, regardless of the retirement age, is over 12%.

Figure 3 and Figure 4 illustrate the regional hypothetical age-earnings profiles of diploma RNs and baccalaureate RNs which are depicted with the regression results in Table 8. In both diploma and baccalaureate, the RNs who are employed in more popular regions such as Ontario or Quebec earn higher annual earnings than less popular regions such as Prairies, Atlantic Canada.

Table 10 shows the maximum points on the age-earnings profile of the model for each regional and educational group in Canada which is also obtained by the regression results in Table 8.[17] In all regions except Prairies, Table 10 indicates that the age at which baccalaureate RNs reach the maximum point of estimated annual earnings is higher than it is for diploma RNs, which might be one of the main causes of the financial benefits from investing in a

[16] By definition, internal rate of return (IRR) is the rate of discount at which the net present value of human capital investment will be zero.

[17] It is based on the quadratic relationship between age and estimated annual earnings. For example, for the diploma RNs in Atlantic Canada, as the RN's age increases up to 45, the estimated wage also increases. Upon reaching the age of 45, the estimated wage reaches its maximum at $38,022. At the given age condition of 45, estimated wage differential between a baccalaureate RN and a diploma RN is $2,783. Over the age of 45, the estimated wage begins to lower.

baccalaureate degree. Prairies, which shows the least wage differentials between baccalaureate RNs and diploma RNs among 5 regions, is the only region in Canada to show that the age of maximum annual earnings for diploma RNs (48.4) is greater than the one for baccalaureate RNs (47.3).

7. Discussion and Conclusion

To estimate empirical models in this study, the method of ordinary least squares (OLS) was applied. Also, Breusch-Pagan-Godfrey test with 5 percent level of significance is adopted to detect whether heteroscedasticity is present or not. If heteroscedasticity is detected, the technique of heteroscedasticity-robust standard errors is performed to correct the standard errors.[18)]

The OLS estimates in this study may have yielded "ability bias" caused by the differences of individual RN's abilities or commitments to nursing and "cost bias" caused by family background as Griliches (1977) and Card (1995, 1999) pointed out. Unfortunately, I could not take those potential sample biases into account with a cross-sectional data set. The variables of family background - such as parents' occupation and parents' education - and/or individual qualities for nursing - such as IQ score or individual motivation - were unable to be obtained, which may allow me to address the bias issue. Furthermore, the direct private costs of nursing education borne by baccalaureate RNs might have been over-estimated owing to scholarships or fellowships (Becker, 1993; Lehrer et al., 1991). Again, I grant an assumption that the amount of overestimated cost can be negligible not to withdraw the obtained empirical results from this model specification with lifetime earnings framework. Also, to the best of my knowledge there are no data available on whether university nursing students are more likely than community college nursing students to have a better chance of receiving such scholarships or fellowships.

Nonetheless, considering the model specifications based on human capital theory and the quality of 2001 Canadian census data, the method developed in this research proves that baccalaureate RNs are paid a wage premium over diploma RNs in most cases. Depending on the assumed interest rate and individual RNs' retirement age, the values of estimated wage differentials vary. However, not every baccalaureate RN gets monetary benefit from one more year of nursing education. With the conditions of retirement age at 55 and 4.37% of the average discount rate during the last 10 years (01/1995 − 01/2005), this study argues that the monetary profit from the choice of a 4-year baccalaureate is less than zero in Western Canada regions.

Moreover, wage differentials between baccalaureate RNs and diploma RNs have a different pattern in each region. Quebec has the highest level of wage differentials, whereas Prairies has the lowest level regardless of the retirement age.

In conclusion, with RNs' the latest trend of retirement, my model specifica-

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18) The technique of heteroscedasticity-robust standard errors is also called as White standard errors or Huber standard errors (Wooldridge, 2002).

tions regarding the recent change in Canadian nursing education lead to the following conclusion: that the decision to invest in one more year of nursing education is economically rational (both paid tuition and forgone earnings for one more year of education in a university nursing program would be compensated sufficiently over their working life) only for the RNs who work in Eastern Canada.

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Table 1
THE PROCESS OF EDUCATIONAL TRANSITION TO A BACCALAUREATE DEGREE

Region	Province	Transition Process
Atlantic Canada		
	Newfoundland & Labrador	Completed by 1998
	Prince Edward Island	Completed by 1998
	Nova Scotia	Completed by 1998
	New Brunswick	Completed by 1998
Quebec		
	Quebec	No transition process
Ontario		
	Ontario	Completed by the end of 2004
Prairies		
	Manitoba	Completed by 2000
	Saskatchewan	Completed in March of 2000
	Alberta	Will be completed by the end of 2009
British Columbia		
	British Columbia	Completed in 2005

Source: Canadian Nurses Association

Table 2

PERCENTAGES OF DIPLOMA RNS AND BACCALAUREATE RNS AT EACH REGION BY AGE GROUPS

Age	Atlantic Canada Diploma (%)		Quebec Diploma (%)		Ontario Diploma (%)		Prairies Diploma (%)		British Columbia Diploma (%)		Canada Diploma (%)	
	A	B	A	B	A	B	A	B	A	B	A	B
25≤x≤29	***4.53***	***8.05***	***14.87***	***26.44***	***22.84***	***40.61***	***7.11***	***12.64***	***6.90***	***12.26***	***56.25***	***100***
30≤x≤34	7.93	11.45	17.80	25.70	25.08	36.21	10.68	15.42	7.77	11.21	69.26	100
35≤x≤39	6.87	9.52	16.25	22.53	28.80	39.93	11.49	15.93	8.45	11.72	72.13	100
40≤x≤44	7.50	10.06	21.31	28.59	26.31	35.30	12.50	16.77	6.67	8.95	74.52	100
45≤x≤49	6.59	8.65	18.83	24.73	28.03	36.81	13.39	17.58	9.21	12.09	76.15	100
50≤x≤54	5.83	7.36	16.23	20.49	32.59	41.16	14.15	17.86	10.12	12.78	79.20	100
55≤x≤59	7.71	9.44	11.79	14.44	34.24	41.94	16.10	19.72	11.56	14.17	81.63	100
60≤x≤64	10.24	12.5	7.09	8.65	30.71	37.50	13.39	16.35	20.47	25.00	81.89	100
25≤x≤64	6.84	9.30	17.04	23.15	28.29	38.44	12.37	16.80	8.90	12.09	73.60	100
Age	Atlantic Canada Baccalaureate (%)		Quebec Baccalaureate (%)		Ontario Baccalaureate (%)		Prairies Baccalaureate (%)		British Columbia Baccalaureate (%)		Canada Baccalaureate (%)	
	C	D	C	D	C	D	C	D	C	D	C	D
25≤x≤29	***5.17***	***12.63***	***7.11***	***17.37***	***13.58***	***33.16***	***9.91***	***24.21***	***4.96***	***12.11***	***40.95***	***100***
30≤x≤34	4.05	14.88	6.80	25.00	7.77	28.57	4.69	17.26	3.88	14.29	27.18	100
35≤x≤39	2.11	8.33	5.68	22.40	8.98	35.42	5.28	20.83	3.30	13.02	25.36	100
40≤x≤44	1.67	7.33	5.71	25.13	7.38	32.46	3.93	17.28	4.05	17.80	22.74	100
45≤x≤49	1.88	9.05	5.13	24.62	6.17	29.65	3.77	18.09	3.77	18.09	20.82	100
50≤x≤54	1.80	9.92	5.83	32.06	4.72	25.95	2.64	14.50	2.91	16.03	18.17	100
55≤x≤59	0.91	5.48	3.40	20.55	6.12	36.99	2.95	17.81	3.17	19.18	16.55	100
60≤x≤64	1.57	11.76	0.79	5.88	7.87	58.82	1.57	11.76	1.57	11.76	13.39	100
25≤x≤64	2.36	9.99	5.54	23.51	7.53	31.96	4.43	18.78	3.64	15.42	23.68	100

(a) Column A: Percentage = (number of diploma RN observations in each age group by region / total number of diploma, baccalaureate and graduates RN observations in each age group) × 100.

(b) Column B: Percentage = (number of diploma RN observations in each age group by region / total number of diploma RN observations in each age group) × 100.

(c) Column C: Percentage = (number of baccalaureate RN observations in each age group by region / total number of diploma, baccalaureate and graduates RN observations in each age group) × 100.

(d) Column D: Percentage = (number of baccalaureate RN observations in each age group by region / total number of baccalaureate RN observations in each age group) × 100.

Table 3

REGIONAL PERCENTAGES OF BACCALAUREATE RNS BY AGE GROUPS

Age	Atlantic Canada (%)	Quebec (%)	Ontario (%)	Prairies (%)	British Columbia (%)
25≤x≤29	***53.33***	***30.84***	***36.84***	***56.10***	***39.66***
30≤x≤34	33.33	26.58	22.64	29.59	32.00
35≤x≤39	23.19	25.44	22.82	31.50	27.17
40≤x≤44	17.72	20.60	21.45	23.24	35.79
45≤x≤49	21.69	20.94	17.20	21.30	28.80
50≤x≤54	22.41	25.93	12.27	15.45	21.65
55≤x≤59	10.53	21.43	15.08	14.94	21.21
60≤x≤64	12.50	10.00	18.52	10.53	7.14
25≤x≤64	25.05	23.89	20.35	25.74	28.15

Note: Percentage = (number of baccalaureate RN observations in each age group by region / total number of RN observations in each age group by region) ×100.

Table 4

MEDIANS OF SELECTED VARIABLES AT EACH REGION BY EDUCATION GROUPS ($: Canadian Dollar)

Sample	Variable	Region					
		Atlantic Canada	Quebec	Ontario	Prairies	British Columbia	Canada
Total							
	Wages	$40,000	$42,686	$45,000	$43,000	$45,000	$43,805
	Age	42	42	43	44	44	43
	N	468	1,198	1,860	863	650	5,051
Diploma							
	Wages	$40,000	$40,000	$45,000	$43,082	$44,037	$42,000
	Age	43	42	44	45	46	44
	N	342	887	1,425	621	451	3,734
Baccalaureate							
	Wages	$41,614	$50,000	$48,000	$43,000	$45,000	$46,000
	Age	38	41	41	38	42	40
	N	116	280	376	222	180	1,178

Note: The wage variable represents the RNs' annual earnings by wages and salaries.

Table 5

MEANS OF LOG(WAGE) AND LOG WAGE DIFFERENTIALS AT EACH REGION BY EDUCATION GROUPS

Sample	Variable	Region					
		Atlantic Canada	Quebec	Ontario	Prairies	British Columbia	Canada
Total							
	Log(Wage)	10.4866	10.5778	10.6265	10.5538	10.5993	10.5865
	SD	(0.3775)	(0.3857)	(0.4497)	(0.4272)	(0.4012)	(0.4206)
	Log wage differentials between region and Canada	-0.0999	-0.0087	0.0400	-0.0327	0.0128	0
	N	468	1,198	1,860	863	650	5,051
Diploma							
	Log(Wage)	10.4660	10.5287	10.6032	10.5488	10.5869	10.5624
	SD	(0.3749)	(0.3811)	(0.4493)	(0.4182)	(0.4078)	(0.4190)
	Log wage differentials between region and Canada	-0.0964	-0.0337	0.0408	-0.0136	0.0245	0
	N	342	887	1,425	621	451	3,734
Baccalaureate							
	Log(Wage)	10.5287	10.7120	10.6785	10.5558	10.6224	10.6402
	SD	(0.3888)	(0.3641)	(0.4455)	(0.4522)	(0.3815)	(0.4187)
	Log wage differentials between region and Canada	-0.1115	0.0718	0.0383	-0.0844	-0.0178	0
	N	116	280	376	222	180	1,178

Note: SD is the standard deviation which is in parentheses and N is the number of observations.

Table 6

MEANS AND STANDARD DEVIATIONS OF WAGES FOR EDUCATION GROUPS BY VARIOUS AGE GROUPS ($: Canadian Dollar)

Age	Full Sample	Diploma	Baccalaureate	Master's/Doctorate
$x \leq 24$	$29,237	$29,572	$27,007	
SD	(12,195)	(12,585)	(9,312)	n.a.
N	92	80	12	
$25 \leq x \leq 29$	$36,828	$36,610	$36,735	$42,585
SD	(12,547)	(12,631)	(12,441)	(11,957)
N	464	261	190	13
$30 \leq x \leq 34$	$39,619	$38,589	$41,446	$45,701
SD	(14,504)	(13,967)	(15,481)	(14,855)
N	618	428	168	22
$35 \leq x \leq 39$	$42,589	$41,328	$45,352	$50,906
SD	(16,453)	(15,067)	(19,204)	(19,508)
N	757	546	192	19
$40 \leq x \leq 44$	$43,930	$42,805	$46,820	$50,547
SD	(15,719)	(15,510)	(15,618)	(18,117)
N	840	626	191	23
$45 \leq x \leq 49$	$46,252	$44,663	$50,479	$57,148
SD	(14,874)	(13,867)	(16,549)	(17,350)
N	956	728	199	29
$50 \leq x \leq 54$	$46,219	$44,714	$51,779	$53,083
SD	(15,310)	(14,925)	(15,407)	(16,143)
N	721	571	131	19
$55 \leq x \leq 59$	$43,271	$41,773	$48,744	$60,732
SD	(16,472)	(16,455)	(14,403)	(16,046)
N	441	360	73	8
$60 \leq x \leq 64$	$40,225	$39,561	$41,890	$47,008
SD	(14,908)	(14,802)	(14,874)	(17,492)
N	127	104	17	6
$65 \leq x$	$31,108	$31,340	$29,714	
SD	(15,527)	(16,134)	(12,614)	n.a.
N	35	30	5	

(a) SD is the standard deviation which is in parentheses and N is the number of observations.

(b) n.a. indicates not available or not applicable.

Table 7
WAGE REGRESSIONS FOR EDUCATION GROUPS

Variable	Dependent Variable: log(Wage)		
	Diploma	Baccalaureate	Master's/Doctorate
Constant	9.1977*	9.0732*	9.5885*
	(82.81)	(47.53)	(15.55)
Age	0.0616*	0.0685*	0.0488
	(11.66)	(7.18)	(1.67)
$Age^2/100$	-0.0661*	-0.0694*	-0.0469
	(10.85)	(6.06)	(1.39)
Dummy=1 for Male;	0.1552*	0.0588	0.1944
=0 otherwise	(5.08)	(1.12)	(1.38)
Dummy=1 for Each Region;			
=0 otherwise			
Atlantic Canada	-0.1023*	-0.1011*	-0.1352
	(4.41)	(2.60)	(1.07)
Quebec	-0.0421*	0.0828*	0.0427
	(2.65)	(3.04)	(0.54)
Ontario	0.0696*	0.0568*	0.1110
	(5.06)	(2.28)	(1.70)
Prairies	-0.0306	-0.0849*	-0.1098
	(1.70)	(2.86)	(1.19)
British Columbia	0.0311	-0.0429	-0.0978
	(1.51)	(1.33)	(1.04)
Northern Territories	0.2494	0.0582	n.a.
	(1.72)	(0.29)	
Sample size	3,734	1,178	139

(a) Absolute t-statistics are in parentheses below the coefficients.
(b) * denotes significant at the 0.05 level (two-tailed tests).
(c) The dependent variable is the natural log of the annual earnings by wages and salaries.

Table 8

WAGE REGRESSIONS FOR EDUCATION GROUPS AT EACH REGION (Dependent Variable: Natural Log of Wage)

Variable	Diploma RNs						Baccalaureate RNs					
	Atlantic Canada	Quebec	Ontario	Prairies	British Columbia	Canada	Atlantic Canada	Quebec	Ontario	Prairies	British Columbia	Canada
Constant	8.8313* (24.11)	9.1848* (37.36)	9.1128* (45.77)	9.6237* (29.40)	9.2567* (24.88)	9.1977* (74.97)	9.5015* (15.75)	8.8139* (23.84)	8.8565* (25.62)	9.0689* (19.50)	10.0057* (20.21)	9.0732* (47.53)
Age	0.0762* (4.37)	0.0605* (4.73)	0.0683* (7.27)	0.0399* (2.64)	0.0598* (3.42)	0.0616* (10.38)	0.0449 (1.45)	0.0800* (4.32)	0.0817* (4.84)	0.0677* (2.88)	0.0214 (0.87)	0.0685* (7.18)
$Age^2/100$	−0.0847* (4.21)	−0.0643* (4.00)	−0.0746* (6.93)	−0.0412* (2.43)	−0.0639* (3.19)	−0.0661* (9.49)	−0.0447 (1.17)	−0.0778* (3.50)	−0.0855* (4.33)	−0.0717* (2.52)	−0.0149 (0.50)	−0.0694* (6.06)
R^2	0.0563	0.0763	0.0389	0.0153	0.0374	0.0424	0.0595	0.2275	0.0901	0.0655	0.0509	0.0956
F	10.11	30.60	28.78	4.82	7.37	75.62	3.58	39.18	18.48	7.67	4.75	62.12
BPG(Θ)	5.12	40.81	4.67	0.41	16.23	29.67	0.79	12.42	3.91	1.04	4.75	3.95
N	342	887	1,425	621	451	3,734	116	280	376	222	180	1,178

(a) Absolute t-statistics are in parentheses below the coefficients.

(b) * Statistically significant at the 0.05 level (two-tailed tests).

(c) Regarding encountered low R^2s, Gujarati (2003) explains: "In cross-sectional data involving several observations, one generally obtains low R^2 because of the diversity of the cross-sectional units…. What is relevant is that the model is correctly specified, that the regressors have the correct (i.e. theoretically expected) signs, and that (hopefully) the regression coefficients are statistically significant."

(d) BPG(Θ) denotes Breusch-Pagan-Godfrey test to detect whether heteroscedasticity is present or not. If heteroscedasticity with 5 percent level of significance is detected, the technique of heteroscedasticity-robust standard errors is performed to correct the standard errors.

Table 9

NET PDV OF WAGE DIFFERENTIALS AND INTERNAL RATE OF RETURN ($: Canadian Dollar)

Retirement age (N)	Interest rate (i)	Net PDV					
		Atlantic Canada	Quebec	Ontario	Prairies	British Columbia	Canada
N = 55							
	i = 0.03	$37,975	$102,722	$38,405	-$4,275	$303	$38,080
	i=0.0437	***$27,086***	***$72,801***	***$22,745***	***-$12,170***	***-$4,004***	***$23,123***
	i = 0.05	$23,041	$61,837	$16,996	-$15,062	-$5,553	$17,632
	i = 0.07	$13,094	$35,435	$3,127	-$22,005	-$9,232	$4,369
	i = 0.09	$6,221	$17,938	-$6,088	-$26,555	-$11,665	-$4,467
	i = 0.11	$1,300	$6,043	-$12,365	-$29,584	-$13,363	-$10,511
	i = 0.13	-$2,346	-$2,248	-$16,745	-$31,629	-$14,615	-$14,754
	IRR	***11.65%***	***12.39%***	***7.59%***	***2.41%***	***3.08%***	***7.89%***
N = 60							
	i = 0.03	$50,821	$126,483	$49,536	-$1,765	$12,885	$50,044
	i=0.0437	***$35,170***	***$87,778***	***$29,763***	***-$10,579***	***$3,905***	***$30,664***
	i = 0.05	$29,589	$73,976	$22,686	-$13,769	$849	$23,743
	i = 0.07	$16,476	$41,721	$6,075	-$21,331	-$5,931	$7,533
	i = 0.09	$7,991	$21,235	-$4,541	-$26,198	-$9,940	-$2,808
	i = 0.11	$2,238	$7,793	-$11,543	-$29,393	-$12,451	-$9,630
	i = 0.13	-$1,843	-$1,307	-$16,303	-$31,526	-$14,126	-$14,280
	IRR	***12.02%***	***12.66%***	***8.04%***	***2.77%***	***5.2%***	***8.37%***
N = 65							
	i = 0.03	$65,329	$146,434	$58,186	-$2,222	$29,932	$60,365
	i=0.0437	***$43,719***	***$99,553***	***$34,871***	***-$10,840***	***$13,943***	***$36,754***
	i = 0.05	$36,309	$83,239	$26,704	-$13,972	$8,737	$28,533
	i = 0.07	$19,637	$46,087	$7,970	-$21,421	-$2,225	$9,790
	i = 0.09	$9,500	$23,323	-$3,634	-$26,239	-$8,173	-$1,728
	i = 0.11	$2,968	$8,806	-$11,103	-$29,412	-$11,596	-$9,107
	i = 0.13	-$1,485	-$809	-$16,086	-$31,535	-$13,707	-$14,023
	IRR	***12.25%***	***12.8%***	***8.27%***	***2.71%***	***6.48%***	***8.63%***

Note: The average interest rate for the last 10 years is 4.37% (Bank of Canada, 2005).

Table 10
ESTIMATED MAXIMUM WAGES ($: Canadian Dollar)

	Atlantic Canada		Quebec		Ontario		Prairies		British Columbia		Canada	
	Dip	Bacc	Dip	Bacc	Dip	Bacc	Dip	Bacc	Dip	Bacc	Dip	Bacc
Age*	45.0	50.2	47.0	51.4	45.8	47.8	48.4	47.3	46.8	71.5	46.6	49.3
Wage*	$38,022	$41,304	$40,443	$52,577	$43,370	$49,334	$39,708	$43,045	$42,462	$47,557	$41,423	$47,155
Wage differential	$2,783	$4,146	$11,360	$12,628	$5,805	$6,085	$3,298	$3,357	$941	$18,847	$5,490	$5,936

(a) Dip denotes diploma RNs and Bacc denotes Baccalaureate RNs.
(b) The maximum points are obtained by the slope, or derivative, of estimated wage variable with respect to age variable in equations (2) and (3) with restricted sample $(\frac{d\ln \hat{W}_n}{dX_n})$.
(c) From the equation of $\boldsymbol{ln W_n} = \beta_0 + \beta_1 X_n + \beta_2 X_n^2 + u$, the maximum conditions that slope equals to zero as follows: $\frac{d\ln \hat{W}_n}{dX_n} = \hat{\beta}_1 + 2\hat{\beta}_2 X_n = 0$, $X_n^* = -\frac{\hat{\beta}_1}{2\hat{\beta}_2}$
The coefficients of ***Age*** and $\boldsymbol{Age^2}$ which is notated by β_1 and β_2 are given in Table 9.
(d) Once I found the maximum condition of age variable (Age*) then by the regression results of each equation in Table 9, I can obtain maximum estimated wages (Wage*) and wage differentials with the age condition as well.

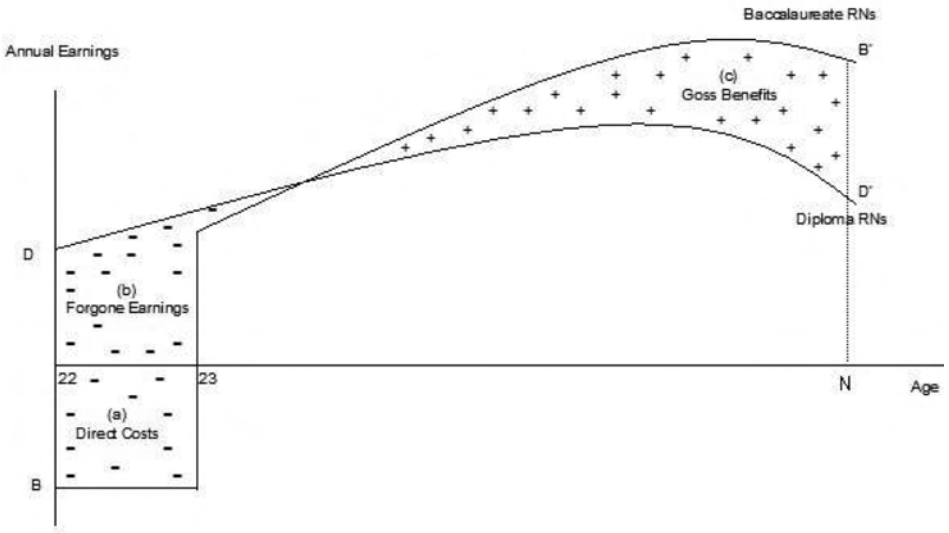

Figure 1
AGE-EARNINGS PROFILES WITH A BACCALAUREATE DEGREE AND DIPLOMA IN THE CANADIAN RN PROFESSION

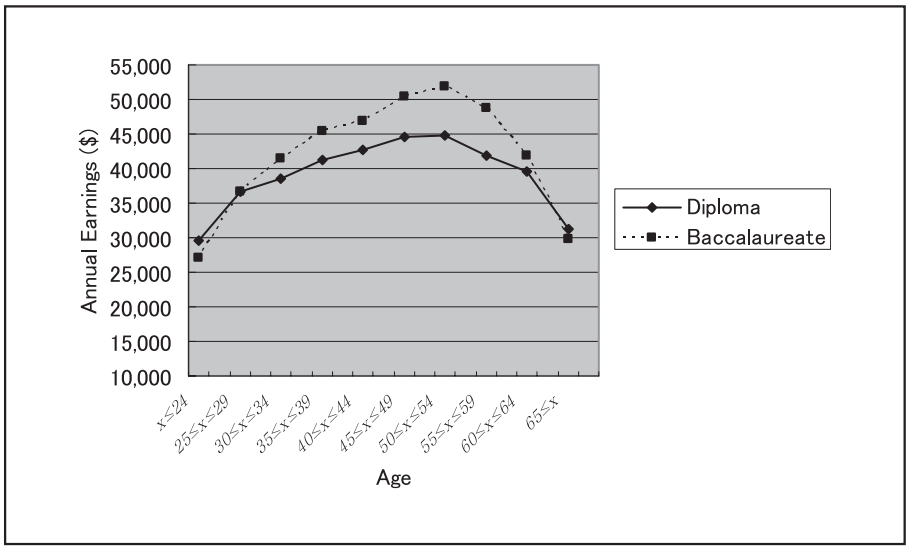

Figure 2
MEAN ANNUAL EARNINGS ($: Canadian Dollar)

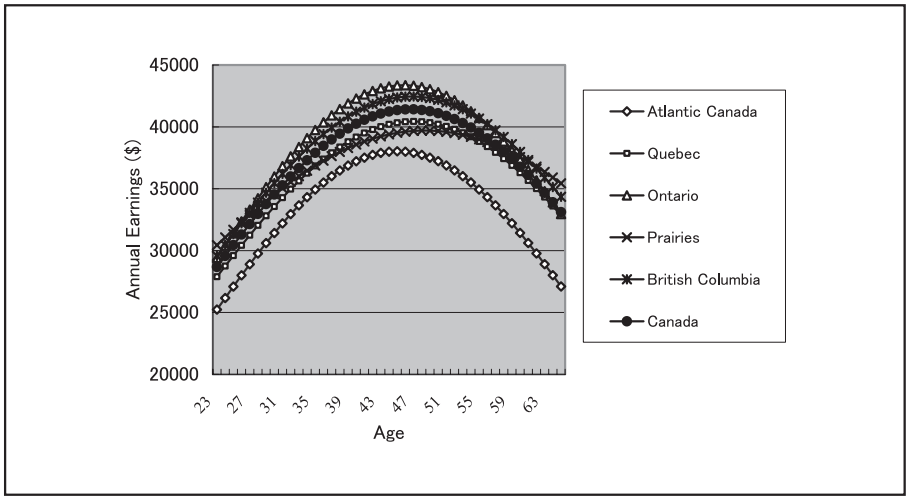

Figure 3
HYPOTHETICAL AGE-EARNINGS PROFILES / DIPLOMA RNS($: Canadian Dollar)

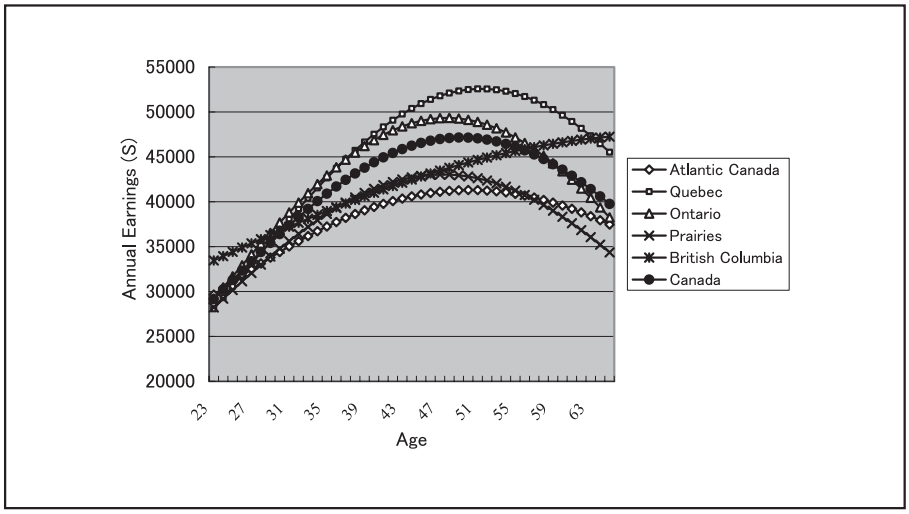

Figure 4
HYPOTHETICAL AGE-EARNINGS PROFILES / BACCALAUREATE RNS($: Canadian Dollar)