

**SHEEPSKIN EFFECT: A MEASURE OF CREDENTIAL
DISCRIMINATION**

by

Jin Ding

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APPROVAL

Name: **Jin Ding**
Degree: **M. A. (Economics)**
Title of Project: **Sheepskin Effect: A Measure Of Credential Discrimination**

Examining Committee:

Chair: Gordon Myers

Dr. Jane Friesen
Senior Supervisor

Dr. Steeve Mongrain
Supervisor

Simon Woodcock
Internal Examiner

Date Approved: December 8, 2003

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Title of Project *Sheepskin Effect: A Measure Of Credential Discrimination*

Author:

Jin

Ding

Date:

Dec. 08. 2003

Abstract

This paper uses data on immigrants from China and native-born Canadian in the Canadian labour market to test the credential effect. We find that diplomas may serve as signals of productivity and that the signalling effects for Chinese Immigrants are larger than native-born Canadian. Further, the labour market value of degrees appears to exceed the returns to years of education for Chinese Immigrants; in contrast, the returns to education for native-born Canadians due to returns to accumulated years of education and returns to credentials are of similar importance. No significant differences were found between genders within demographic groups. As a result of higher sheepskin effects, Chinese Immigrants have to obtain higher credentials in order to signal their abilities to employers in the labour market.

Dedication

To my Lord, who gives me the spirit and power to write this project. It is only through His Love and Mercies that my soul survives and enjoys.

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1. Literature Review

According to a wide range of empirical studies, more schooling will lead to more earnings for individuals. However, the reason why schooling enhances earnings has been debated for a long time. The screening hypothesis posits that more schooling not only increases productivity, but also credentials workers as more productive. That is, schooling is also used as a screening device which helps employers to assess the productivity levels of individuals in the labour market; the skills learned in school may not be so important. This idea is crucial in the Canadian context with the arrival of thousands of highly qualified immigrants since 1990. If it is the signalling effect that is rewarded in the labour market, we can predict that some individuals who receive diplomas will earn more than those with the same number of years of schooling but without diplomas. This “sheepskin effect” can be identified from the differences in wages between those who possess a diploma and those who do not, conditional on the same numbers of years of schooling.

In the year 1973, Spence and Arrow each published research about the credential’s signaling effect of greater innate productivity. In their formulation, the logarithm of the observed wage rate is an additive function of a linear term in years of completed schooling and a quadratic term in experience. If the coefficients on the years of completed schooling are referred to as the “rate of return” to education, the coefficients of particular years, in which individuals are

assumed to get their diplomas in standard education system, will partly represent any sheepskin effect. Using the sample of a prime aged white men from the United States, Hungerford and Solon (1987) identified significantly larger returns to diploma years than to other years of education using both spline and step functions, which confirmed the existence of this sheepskin effect. Belman and Heywood (1991) examined the patterns of sheepskin effect not only for the white male sample, but also for women and racial minorities. Their finding of a nearly identical 9-10% return for a college degree supports the Hungerford and Solon's estimates. Women and minorities receive larger sheepskin effects than white men for college and graduate school but smaller sheepskin effects for high school graduation in their studies. These roughly show the different roles credentials may play for women and minorities in the labour market, although the pattern of these differences in credentialing effects is ambiguous.

Most tests of the credential effect are indirect, examining whether wages rise faster with extra years of education when the extra years correspond to the standard time needed for a credential, rather than looking directly at the value of credentials. Due to the lack of information on degree attainment, they impute the 'usual' number of years of education taken to complete a degree. This measurement error might lead to underestimation of the size of sheepskin effects resulted. Not all the individuals earn their degrees in the standard years; some even will not get it eventually. Furthermore, the standard number of years to finish a certain education level might differ by regions. For example, in Canada, Ontario requires students to finish their education to high school in 13 years,

while other provinces only require 12 years. If we only use the return to an assumed credentialing year for measuring sheepskin effect within a country, while actually individuals take different amounts of time to finish it, the underestimate of the sheepskin effect will result. Jaeger and Page (1996) found evidence of this downward bias when examining the differences of return to credentials between two specifications. One was non-linear wage returns only to the schooling years in which credentials might typically be granted; the other used not only the traditional measure of years of schooling but also data which identified the actual degree completed. The latter regression did produce larger estimated sheepskin effects. However, they failed to confirm a pattern of effects that differ by gender or race in the United States.

Belman and Heywood's work, showed a differential signal quality of sheepskin effect across demographic groups. That is, for white females, minority males and minority females, high quality (college and grad school) sheepskin effects are larger than for white males, and lower quality (elementary and high school) sheepskin effects are smaller. In the circumstances where diploma years serve as a signal of potential productivity, the above evidence might suggest the possibility of statistical discrimination. To show why such an inference can be made, consider two workers of equally high productivity, one from a minority group whose average characteristics are less favourable than for the majority group. If a credential gives minority workers larger wage gains than the non-minorities in the absence of information on individuals, it means the average productivity of the minority group is less valued than majority in the labor market.

If this hold for the sheepskin effect, it would indicate that resources invested in education may have a high private rate of return for some groups in the society, but a low or even negative social return since the gains from credentials are not evenly distributed.

A central objective of this paper is to test and compare the credential effect for native-born and foreign born workers in Canada.

2. Data

2.1 Data Source

This empirical work uses the 1996 Canadian Census Microdata. The sample is restricted to individuals between age 15 and 65 who are either native-born Canadians or Chinese Immigrants and who reported wage and salary income as well as other useful variables. Individuals whose information is incomplete or having obvious discrepancies between variables are excluded. These exclusions reduce the total sample to 38616 individuals including 30516 native-born Canadians and 8100 Chinese Immigrants. Each of these two groups is divided into 4 groups according to the first official language spoken: i) English First Spoken (EFS), ii) French First Spoken (FFS), iii) Both English and French Spoken (E&F), and iv) Neither English Nor French Spoken (NEF). Chinese Immigrants are further divided into three groups based on the age upon immigration: i) Age Group 1 = 0-12, ii) Age Group 2 = 12-24, and iii) Age Group 3 = 25-60. Due to insufficient sample size, only the EFS samples of native-born

Canadian and Chinese Immigrants can be used properly for regression to examine the sheepskin effects. There are 21,892 EFS native-born Canadian, 1111 EFS Chinese Immigrants in Age Group 1, 2688 EFS Chinese Immigrants in Age Group 2, and 3889 EFS Chinese Immigrants in Age Group 3 employed for regression. The Public Use Microdata File is used by this paper, which contains 2.8 percent of 1996 Canadian Census data. Because of the too large sample of native-born Canadian in the file we used, we selected 10 percent from them randomly. Therefore, the EFS native-born Canadian observations in this paper reflect approximately 7,818,571 EFS native-born Canadian individuals, and the total EFS Chinese Immigrants observations reflect approximately 274,571 Chinese Immigrants individuals. The total number 8,093,142 is about 24% of the total Canadian population in 1996.

2.2 Descriptive Analysis

Tables (please refer to the Appendix) are presented for the descriptive analysis, each of which is also supplemented by several charts for the convenience of comparison.

Table 1 summarizes average years of education, average years of working experience, and mean weekly earnings for the sample of Chinese Immigrants grouped by Age at Immigration. The Census does not measure working experience directly. Here in this paper (age-years of schooling-6) is used as a proxy for working experience for individuals younger than 22 years old. (Age – 22) is used for those older than 22 years, which may be more proper than (age - school years – 6) for them, since most Masters and Doctoral students work while

studying. According to the table, males earn substantially more than females on the whole, and tend to have slightly more labour market experience and education. This is more apparent for those who immigrated at the age after age 25. This difference may be due to discrimination. Another possibility is that our measure of work experience could seriously over-estimate the number of years of experience of women if women who are currently in the labour market have taken time out at an earlier point in their career to raise children. And women who immigrated at age greater than 25 are more likely to be in such kind of situation. Because they are more likely to have children during the first a few years after arriving Canada, when they are not adaptable enough to raise their children and work at the same time. However, for women in other age groups, they have more time to prepare for their lives in Canada before having a child, and might be able to raise children and work together later. This will result in generating more chances for an upward bias of working experience for women in age group 3. Thus their lower wage may to some extent be due to their having less work experience than men.

Table 2 represents the distribution of degrees or diplomas for Chinese Immigrants, for both sexes as well as males and females separately. Table 3 shows their average years of education by credentials. Several points are noteworthy. The data varies widely by First Official Language Spoken group, especially for immigrants who immigrated before the age of 25. For Neither English Nor French speaker, the degree percentages are remarkably lower; language may be a major obstacle for them to get educated. A higher percentage

of both English and French speakers have High School and Bachelor degrees than other immigrant groups, while this advantageous position is replaced by English First Spoken immigrants for Master and Doctor degrees. Their bilingual even trilingual ability may equip them with some superiority in job search, but at the mean time, the more chances to get a good job may reduce their enthusiasm in deeper degree pursuit. For English First Spoken immigrants, their concentration on one language, which is the major educational language, could make it more probable for them to deeply pursue their study. Also, as individuals' ages at immigration increases, the percentage of immigrants who hold higher degrees such as Masters and Doctorates increases notably, which indicates the increasing importance of education in their life in Canada.

Tables 4 and 5 show the average years of education, average years of working experience, and mean weekly earnings of native-born Canadian and Chinese Immigrants separately. Except for the French First Spoken group, all the other Chinese immigrants have more years of education and more working experience than native-born Canadian. Nevertheless, only the Both English and French Speakers with outstandingly longer education and working experience compared to their native-born Canadian counterpart, have higher wages. It is also apparent from Tables 4 and 5 that Chinese Immigrants have higher percentages of degree certificates than native-born Canadian for each language group, despite their relatively lower wages.

Table 6 presents a cross-tabulation of qualifications received by completed years of education based on our total sample. Since the education

system in Ontario requires students to finish their high school in the thirteenth year of schooling instead of the standard twelfth year as in other provinces, Table 7 presents a separate version for individuals from Ontario. For our total sample, while higher qualifications are associated with more years of schooling, many observations are not in the assumed standard years of degree completion. Among individuals whose highest reported degree was a high school diploma, only 43.2% received exactly 12 years of education, more than half of them took either more or fewer years. Only 54.2% of those individuals who reported having finished exactly 12 years of schooling received a high school diploma as the highest degree. In Census, the total years of schooling are divided into 9 groups which are 5-8 years of schooling, 9,10, 11,12,13 years of schooling respectively and 14-18 years of schooling. Thus, we cannot get accurate information for 16 years of education, which is the assumed standard number of years for obtaining a Bachelor's degree in literature. But we can see only 65.1% of those individuals using 14-17 years to finish their Bachelor's degree. Similarly, 85.3% of individuals who received master's degrees have 18 or more years of education, compared to 9.6% of those receiving Doctorates who report less than 18 years of education. For individuals from Ontario, the numbers of years to obtain a certain degree are even more deviated. Especially for High school, those who finished it in 11 and 12 years are 37.7 percent and 29.7 percent of our sample respectively, even exceeds the number of those in the required 13 years. Deeper analysis will be done regarding these differences of data between Ontario and other provinces. The above results suggest that using only information about years of

education to infer the qualification received will result in largely biased estimates of the sheepskin effects.

3. Introduction and Methods of Estimation

The positive correlation between education and wages is one of the most well established relationships in labour economics. Most empirical research on the return to schooling is based on the Mincer human capital wage equation. According to this model, the logarithm of individual earnings can be expressed as a linear function of years of completed schooling and a quadratic function of labour market experience. This specification has some obvious implications. First, in this return to education relationship, credential plays no role – only years of education matters, we cannot even tell the difference between the return in the last year of schooling and the others. Second, this specification assumes that controlling experience, the return to education is equally weighted across years. This will not hold if the mean rate of return to schooling is higher for some levels than others, university education compared to primary school, for example. Such differences could be driven by a multitude of factors, including differences in costs or quality across levels, different learning abilities of students in different ages, or changes in the supply of and demand for graduates which have an effect on the price of them in the labour market. Thus, many researchers have switched from this specification to the quadratic function form, which include both years of schooling and years of schooling square as independent variables. Although this specification is more flexible than the linear form, it still cannot

reflect the roles credentials may play in the returns to education. It also imposes additional constraints on the regression when the actual function is not the strict quadratic form of years of schooling.

In investigating potential non- quadratic returns to schooling, the common approach is to estimate a wage equation that specifies the schooling variables as: $\ln w_i = a_i + \sum \beta D_i(\text{schooling}) + \lambda X + e_i$, where $D_i(\text{schooling})$ denotes dummies for different levels of schooling and β is interpreted as the wage premium of that certain level or year of schooling. X is a vector including additional explanatory variables and λ is a vector of parameters. In a number of studies the non-linearities at 12 and 16 years of schooling have been empirically confirmed and interpreted as sheepskin effects. To allow for the discontinuity in the increasing of returns to education in diploma years, the above specification is often generalized by treating the relationship between the log wage and $D(\text{schooling})$ as a discontinuous spline function with discontinuities at $D=8$, 12, and 16. Operationally, three dummy variables $D \geq 8$, $D \geq 12$, $D \geq 16$, and the interaction term of them with $D-8$, $D-12$, and $D-16$ correspondingly are added to capture the sheepskin effect. Nevertheless, as mentioned before in the literature review, this specification also has potential flaws. First, individuals may not take their exams in the standard number of years and spend different amounts of time to finish their degree; some even will not get their degrees at the end, which might lead to a bias in the estimation of sheepskin effects. In addition, the education effect of going from a lower grade to a higher one may also be captured as part of the sheepskin effect.

We employ a data set drawn from the Microdata File of the Canadian Census Analyzer, which has information on both years of education and qualifications received. The estimating equation takes the form:

$\ln w_i = a_i + \sum \beta D_i(\textit{schooling}) + \sum \beta_j D(\textit{qualification}) + \lambda X + e_i$, where there are strings of dummy variables for both qualifications and schooling years. But, there is an additional assumption from this specification, that the sheepskin effects associated with each qualification are the same regardless of the number of years of education spent obtain it. A more general approach is to include separate dummies for the interaction terms for each year of education and each qualification as well: $\sum_{i=1}^I \sum_{j=1}^J \beta_{ij} D_i(\textit{qualification}) \times D_j(\textit{schooling})$. In this framework, the marginal values of degrees are allowed to vary conditional on different years of education used to complete them.

In addition, our data allow us to address the question of comparing sheepskin effects across demographic groups. The tables presented earlier showed both higher levels of education and poorer labour market outcomes for Chinese Immigrants in Canada compared to native-born Canadian. Discrimination is sometimes listed as a possible cause. Signalling models give a possible framework for understanding why labour markets may provide especially large incentives for some members of minority groups to acquire high-level credentials while giving poorer incentives for others. We estimate separate diploma effects for native-born Canadian and Chinese Immigrants, and also by

sexes, then test for the differences across groups to see if minorities enjoy larger sheepskin effects for signals of high productivity.

4. Regression analysis:

4.1 Model Introduction and Estimation Results

The dependent variable in all specifications reported is the log of annual earnings. Weeks worked per year is included to control for heterogeneous labour supply. The following variables are also included in all specifications: Legal marital status, years of experience and its square and a sex dummy.

4.1.1 Regressions on the Years of Schooling

The first model reported includes years of schooling and its square.

The results of this baseline model are presented in Table 15. While other independent variables all have the expected signs, we mainly focus on the coefficients of Years of Schooling and Years of Schooling Square. As in the literature, education has positive return. $\beta(\text{YOS})$ is not only positive, but increases dramatically, when our sample group changes from native-born Canadian to Chinese Immigrants. It also increases as the age at immigration of Chinese immigrants gets larger. $\beta(\text{YOSsq})$ has the same sign and changing tendency as $\beta(\text{YOS})$, but the difference between native-born Canadian and Chinese Immigrants is not so large. There are several possible explanations. First, the positive difference between Chinese Immigrants and native-born

Canadians may be partly due to the greater credential effects experienced by Chinese Immigrants in the labour market. $\beta(\text{YOSsq})$ is also positive, which means that the rate of return to years of education is increasing in years of schooling. This can also be due to an increasing sheepskin effect together with years of education.

Second, the difference between the estimated rate of return for Chinese Immigrants and native-born Canadian may reflect ability bias. Chinese Immigrants who immigrated after age 15 finished their middle school in China, where the competition for education is much hotter than in Canada, because of the large population and rare opportunities to enter a limited number of schools. These Immigrants therefore may have been more highly selected on the basis of ability. But such an effect should not exist for Chinese Immigrants group 1, and the difference of β between group 1 and the other two Chinese Immigrants groups may be a reflection of it.

There are also immigrant selection effects. From the supply side, Chinese Immigrants usually have higher levels of unobserved ability than the general population, which enables them to immigrate to another country and keep almost the same or better level of living standard as in their home country. From the demand side, the point system of the Canadian Immigration policy favours the most skilled immigrants. However, it is also argued that sometimes the immigrant nonassessed classes (family and refugee) will dominate the point system. Those people fare worse than independent immigrants, which makes the average level

of unobserved ability lower. Thus, it is undetermined whether the differences are due to the selection bias of Immigrants from China or not.

Fourth, the difference in education quality between China and Canada cannot be neglected. The huge population and limited resources in China have made the various school examinations very important, and students are forced to do a lot of work and absorb as much knowledge as they can from very young ages. The strenuous study also makes the whole middle-school education system a relatively higher quality one than the relaxed Canadian education system. Therefore, the rate of return to education will be different between the two countries. However, this reason should not exist for Chinese Immigrants Age Group 1 and part of Age Group 2, who immigrated at a very young age.

From the above analysis, the sheepskin effect is a strong candidate in explaining the difference between Chinese Immigrants in group 1 and native-born Canadian. We therefore want to test if there is any statistical difference in the sheepskin effect between Chinese Immigrants and native-born Canadian.

4.1.2 Regressions on sheepskin effect

For each group, we specify the following log-earnings function:

$$\begin{aligned} \ln \text{wage} = & \beta_0 + \beta_1 \text{wkswkp} + \beta_2 (\text{Legal marital status}) + \beta_3 \text{WORKEXP} + \beta_4 \\ & \text{WORKEPSSQ} + \beta_5 (\text{Secondary/high school graduation certificate or equivalent}) \\ & + \beta_6 \text{Bachelor} + \beta_7 \text{Master} + \beta_8 \text{Doctorate} + \sum_{n=6.5}^{18} \beta_n (n \text{ years of schooling}). \end{aligned}$$

The data on the highest qualifications enable four dummy variables to be defined, distinguishing between high school certificate, Bachelor degree, Master degree and Earned Doctorate. The β coefficients estimate the marginal effect of each level of education, as compared with the excluded group who has no school qualifications. We use each dummy variable for years of completed education, so that the assumption that education enters the wage equation linearly or piece – wise linearly is relaxed and the amount of wage variation that can be explained by years of schooling is maximized. Leaving these dummy variables to capture any returns to schooling years, the qualification variables will capture any sheepskin effects (Jaeger and Page, 1996).

The direct estimates of sheepskin effects are presented in Table 12. Because of the insufficient sample, we can only test on the English First Spoken group of native-born Canadian and Chinese Immigrants. It is apparent from the results of F- test in Table 12 that both years of education and highest qualification gained are relevant in explaining earnings, with the null hypothesis excluding each set of variables easily rejected ($P < 0.0001$) for all sample groups.

Model₁ present the coefficients in the model that has dummy variables for each completed year of school and qualification. All of these qualifications earn their holders a statistically significant earnings premium as sheepskin effects, except for the Doctorate degrees. This last result probably reflects the small numbers of this group in the sample. For example, native-born Canadians who have high school qualifications have annual earnings that are 11.45% higher than those with the same number of years of education but with no such

qualifications, while Chinese Immigrants earn 29.56%, 27.41%, and 25.54% higher respectively by Age at Immigration groups. For Bachelor's and Master's degrees, the earnings differentials are even larger.

Model₂ are coefficient estimates from a specification that only includes dummy variables for the number of years of schooling. If we interpret the dummy variables in this column as the total returns to education, and the coefficients in columns of Model 1 as the total return to education net of sheepskin effects, the difference between the two columns can be interpreted as part of the total return to education that is due to sheepskin effects (Jaeger and Page, 1996). The figures 9 through 12 plot the percentage earnings ($\ln wage$) increase implied by coefficients Model 1 and Model 2. For different groups we have different results. But normally, the difference between these two coefficients increases together with the years of education, and in the assumed credentialing years 12, 16 (we use 14-17 years instead, due to our data limitation) and 18, the difference is outstandingly high. For example, sheepskin effect explains approximately a quarter of the return to 12 years of study for native-born Canadian, half of the total return to completing 12 years of study for Chinese Immigrants Age Group 1, and more than one-third of Age Group 2. For Chinese Immigrants, especially Age Group 2 and 3, there is another year of outstandingly higher difference between β_1 and β_2 , which is year 9. The data in Tables 9 through 11, which is the cross-tabulation of highest degree received by completed years of education, show that in the Chinese Immigrants Age Group 2 and 3, the percentages of individuals who finished their high school in year 9 are much higher than in native-born

Canadian and Chinese Immigrants Age Group 1. Therefore, after adding in the credentials, the high school certificate will extract more returns as sheepskin effect from the year 9 schooling in Chinese Immigrants Group 2 and 3 than the other two groups, which result in the larger difference between β_1 and β_2 . This might be a support of the ability selection bias we mentioned before.

4.2 Differences in Sheepskin Effects across Ethnic Groups

The literature on statistical discrimination suggests that sheepskin effects may vary across demographic groups if diplomas provide a stronger productivity signal for some groups than for others. Belman and Heywood (1991) predict that the sheepskin effects for minorities and women should be larger than those for white men using US data, starting with a model in which employers base expectations of worker productivity on the average productivity of the worker's race/sex group. However, they did not statistically test it.

The analyses on the method of indirectly estimating sheepskin effects in our second and third section indicate that bias may be presented in the model Belman and Heywood used before, especially for our data here, which contains high deviations in the schooling years spent to complete a credential (please refer to Table 6 and relevant analysis). We therefore wish to know whether the hypothesis that sheepskin effects differ across demographic groups holds when estimated with actual indicators of diploma receipt on our data set, and also test it statistically. I present estimated diploma effects for native-born Canadian and Chinese Immigrants with different age at immigration in Table 12. Tables 13 and 14 shows the tests for the equality of diploma effects between native-born

Canadian and all Chinese Immigrants groups, and between Males and Females within each group separately. The model estimates one equation for each comparison hypothesis in Tables 13 and 14, with the effects for both comparable groups in one regression by interacting group dummy variables with each of the years of education and diploma dummy variables. The diploma variables are Secondary/high school graduation certificate or equivalent, Bachelor degree, Master degree and Doctorate degree, so that we can estimate the marginal effects over them. As in the literature, the model includes potential working experience and potential working experience squared; and also other independent variables as defined in section 4.1. We estimate separate intercepts for the comparable groups, and separate female dummy variables when based on both sexes, while the coefficients on the experience and other variables are restricted to be the same within each pair of comparable groups.

Ontario requires the high school to be finished in the thirteenth year of schooling, which is one year more than in other provinces in Canada. This longer education may equip students with more skills, and thus make their return to credentials higher than students in other places. To test the difference, we interact the province dummy for Ontario with each credential and schooling years, for both native-born Canadian and Chinese Immigrants group 1, who finished their high school within Canada. The results show that none of the coefficients on these interaction dummies is significant at the 20 percent significance level. The P-value of F- tests are 0.3236 and 0.8713 for Chinese Immigrants and native-born Canadian respectively, which also indicate their joint

insignificance. Therefore, we can safely test the sheepskin effect over the whole sample.

To set up the testing framework, it first must be determined whether the search for ethnic differences should be carried out separately for males and females. I do not found enough support for the hypothesis that the sheepskin effects are different by genders for all the credentials, as Belman and Heywood claimed before in their 1991 paper, although the intercept difference between genders are statistically significant across all the ethnic groups ($p < 0.0001$). Therefore, I estimate regressions based on both sexes for sheepskin effects, and present the results in Table 12. Due to the insufficient sample, we cannot estimate and test the gender difference in Chinese Immigrants Age Group 1.

Because the gender difference in sheepskin effects do not have statistically significant and consistent pattern, I test the difference of sheepskin effects between native-born Canadian and Chinese Immigrants Age Groups based on both sexes. We found that most of the differences between native-born Canadian and Chinese Immigrants for Secondary, Bachelor and Master degrees are statistically significant in 10 percent level; some of the P-values are even less than 0.1 percent. Also bear in mind that our failure to reject some of the hypotheses of equality across the groups for diploma, such as the difference in master degree between native-born Canadian and Chinese Immigrants group1, may have resulted from the relatively small numbers of Chinese Immigrants in these regressions. For Doctorate degree, the insignificant results maybe due to the too small number of holders. The F- tests can also statistically reject the

hypothesis that there are no differences in all degrees between each two comparable groups in 1 percent level.

Table 12 shows that the sheepskin effects of all credentials are larger for Chinese Immigrants than they are for native-born Canadians except for the Doctorate degree, which supports the hypothesis of statistical discrimination. For the Age Group 2 and 3 of Chinese Immigrants, this may be due to relatively poor language abilities, but for Age Group 1, since they immigrated into Canada as children and at least finished their High School here, language problems are unexisted, and the only difference is their ethnicity. Controlling for years of completed education, a High School certificate raises the annual earnings of a native-born Canadian 11.45 percent, compared with the base group of those with no qualifications, while for a Chinese Immigrant from Age Group 1 the predicted increase in earnings is 23.60 percent, and even higher at 33.60 percent and 37.67 percent for Immigrants from Group 2 and 3. Group 1 have a 4 percent higher return than native-born Canadians for Bachelor degree, while the increase in earnings for immigrants from Groups 2 and 3 are not so large. The native-born Canadian Master's graduates earn 18.11 percent more than those who receive only a Bachelor's degree and the difference for the three Chinese Immigrants groups are 27.96%, 37.57% and 30.70% respectively. The difference in sheepskin effects means that all else equal, Chinese Immigrants have to obtain higher credentials in order to signal their abilities to employers in the labour market. The fact that there may be a low supply and high demand for educated minority workers should not affect the inference of statistical discrimination

because such a supply/demand balance should also show up in the return to years of education and hence not affect the sheepskin effect per se (Belman and Heywood, 1991). In our sample, it does not seem likely that the higher signalling value of a qualification for Chinese Immigrants reflects a high demand for or low supply of highly educated minority workers or even bilinguals and trilinguals of Chinese, since there is no statistically difference in the returns to advanced years of education for Chinese Immigrants and native-born Canadians.

I also find that the hypothesis that Chinese Immigrant workers get no return to accumulated years of education cannot be rejected at the 5 percent significance level for the first two groups ($P_1=0.1008$, $P_2=0.0635$), while the same hypothesis for native-born Canadian workers is conclusively rejected ($P=0.0000$) (please refer to the F- test in last two rows of Table 12). Hence, the returns to education for Chinese Immigrants may be due more to credentials, which means credentials may be more important than years of education for group 1 and 2. In contrast, the returns to education for native-born Canadian are due to both returns to accumulated years of education and returns to credentials, with similar importance.

In the presence of more signalling effects for Chinese Immigrants, there may be more external costs of education for them. The reason is that if each individual fails to take account of the effect of their investment decisions on the market equilibrium, additional education obtained by individuals of a given ability will raise the education needed by the more able if they are to signal their greater talents and all else are equal, so a case can be made for interventions to raise

the private cost of education (Riley, 1979). We have already seen the increasing number of Chinese students in the graduate school in Canada. For example, more than one third of the graduate class in Simon Fraser University are Chinese, and there are also a potentially large number of Chinese candidate each semester as well. Their pursuing higher education due to the large sheepskin effect will affect the cost of education especially for postgraduate education.

5. Conclusion

This paper is the first to use the sheepskin effects to test the hypotheses of statistical discrimination against Chinese people in the Canadian labour market. In drawing conclusions, our evidence suggests that education does not contribute to earnings solely by enhancing skills. The findings do suggest, however, that diplomas may serve as signals of productivity. Further, we argue that the signalling effects for minority people, particularly for Chinese Immigrants, are even larger, and the labour market value of degrees appears to exceed the returns to years of education for them. However, within demographic groups, we did not find significant differences between genders, in contrast to the results from Belman and Heywood (1991), which uses an indirect method to estimating the sheepskin effects.

Our test, which is to compare the earnings of those who have the degree and those who do not, conditional on both groups having the same number of years of schooling (Park, 1999) is much stronger than the indirect test.

I would like to end with several notes of caution. First, in our model, we constrain the sheepskin effect associated with one diploma to be the same for all years of educational attainment. That is, we assume that the difference between those have 16 years of education without a bachelor degree and those have 16 years of education with a bachelor degree is the same as the difference between those have 17 years of education but no bachelor degree and those who have 17 years of education with a bachelor degree. As argued by Park (1999), we should test the robustness of our results by estimating a fully interacted model, with the interaction between each year of education and degree as a separate dummy variable. But due to the limited sample size of our data, we cannot run that regression. The assumption of the additive separability of schooling and experience — an assumption which has been shown to be far from innocuous (Card and Lemieux 2001; Heckman, Lochner and Todd 2001), can also be relaxed by the fully interacting dummy variables of schooling years with working experience. An obvious limitation of this strategy is that it will produce very noisy estimates in our sample as well. Another drawback is that, we cannot control for the difference in the individual's born ability and difference in the grown background. Only if we have the data on their parental education or similar information, then can we use it as a proxy for that.

Another note of caution is that the signalling hypothesis is not the only possible explanation for the presence of sheepskin effects. Chiswick (1973) points out that graduates are, on average, more efficient learners and that as a result they enjoy proportionately larger increases in productivity than their years of education alone would indicate. Thus, the sheepskin effect could arise from education increasing productivity and a self-selection process rather than signalling. Therefore, we could probably say in the Chinese Immigrants Age Group 2 and 3, due to the large population and relatively rare education opportunities in China, the competition for obtaining higher levels of study is very intense. Individuals in these groups may be more intensely selected on ability than their foreign counterparts, which may lead to higher estimated returns to their diplomas. But for the Chinese Immigrants in Age Group 1, there should be no such explanation, since they finished most of their studies in Canada.

The next step in this research would be to investigate the time path of sheepskin effects. That is, as tenure increases, the employers can directly observe the individual's productivity, which allows them to correct the wage. This then raises other interesting questions. How soon will the employers learn about the employee's true level of productivity? Is there any difference among ethnic groups? Will the sheepskin effects be diminishing or just remain the same on average? Unfortunately, our data do not contain enough information to allow these additional questions to be investigated. Doing so would require data on the true working experience of individuals, and also a larger sample size in order to further divide them into sub age groups.

Appendices

Table 1. Descriptives of Chinese Immigrants by Age at Immigration and FOLP group:

		Both Sexes					Male			Female		
		Number of Observations	Avg. Wage	Avg. Years of Education	Avg Working Experience	Avg. Wage	Avg. Years of Education	Avg Working Experience	Avg. Wage	Avg. Years of Education	Avg Working Experience	
AGE GROUP = 0-12 years	FOLP = English First Spoken	1110	537.98	7.48	7.58	574.38	7.47	7.71	499.11	7.49	7.43	
	FOLP = French First Spoken	24	308.00	7.17	4.17	398.61	6.90	6.30	243.28	7.36	2.64	
	FOLP = Both English and French	45	482.40	7.51	3.56	387.95	7.63	4.46	590.33	7.38	2.52	
	FOLP = Neither English Nor French	8	431.12	3.37	22.88	653.21	1.50	25.00	357.09	4.00	22.17	
AGE GROUP = 13-24 years	FOLP = English First Spoken	2683	587.59	6.83	15.24	643.99	6.79	15.74	531.66	6.88	14.75	
	FOLP = French First Spoken	44	404.19	5.64	10.45	337.41	5.04	11.96	480.99	6.29	8.81	
	FOLP = Both English and French	85	509.23	7.26	12.08	551.05	7.34	12.28	449.49	7.14	11.80	
	FOLP = Neither English Nor French	194	425.15	4.21	12.94	475.84	4.28	13.24	385.25	3.99	12.71	
AGE GROUP = 25-60 years	FOLP = English First Spoken	3871	609.25	6.90	23.58	686.40	7.04	24.36	525.55	6.74	22.74	
	FOLP = French First Spoken	57	580.06	5.46	25.49	760.60	5.59	28.85	417.56	5.33	23.03	
	FOLP = Both English and French	88	542.78	7.26	21.05	623.50	7.38	22.49	420.53	7.09	18.86	
	FOLP = Neither English Nor French	891	465.22	3.74	27.83	427.21	3.98	27.50	498.02	3.54	28.12	

Table 2. Credential Frequency of Chinese Immigrants:

	Both Sex			Male			Female					
	Frequency	Percent	Total	Frequency	Percent	Total	Frequency	Percent	Total			
HIGH SCHOOL	AGE GROUP = 0-12 years	FOLP = English First Spoken	926	86.1	1110	461	85.8	572	465	86.4	538	
		FOLP = French First Spoken	20	83	24	8	80.0	10	12	85.7	14	
		FOLP = Both English and French	40	88.9	45	21	87.5	24	19	90.5	21	
	AGE GROUP = 13-24 years	FOLP = Neither English Nor French	2	25	8	0	0	2	2	3.3	6	
		FOLP = English First Spoken	1963	75.4	2683	933	74.4	1335	1030	76.4	1348	
		FOLP = French First Spoken	28	63.6	44	12	52.2	23	16	76.2	21	
	AGE GROUP = 25-60 years	FOLP = Both English and French	68	80	85	41	50.0	82	27	77.1	35	
		FOLP = Neither English Nor French	54	27.8	194	26	30.2	86	28	25.9	108	
		FOLP = English First Spoken	3067	79.2	3871	1592	79.0	2016	1475	79.5	2016	
	BACHELOR	AGE GROUP = 0-12 years	FOLP = French First Spoken	34	59.6	57	15	55.627	27	19	63.3	30
			FOLP = Both English and French	73	83	88	44	83.0	53	29	82.9	35
			FOLP = Neither English Nor French	224	85.1	891	111	26.9	413	113	23.6	478
FOLP = English First Spoken			366	33.0	1110	177	30.9	572	189	35.1	538	
AGE GROUP = 13-24 years	FOLP = French First Spoken	2	8.3	24	0	0	10	2	14.3	14		
	FOLP = Both English and French	16	35.6	45	11	45.8	24	5	23.8	21		
	FOLP = Neither English Nor French	0	0	8	0	0	2	0	0	6		
AGE GROUP = 13-24 years	FOLP = English First Spoken	741	27.6	2683	395	29.6	1335	346	25.7	1348		

		Both Sex				Male			Female		
		Frequency	Percent	Total	Frequency	Percent	Total	Frequency	Percent	Total	
	FOLP = French First Spoken	10	22.7	44	2	8.7	23	8	38.1	21	
	FOLP = Both English and French	32	37.6	85	14	28	82	18	51.4	35	
	FOLP = Neither English Nor French	3	1.5	194	3	3.5	86	0	0	108	
	FOLP = English First Spoken	1186	30.6	3871	723	36.3	2016	453	24.4	2016	
AGE GROUP = 25-60 years	FOLP = French First Spoken	9	57	57	5	27	27	4	13.3	30	
	FOLP = Both English and French	43	48.9	88	28	52.8	53	15	42.9	35	
	FOLP = Neither English Nor French	15	1.7	891	9	2.2	413	6	1.3	478	
	FOLP = English First Spoken	42	3.8	1110	24	4.2	572	18	3.3	538	
AGE GROUP = 0-12 years	FOLP = French First Spoken	0	0	24	0	0	10	0	0	14	
	FOLP = Both English and French	0	0	45	0	0	24	0	0	21	
	FOLP = Neither English Nor French	0	0	8	0	0	2	0	0	6	
	FOLP = English First Spoken	115	4.3	2683	77	5.8	1335	38	2.8	1348	
AGE GROUP = 13-24 years	FOLP = French First Spoken	0	0	44	0	0	23	0	0	21	
	FOLP = Both English and French	2	2.4	85	2	4.0	82	0	0	35	
	FOLP = Neither English Nor French	0	0	194	0	0	86	0	0	108	
	FOLP = English First Spoken	404	10.4	3871	287	14.2	2016	117	6.3	2016	
AGE GROUP = 25-60 years	FOLP = French First Spoken	5	8.8	57	2	27	27	3	30	30	
	FOLP = Both English and French	26	29.5	88	18	53	53	8	22.9	35	
	FOLP = Neither English Nor French	2	0.2	891	1	0.2	413	1	0.2	478	

MASTER

		Both Sex			Male			Female			
		Frequency	Percent	Total	Frequency	Percent	Total	Frequency	Percent	Total	
DOCTORATE	AGE GROUP = 0-12 years	<i>FOLP = English First Spoken</i>	5	0.5	1110	5	0.9	572	0	0	538
		<i>FOLP = French First Spoken</i>	0	0	24	0	0	10	0	0	14
		<i>FOLP = Both English and French</i>	0	0	45	0	0	24	0	0	21
	AGE GROUP = 13-24 years	<i>FOLP = Neither English Nor French</i>	0	0	8	0	0	2	0	0	6
		<i>FOLP = English First Spoken</i>	12	0.4	2683	10	0.7	1335	2	0.1	1348
		<i>FOLP = French First Spoken</i>	0	0	44	0	0	23	0	0	21
		<i>FOLP = Both English and French</i>	2	2.4	85	2	4.0	82	0	0	35
		<i>FOLP = Neither English Nor French</i>	0	0	194	0	0	86	0	0	108
		<i>FOLP = English First Spoken</i>	102	2.6	3871	82	4.1	2016	20	1.1	2016
AGE GROUP = 25-60 years	<i>FOLP = French First Spoken</i>	0	0	57	0	0	27	0	0	30	
	<i>FOLP = Both English and French</i>	10	11.4	88	8	15.1	53	2	5.7	35	
	<i>FOLP = Neither English Nor French</i>	1	0.1	891	1	0.2	413	0	0	478	

Table 3. Average Years of Education by Credentials

	Avg. Years of Schooling				
	NO DEGREE	HIGH SCHOOL	BACHELOR	MASTER	DOCTORATE
FOLP = English First Spoken	4.25	6.73	8.31	8.80	8.85
FOLP = French First Spoken	2.72	6.50	8.25	9.00	-
FOLP = Both English and French	4.05	7.03	8.44	8.88	8.75
FOLP = Neither English Nor French	2.90	5.95	8.23	9.00	9.00

Notes:

- 1: Less than Grade 5 or never; 2: 5 to 8 years of schooling; 3: 9 years of schooling; 4: 10 years of schooling
- 5: 11 years of schooling; 6: 12 years of schooling; 7: 13 years of schooling; 8: 14 to 17 years of schooling
- 9: 18 or more years of schooling

Table 4. Descriptive of Native-born Canadian:

	Both Sexes			Male			Female		
	Avg. Wage	Avg. Years of Education	Avg Working Experience	Avg. Wage	Avg. Years of Education	Avg Working Experience	Avg. Wage	Avg. Years of Education	Avg Working Experience
FOLP = English First Spoken	641.3659	6.57	16.1030	758.6001	6.46	16.2528	513.7416	6.69	15.9402
FOLP = French First Spoken	618.7115	6.32	17.6501	720.5379	6.13	18.1414	495.5408	6.55	17.0564
FOLP = Both English and French	472.4819	6.93	10.1546	444.3598	6.58	8.7209	494.8754	7.20	11.2963
FOLP = Neither English Nor French	476.2487	2.40	24.8000	701.9231	1.00	25.0000	330.7991	3.33	23.9667

Table 5. Descriptive of Chinese Immigrants:

	Both Sexes			Male			Female		
	Avg. Wage	Avg. Years of Education	Avg Working Experience	Avg. Wage	Avg. Years of Education	Avg Working Experience	Avg. Wage	Avg. Years of Education	Avg Working Experience
FOLP = English First Spoken	591.3947	6.96	18.3462	655.6764	7.2	19.0008	523.9440	6.9	17.6597
FOLP = French First Spoken	466.4153	5.85	16.2400	538.0480	5.6	18.6167	399.2597	6.8	14.0462
FOLP = Both English and French	517.2325	7.31	13.9404	550.4639	7.41	15.0630	470.8547	7.18	12.3736
FOLP = Neither English Nor French	457.8346	3.8	25.1537	436.4597	4.02	25.0439	475.8652	3.62	25.2466

Table 6. Cross-Tabulation of Highest Degree Received by Completed Years of Education

Years of Education	High School		Bachelor		Master		Doctorate	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Less Than 5 or Never	0	0	0	0	0	0	0	0
5 through 8	0	0	0	0	0	0	0	0
9	142	1.4	0	0	0	0	0	0
10	288	2.8	0	0	0	0	0	0
11	812	7.9	0	0	0	0	0	0
12	4416	43.2	2	.0	1	.1	0	0
13	2263	22.1	9	.2	1	.1	0	0
14-17	2268	22.2	3345	65.1	173	14.5	22	9.6
18 or more	40	.4	1779	34.6	1017	85.3	208	90.4
Degree Total	10229	100.0	5135	100.0	1192	100.0	230	100.0

Table 7. Cross-Tabulation of Highest Degree Received by Completed Years of Education (Ontario)

Years of Education	High School		Bachelor		Master		Doctorate	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Less Than 5 or Never	0	0	0	0	0	0	0	0
5 through 8	26	1.2	0	0	0	0	0	0
9	83	3.8	0	0	0	0	0	0
10	136	6.2	0	0	0	0	0	0
11	829	37.7	0	0	0	0	0	0
12	653	29.7	0	0	0	0	0	0
13	563	25.6	3	.02	0	0	0	0
14-17	11	0.5	983	71.6	64	18.7	12	12.8
18 or more	0	0	387	28.2	279	81.3	82	87.2
Degree Total	2201	100.0	1373	100.0	343	100.0	94	100.0

Table 8. Cross-Tabulation of Highest Degree Received by Completed Years of Education (EFS Native-born Canadian)

Years of Education	High School		Bachelor		Master		Doctor	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Less Than 5 or Never	0	0	0	0	0	0	0	0
5 through 8	0	0	0	0	0	0	0	0
9	13	.2	0	0	0	0	0	0
10	80	1.4	0	0	0	0	0	0
11	246	4.2	0	0	0	0	0	0
12	3005	51.4	0	0	1	.2	0	0
13	1147	19.6	2	.1	1	.2	0	0
14-17	1333	22.8	1722	67.8	53	10.1	1	1.4
18 or more	25	.4	814	32.1	470	89.5	70	98.6
Degree Total	5849	100.0	2538	100.0	525	100.0	71	100.0

Table 9. Cross-Tabulation of Highest Degree Received by Completed Years of Education (EFS Chinese Immigrants Age Group 1)

Years of Education	High School		Bachelor		Master		Doctor	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Less Than 5 or Never	0	0	0	0	0	0	0	0
5 through 8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	3	.9	0	0	0	0	0	0
11	3	.9	0	0	0	0	0	0
12	79	23.5	1	.3	0	0	0	0
13	66	19.6	0	0	0	0	0	0
14-17	181	53.9	197	64.6	6	16.2	1	20.0
18 or more	4	1.2	107	35.1	31	83.8	4	80.0
Degree Total	336	100.0	305	100.0	37	100.0	5	100.0

Table 10. Cross-Tabulation of Highest Degree Received by Completed Years of Education (EFS Chinese Immigrants Age Group 2)

Years of Education	High School		Bachelor		Master		Doctor	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Less Than 5 or Never	0	0	0	0	0	0	0	0
5 through 8	0	0	0	0	0	0	0	0
9	9	1.5	0	0	0	0	0	0
10	12	2.0	0	0	0	0	0	0
11	21	3.6	0	0	0	0	0	0
12	200	33.8	0	0	0	0	0	0
13	141	23.9	1	.2	0	0	0	0
14-17	203	34.3	412	70.8	19	18.4	0	0
18 or more	5	.8	169	29.0	84	81.6	12	100.0
Degree Total	591	100.0	582	100.0	103	100.0	12	100.0

Table 11. Cross-Tabulation of Highest Degree Received by Completed Years of Education (EFS Chinese Immigrants Age Group 3)

Years of Education	High School		Bachelor		Master		Doctor	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Less Than 5 or Never	0	0	0	0	0	0	0	0
5 through 8	0	0	0	0	0	0	0	0
9	10	1.3	0	0	0	0	0	0
10	34	4.6	0	0	0	0	0	0
11	69	9.3	0	0	0	0	0	0
12	283	38.0	0	0	0	0	0	0
13	230	30.9	0	0	0	0	0	0
14-17	116	15.6	487	69.0	62	20.5	17	16.7
18 or more	2	.3	219	31.0	240	79.5	85	83.3
Degree Total	744	100.0	706	100.0	302	100.0	102	100.0

Table 12. Estimated Diploma Effects for Ethnic Groups (Both Sexes)

	English First Spoken (Both Sexes)															
	native-born Canadian				Chinese Immigrants				Chinese Immigrants							
	Model ₁	Model ₂	Difference		Model ₁	Model ₂	Difference		Model ₁	Model ₂	Difference					
					AGEGROUP = 0-12 years				AGEGROUP = 13-24 years				AGEGROUP = 25-60 years			
WKSWKP	0.0367 ***	0.0368 ***			0.0391 ***	0.0388 ***			0.0372 **	0.0382 ***			0.0408 ***	0.0407 ***		
Legal marital status	0.0497 ***	0.0507 ***			0.0928 ***	0.0964 ***			0.1646 ***	0.1462 ***			0.0286 ***	-0.0194 ***		
WORKEXP	0.0826 ***	0.0843 ***			0.1409 ***	0.1504 ***			0.0843 ***	0.0862 ***			0.0521 ***	0.0503 ***		
WORKEXSQ	0.0015 ***	0.0015 ***			0.0033 ***	0.0036 ***			0.0016 ***	0.0016 ***			0.0009 ***	-0.0009 ***		
Secondary/high school graduation certificate or equivalent	0.1145 ***				0.2360 ***				0.3332 ***				0.3767 ***			
Bachelor's degree(s)	0.2544 ***				0.2956 ***				0.2741 ***				0.2554 ***			
Master's degree(s)	0.1811 ***				0.2796 ***				0.3757 ***				0.3070 ***			
Earned doctorate	0.0978				0.1779 ***				0.0088 ***				0.0404 ***			
6.5 years schooling	0.2664 *	0.2642 **	-0.0022		0.1430 **	0.1605 **	0.0175		0.3173 **	0.2920 ***	0.0253		0.0202 *	0.0190 *	0.0012	
9 years schooling	0.2314 **	0.2474 **	0.0160		0.1366 *	0.1569 ***	0.0203		0.2877 **	0.1832 ***	0.1045		0.0523 **	0.0502 **	0.0021	
10 years schooling	0.1948 *	0.2194 *	0.0246		0.1627 *	0.1855 *	0.0228		0.2926 *	0.2048 *	0.0877		0.1645 *	0.1509 *	0.0136	
11 years schooling	0.2876	0.3374 *	0.0497		0.1059 **	0.1308 **	0.0249		0.6185 *	0.4829 **	0.1356		0.0934 *	0.0600 *	0.0333	
12 years	0.3855	0.4673	0.0818		0.0894	0.1731	0.0837		0.5272	0.3054	0.2218		0.1998	0.1560	0.0437	

	English First Spoken (Both Sexes)											
	native-born Canadian				Chinese Immigrants				Chinese Immigrants			
	Model ₁	Model ₂	Difference	AGEGROUP = 0-12 years	Model ₁	Model ₂	Difference	AGEGROUP = 13-24 years	Model ₁	Model ₂	Difference	AGEGROUP = 25-60 years
schooling	0.3975 *	0.4981 *	0.1006	0.0987 *	0.1221 **	0.0234	0.7080 **	0.4283 **	0.2688 *	0.2188 **	0.0500	
13 years schooling	0.5305 ***	0.7006 ***	0.1701	0.4133 ***	0.1212 ***	0.2921	0.9128 ***	0.4736 ***	0.6519 ***	0.4586 ***	0.1933	
14-17 years schooling	0.5348 **	0.9032 **	0.3684	0.5031 **	0.1076 ***	0.3955	1.0838 **	0.4290 ***	0.7419 **	0.4376 **	0.3043	
18 or more years of schooling	0.2918 ***	0.2863 ***		0.1541 ***	-0.143 **		0.0289 ***	0.0608 ***	0.2395 ***	-0.2407 ***		
Female	6.9007 ***	6.8829 ***		6.8285 ***	6.7899 **		6.4682 ***	6.4426 ***	6.9986 ***	7.028076 ***		
(Constant)												
F- Test	For years of schooling: P=0.0000			For years of schooling: P=0.1008			For years of schooling: P=0.0635			For years of schooling: P=0.0000		
	For credentials: P=0.0000			For credentials: P=0.0000			For credentials: P=0.0000			For credentials: P=0.0000		

Note:

*: Significant at 10%

**: Significant at 5%

***: Significant at 1%

Table 13. Hypothesis Test for Diploma Effects: Equality Across Groups

Credential	Hypothesis			
		Chinese Immigrants Male=Chinese Immigrants Female (Age Group 2)	Chinese Immigrants Male=Chinese Immigrants Female (Age Group 3)	Native-born Canadian Male= native-born Canadian Female
Secondary/high school graduation certificate or equivalent	<i>t</i> -statistics	1.3683	0.2388	-0.9146
	(Probability)	(0.1713)	(0.8112)	(0.3604)
Bachelor	<i>t</i> -statistics	0.1474	3.5271	2.8761
	(Probability)	(0.8828)	(0.2504)	(0.7042)
Master	<i>t</i> -statistics	0.2818	0.9143	-0.7341
	(Probability)	(0.7781)	(0.3606)	(0.8590)
Doctorate	<i>t</i> -statistics	0.0700	0.4565	-0.5598
	(Probability)	(0.9442)	(0.6480)	(0.8760)
All Degrees	<i>F</i> -test	0.4899	3.1702	2.4472
	(Probability)	(0.7432)	(0.0130)	(0.0442)

Table 14. Hypothesis Test for Diploma Effects: Equality Across Groups

Credential	Hypothesis		
	Native-born Canadian=Chinese Immigrants Age Group 1	Native-born Canadian=Chinese Immigrants Age Group 2	Native-born Canadian=Chinese Immigrants Age Group 3
Secondary/high school graduation certificate or equivalent	1.7955 (0.0726) 2.1899	3.1939 (0.0014) 2.5378	3.7454 (0.0002) 2.9385
Bachelor	(0.0285) 1.2803 (0.2004)	(0.0112) 1.8435 (0.0653)	(0.0033) 2.1187 (0.0341)
Master	0.0445 (0.9645) 5.2794	0.3521 (0.7458) 3.6995	0.9003 (0.3680) 3.5261
Doctorate	(0.0003)	(0.0051)	(0.0070)
All Degrees			

Table 15. Regressions on Years of Schooling

	English First Spoken (Both Sexes)											
	native-born			Chinese Immigrants			Chinese Immigrants			Chinese Immigrants		
	Canadian			AGEGROUP = 0-12			AGEGROUP = 13-24			AGEGROUP = 25-60		
	β	t-Probability	β	t-Probability	β	t-Probability	β	t-Probability	β	t-Probability	β	t-Probability
WKSWKP	0.040618	0.0000	0.037347	0.0000	0.039983	0.0000	0.042106	0.0000	0.042106	0.0000	0.042106	0.0000
Legal marital status	0.085824	0.0000	0.104963	0.1953	0.137674	0.0016	-0.028931	0.4548	-0.028931	0.4548	-0.028931	0.4548
WORKEXP	0.079049	0.0000	0.153037	0.0000	0.086827	0.0000	0.051152	0.0000	0.051152	0.0000	0.051152	0.0000
WORKEXSQ	-0.001435	0.0000	-0.003735	0.0000	-0.001685	0.0000	-0.000895	0.0000	-0.000895	0.0000	-0.000895	0.0000
Female	-0.422170	0.0000	-0.166267	0.0031	-0.163632	0.0000	-0.215450	0.0000	-0.215450	0.0000	-0.215450	0.0000
Years of Schooling	0.003454	0.0117	0.020997	0.0012	0.022283	0.0001	0.024575	0.1334	0.024575	0.1334	0.024575	0.1334
Years of Schooling Square	0.002631	0.0000	0.003006	0.4424	0.003566	0.0014	0.003757	0.0000	0.003757	0.0000	0.003757	0.0000
(Constant)	6.880330	0.0000	6.404002	0.0000	6.774351	0.0000	6.953076	0.0000	6.953076	0.0000	6.953076	0.0000

Figure 1. Average Weekly Wage of Chinese Immigrants

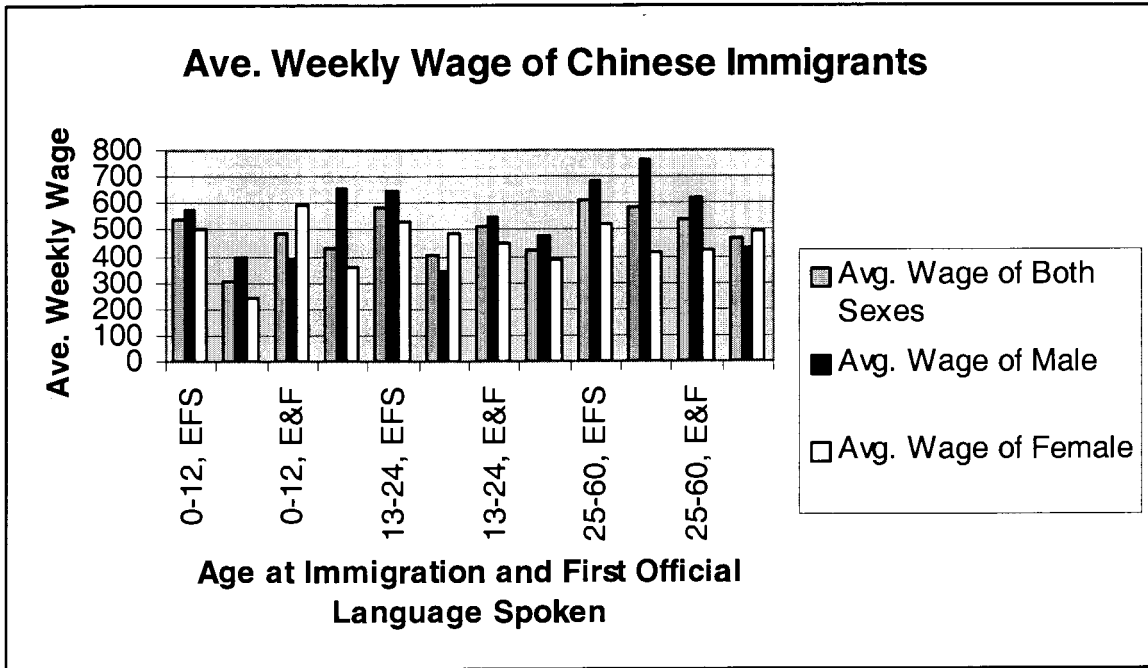


Figure 2. Average Years of Education of Chinese Immigrants

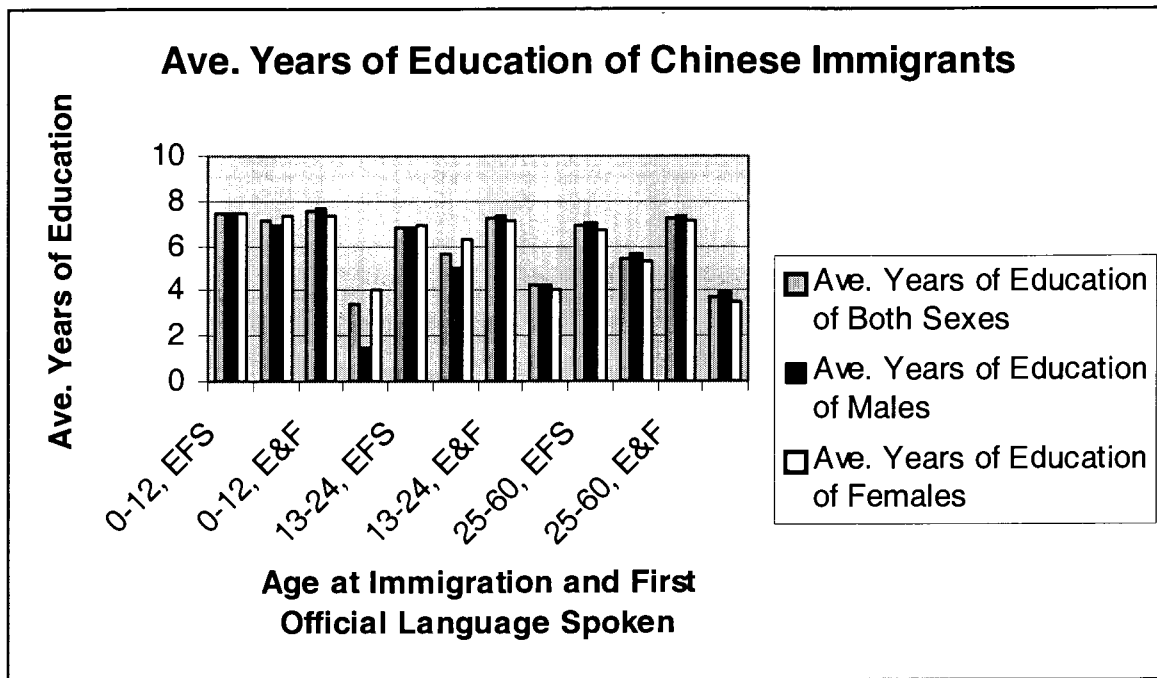


Figure 3. Average Working Experience of Chinese Immigrants

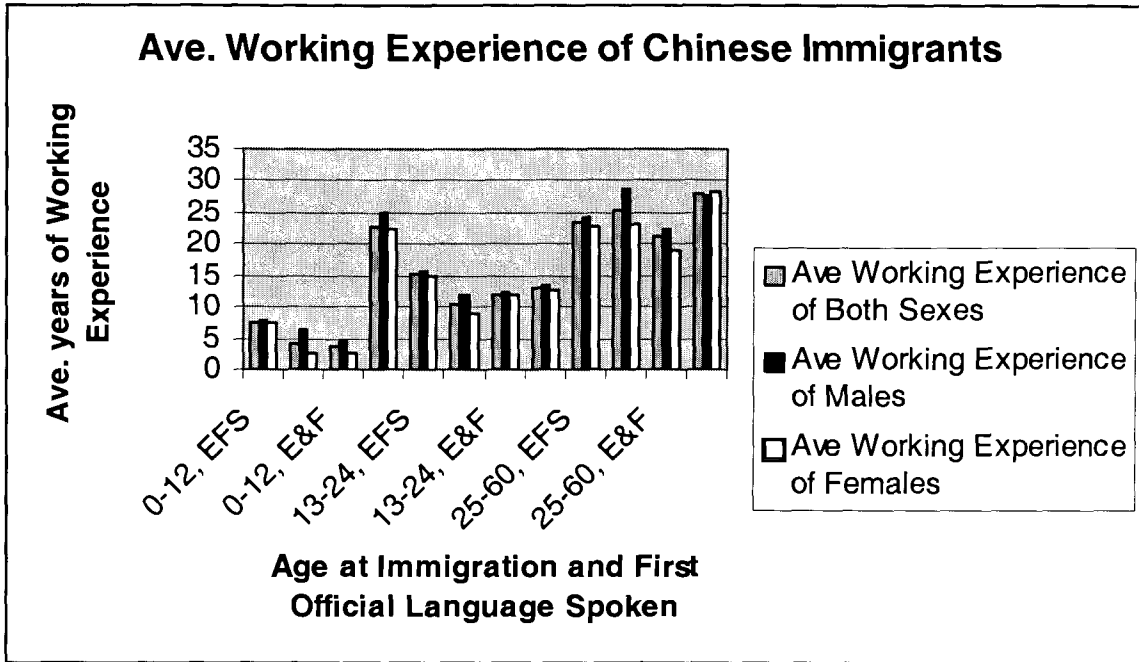


Figure 4. Chinese Immigrants Education Credentials of Both Sexes

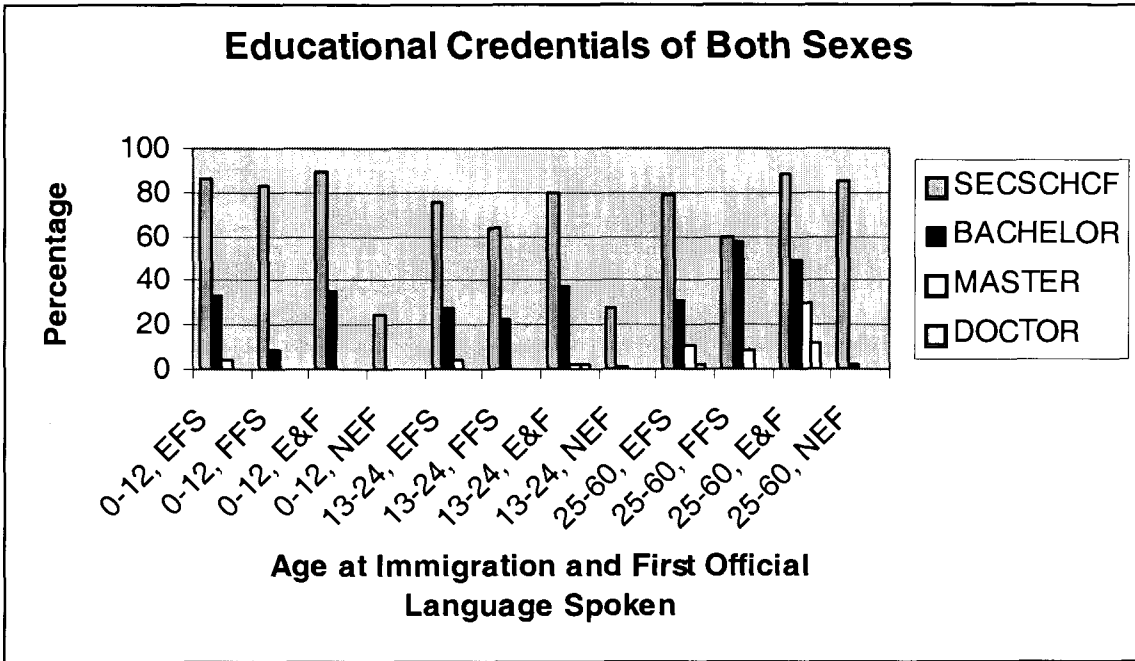


Figure 5. Chinese Immigrants Education Credentials of Males

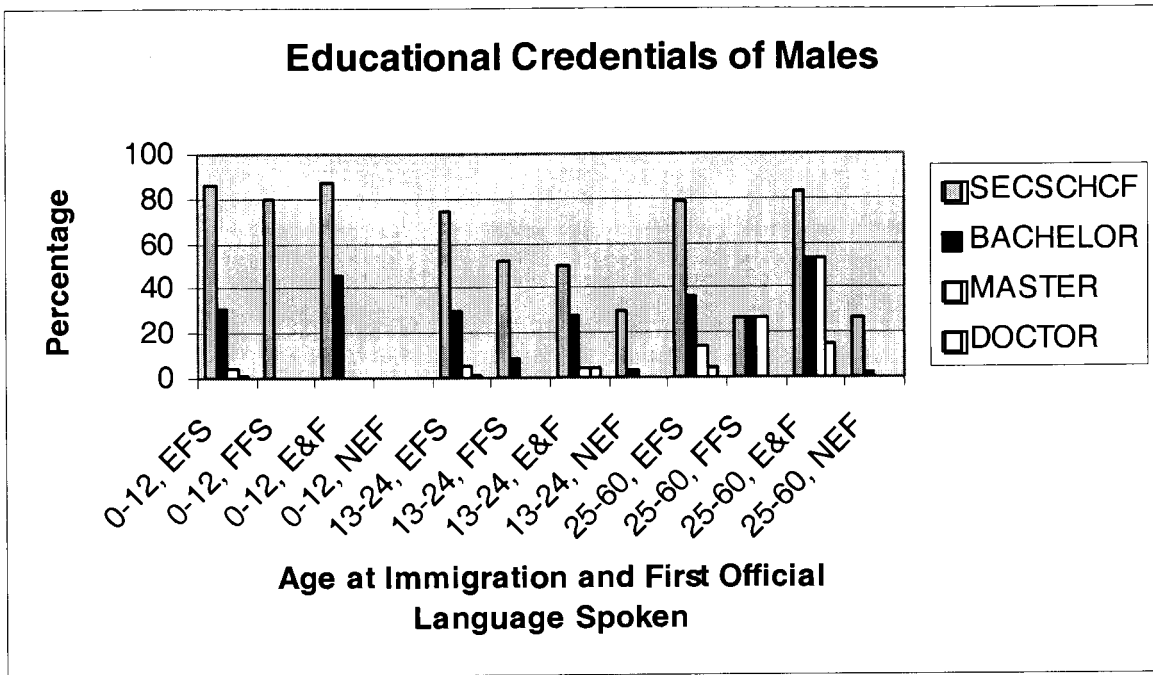


Figure 6. Chinese Immigrants Education Credentials of Females

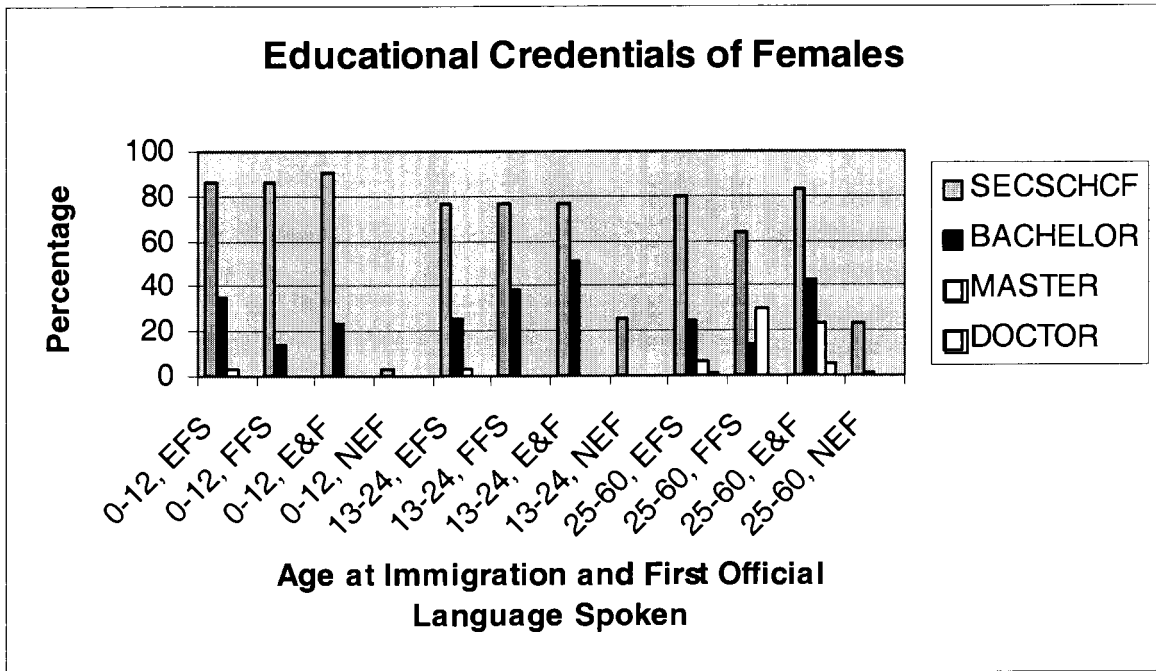


Figure 7. Average Years of Education by Credentials

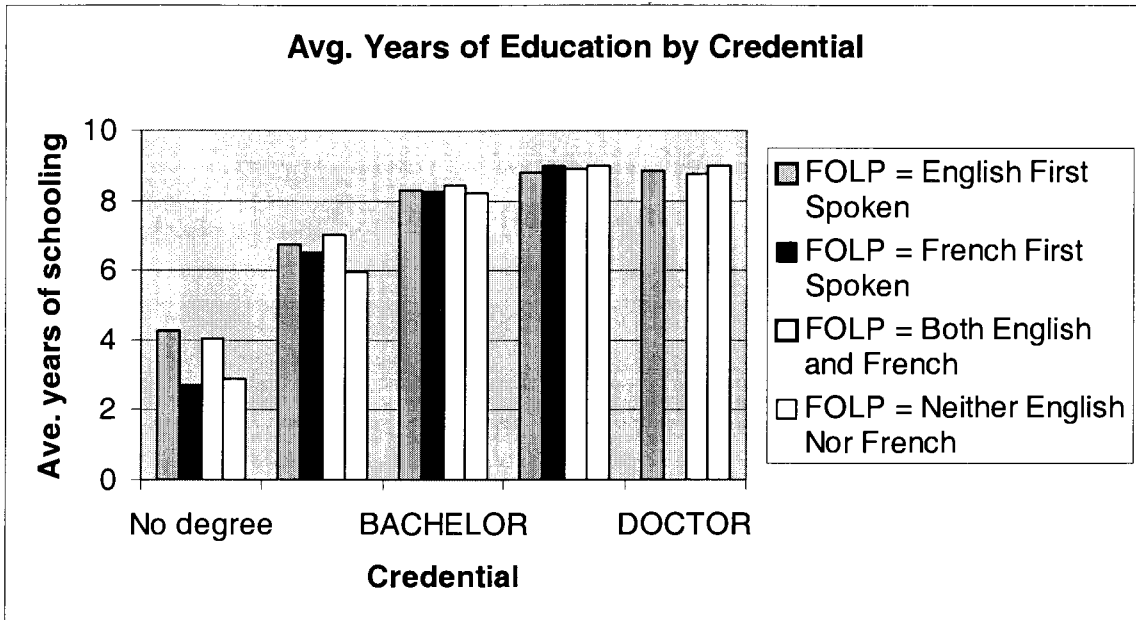


Figure 8. Average Education and Working Experience Comparison Between Native-born Canadian and Chinese Immigrants

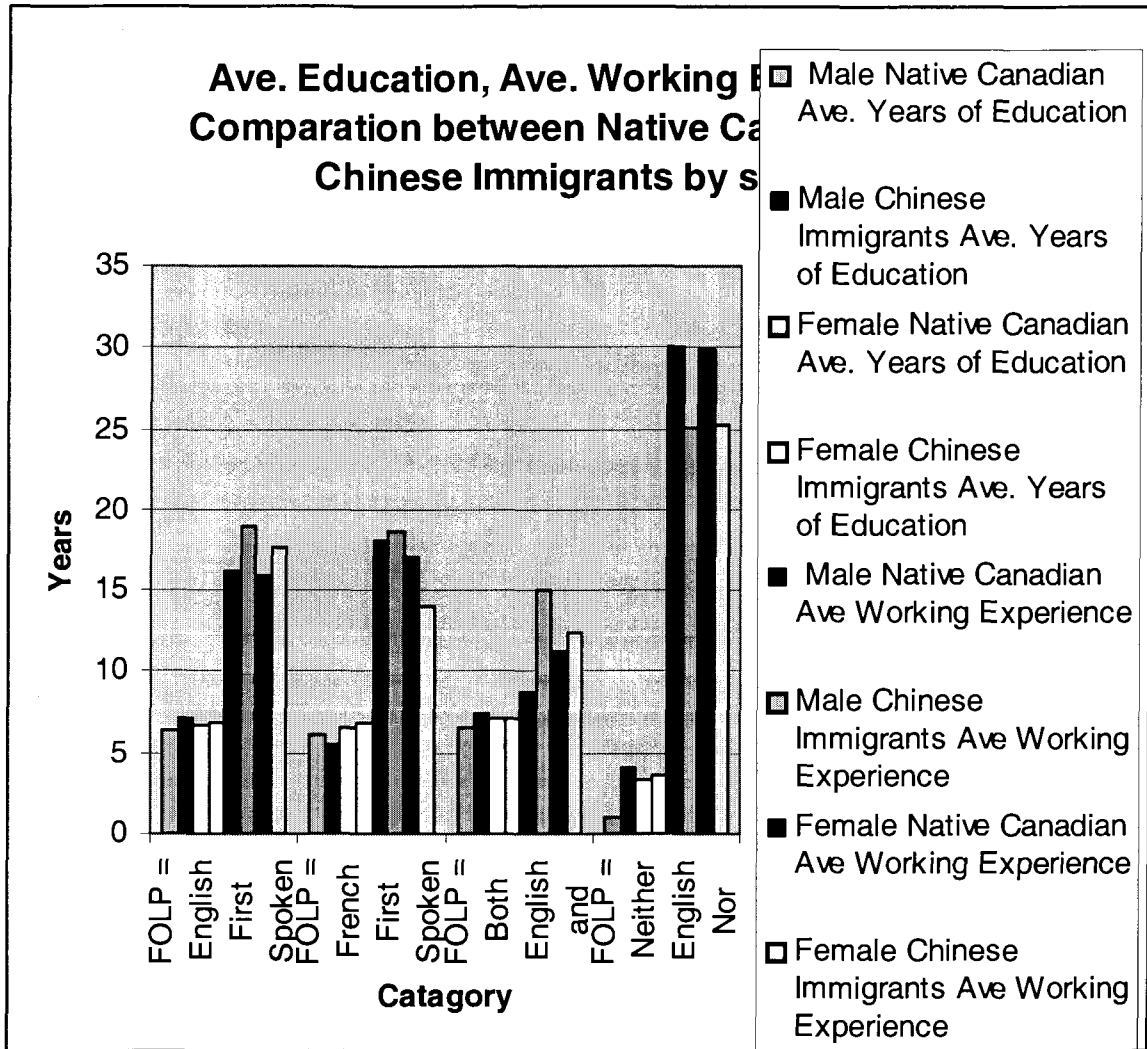


Figure 9. Total Return to Completed Years of Education for Native-born Canadian

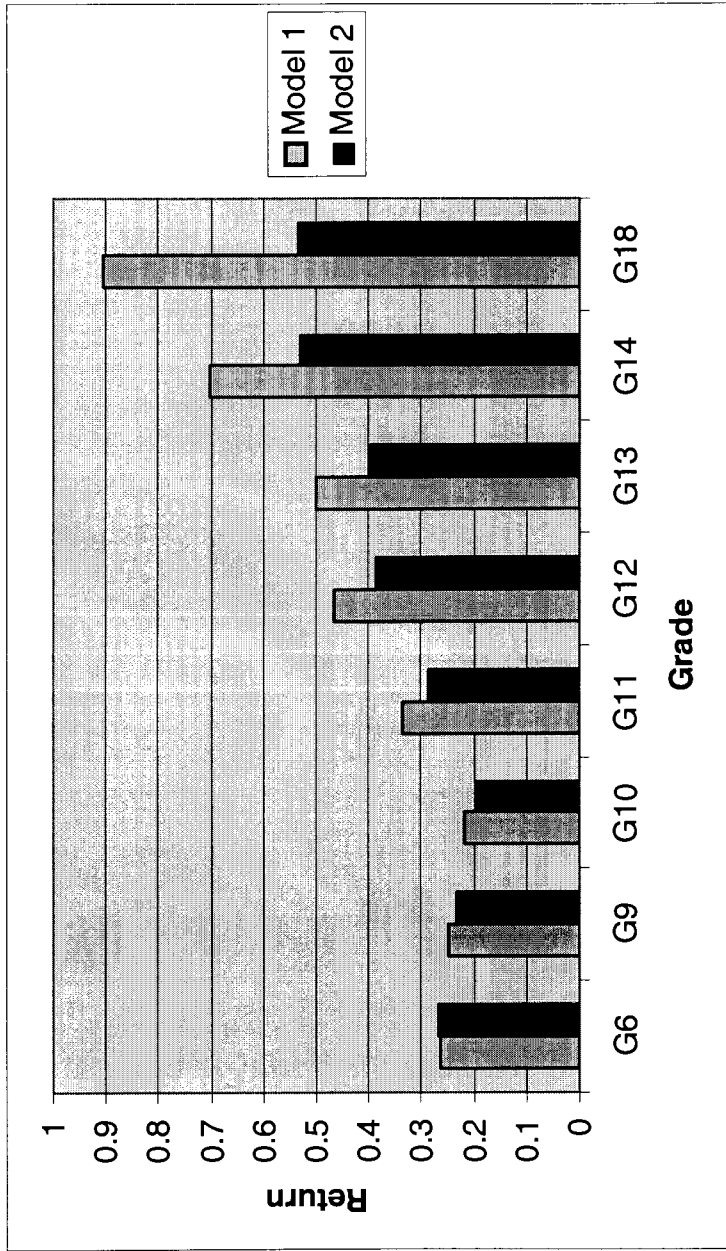


Figure 10. Total Return to Completed Years of Education for Chinese Immigrants Age group 1

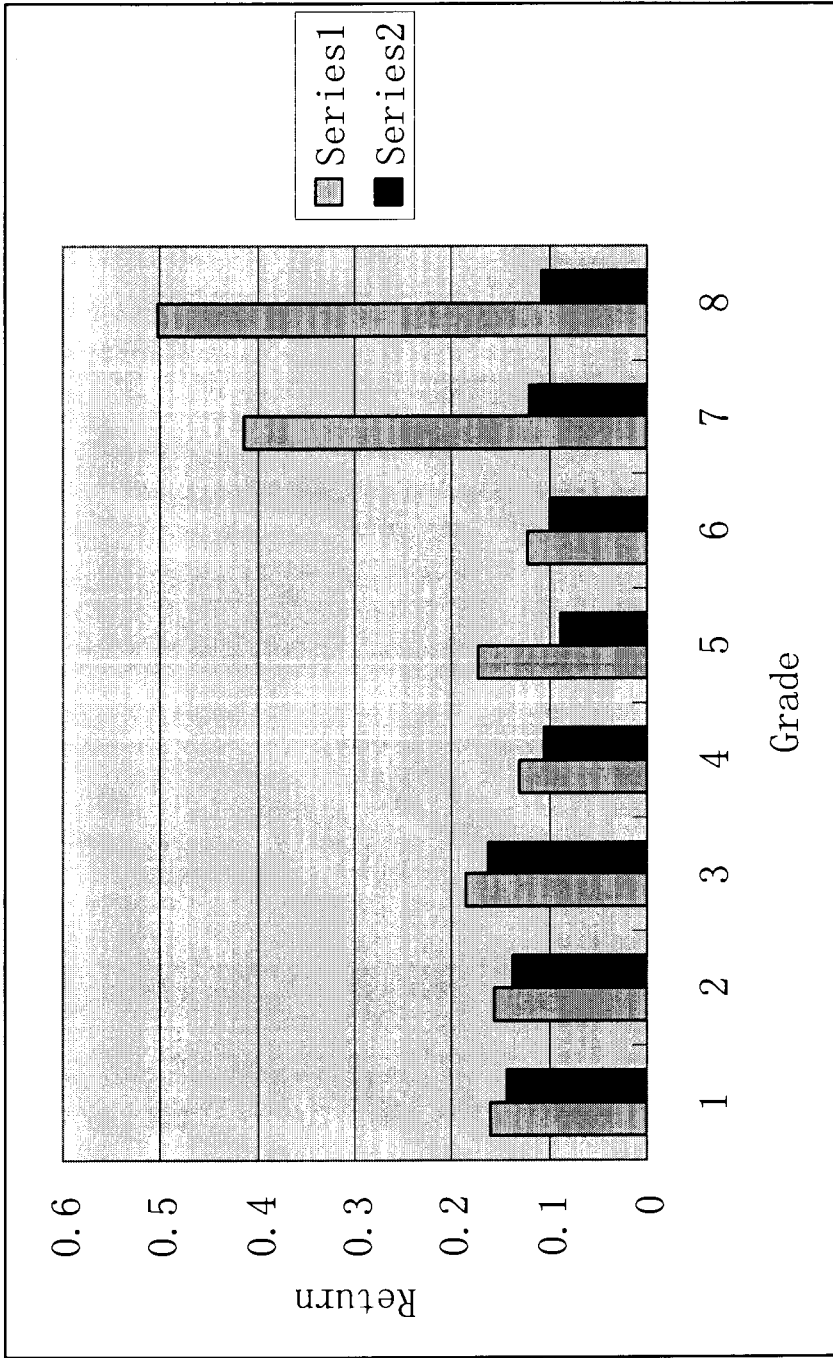


Figure 11. Total Return to Completed Years of Education for Chinese Immigrants Age group 2

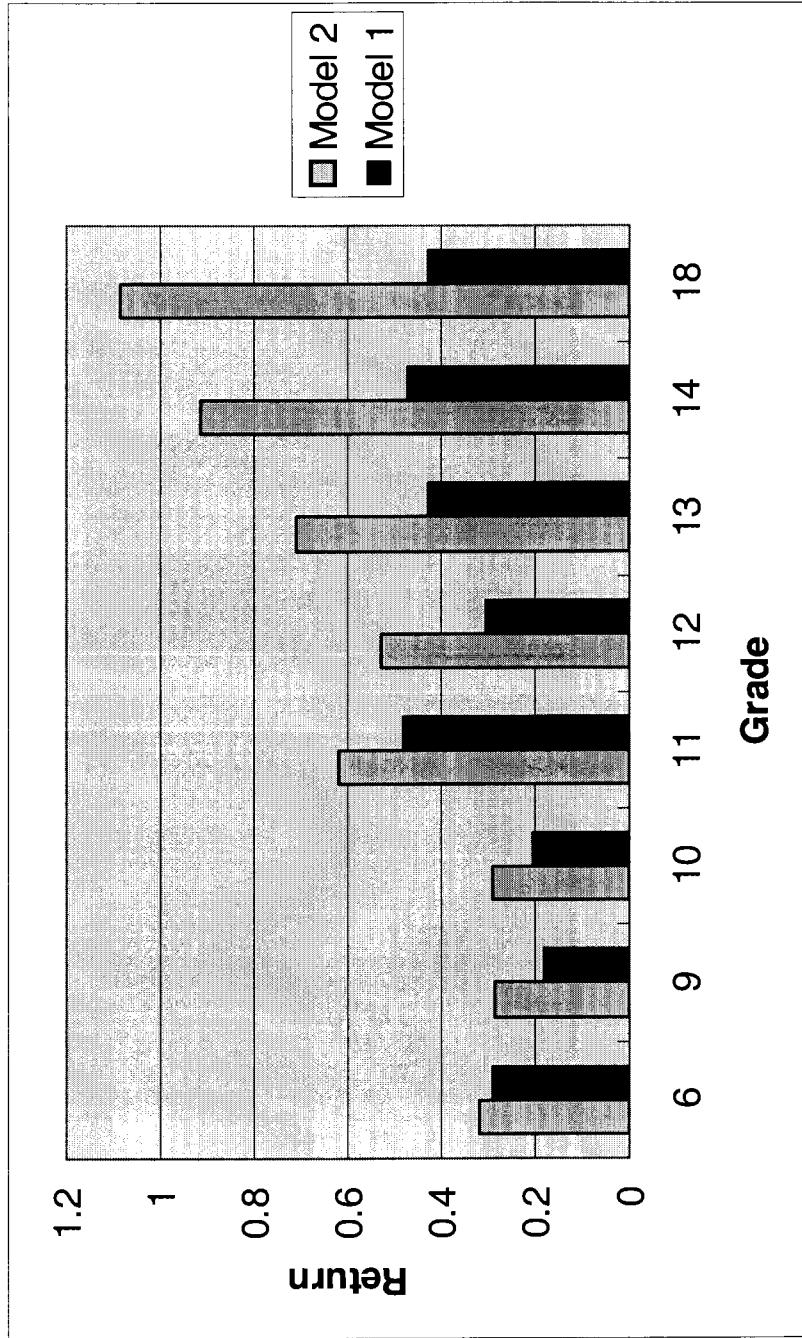
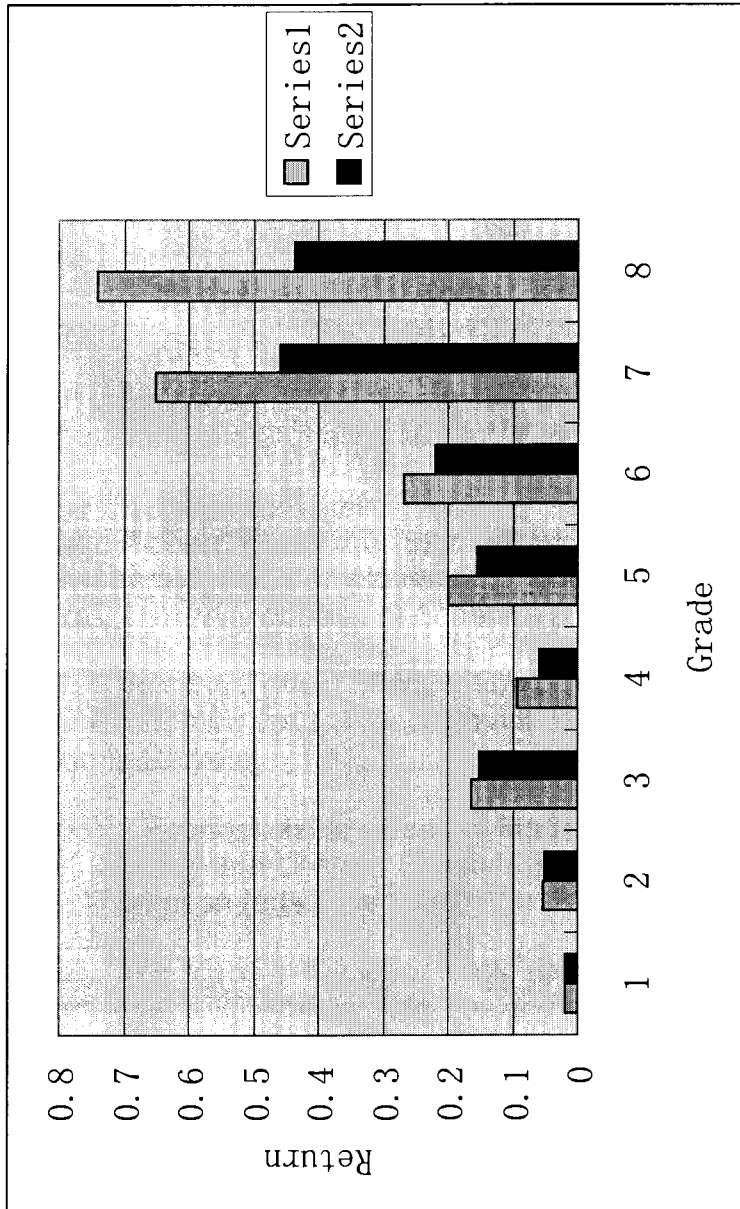


Figure 12. Total Return to Completed Years of Education for Chinese Immigrants Age Group 3



REFERENCE

- Aigner, D. and Cain, G. 1977, "Statistical theories of discrimination in the labor market". *Industrial and Labor Relations Review* 30(2): 175-187.
- Ana M. Ferrer and W. Craig Riddell. 2002, "The Role of credentials in the Canadian Labor Market", *Canadian Journal of Economics* 35 (4):879-905.
- Belman, D. and J. Heywood. 1991, "Sheepskin effects in the returns to education: an examination of women and minorities". *Review of Economics and Statistics* 73 (4): 720-724.
- Belman, D. and J. Heywood. 1997, "Sheepskin effects by Cohort: Implications of Job Matching in a Signaling Model". *Oxford Economics Paper*, 49: 623-637.
- Bound, John, and Richard Freeman, 1992, "What went wrong? The erosion of relative earnings and employment among young black men in the 1980's", *Quarterly Journal of Economics*, 107: 201-232.
- Card, D., 1999. "The causal effect of education on earnings", *the Handbook of Labor Economics vol.1.3*. Department of Economics, University of California-Berkeley.
- Dalziel, P. (1991), " Economists' analyses of Maori economics experience: 1959-1989", *Society and Culture: Economics Perspectives*, J. Whitwell and M. A. Thompson (eds.), pp 193-217.
- Easton, B. 1995, "The Maori in the labor force". In P.S. Morrison (ed) *Labor, Employment and Work in New Zealand* Wellington: Victoria University of Wellington, pp.206-213.
- Heywood, J.S. 1994, "How widespread are sheepskin returns to education in the U.S.", *Economics of Education Review*, 13: 227-234.

- Hungerford, T. and Solon, G. 1987, "Sheepskin effects in the returns to education". *Review of Economics and Statistics* 69(1): 175-178.
- Jaeger, D. and Page, M. 1996, "Degrees mater: new evidence on sheepskin effects in the returns to education", *Review of Economics and Statistics* 78(4): 733-739.
- Layard, R. and Psacharopoulos, G. 1974, "The screening hypothesis and the returns to education", *Journal of Political Economy*, 82: 985-998
- Park, J. 1999, "Estimation of sheepskin effects using the old and new measures of educational attainment in the Current Population Survey", *Economics Letters* 62(3): 237-240.
- Patrinos, H. 1996, "Non-linearities in the returns to education: sheepskin effects or threshold levels of human capital", *Applied Economics Letters* 3(3):171-173.
- Riley, J. 1979, "Testing the educational screening hypothesis", *Journal of Political Economy*, 87 (5): S227-S252.
- Spence, A.M., 1974, "Market signaling: Information transfer in hiring a related a related processes", Cambridge: Harvard University press.