

Education-occupation Mismatch for Canadian University Graduates

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Abstract

This paper uses logit models to examine the probability of education-occupation match for Canadian university graduates. Data from the 2005 and 2013 National Graduates Surveys are employed to examine the correlates of and trends in education-occupation mismatch for Canadian university graduates. The data indicate that a majority of graduates found jobs that were highly related to their education, even though there is a decrease in the probability of achieving education-job match in 2013 as compared to 2005.

The empirical results show that education-occupation match is mainly influenced by what graduates studied in their university program and how graduates performed in the program. With respect to employment characteristics, some indicators have statistically significant effects on the probability of a match. With respect to social characteristics, most indicators do not matter very much for education-occupation match in the 2005 National Graduates Survey. However, in the 2013 National Graduates Survey, more socio-demographic characteristics have statistically significant effects on education-occupation match, especially age and gender.

Keywords: Education-occupation match/mismatch, National Graduates Survey, Logit model

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1. Introduction

In Canada, a high percentage of individuals obtain a post-secondary degree. In addition, more and more students consider the correlation between field of study and occupation when they choose their university program. The cost of and return to post-secondary education are important for society and graduates. If there is a high probability of university graduates experiencing education-occupation mismatch, the efficiency of social and educational resources will be low. Furthermore, since the global recession in 2008, the Canadian labour market has been underperforming. According to the Labour Market Assessment 2014 (Canada Parliamentary Budget Officer, 2014), most labour market indicators are still below trend. This may affect the education-occupation match of recent university graduates dramatically. Finally, education-occupation mismatch is associated with many other issues: employees' job satisfaction, unemployment and human capital investment, etc.

There are two main types of education-occupation mismatch. The first one involves the relationship between the *field of study* and the occupational category. If the field of study of a graduate is not related to the graduate's occupation, there is an education-occupation mismatch. The second type concerns the relationship between *the level of education* and the occupational requirement. If the level of education of an individual is higher or lower than the required level for the individual's occupation, there is an education-occupation mismatch.

Many studies focus on the second type of education-occupation mismatch and relate education-occupation mismatch to the level of education and human capital indicators (Quinn and

Rubb, 2005; Tani, 2012; Sharif and Dar-Brodeur, 2013; Mavromaras et al., 2013). Some studies focus on the first type of mismatch, which is a mismatch between field of study and occupation (Woblers, 2003; Garcia-Espejo and Ibanez, 2006; Robst, 2007; Nordin et al., 2010; Boudarbat and Chernoff, 2012; Bender and Roche, 2013). This paper considers the first type of education-occupation mismatch.

The first purpose of this paper is to determine the effect of the characteristics of university graduates on education-occupation match. The second purpose of this paper is to examine recent trends in education-occupation match. To meet these objectives, one must first choose a measure of education-occupation match/mismatch. There are three main types of measure of education-occupation match/mismatch – Job Analysis, Worker Self-Assessment and Realized Matches (Hartog, 2000). In this paper, which uses data from the 2005 and 2013 National Graduates Surveys, the Worker Self-Assessment method is used, because the data sets include information on the respondents' opinions of their education-occupation match. In particular, individuals can describe their occupation as closely related, somewhat related or not related to their education. In order to examine recent trends, this paper compares results from the 2005 and 2013 surveys.

In addition, my analysis is based on Boudarbat and Chernoff (2012) who use the master file of the Follow-up Survey of Canadian Graduates – Class of 2000 (FOG), which was carried out in 2005, to study the determinants of education-job match of university graduates. For purposes of comparison, I choose a model as similar as possible to the model of Boudarbat and Chernoff (2012). In addition, I choose a reference individual as similar as possible to the reference individual of Boudarbat and Chernoff (2012). These choices facilitate comparisons between my results for 2005

and those of Boudarbat and Chernoff (2012). Because I am using data from the same survey, differences between my results and theirs likely derive from differences between the public use file and the master file. Meanwhile, I can draw conclusions about the determinants of education-occupation match.

The first results of this paper derive from a descriptive summary of the data. In the public use file of the 2005 National Graduates Survey, about 71.4% respondents indicate that their jobs are closely related to their education. In Boudarbat and Chernoff (2012), about 64.9% respondents say that their occupation is closely related to their education. The difference between these two numbers can be attributed to differences between the master file and the public use file. In the public use file of the 2013 National Graduates Survey, the proportion of respondents who think that their jobs and education are closely related drops to about 65.9%. These results show that a high proportion of university graduates achieve education-occupation match. In addition, the predicted probability that the reference individual will achieve a match in the 2013 National Graduates Survey is lower than in the 2005 National Graduates Survey. This indicates that it was harder for university graduates to achieve an education-job match in 2013 than in 2005.

With respect to education characteristics, most characteristics have statistically significant effects on education-occupation match. According to the empirical results, education-occupation match is mainly influenced by what graduates studied in their university program and how graduates performed in the program. However, there are some changes in the 2013 National Graduates Survey results as compared to the 2005 National Graduates Survey results.

With respect to employment characteristics, some indicators have statistically significant effects

on education-occupation match in both the 2005 National Graduates and the 2013 National Graduates Survey.

However, most socio-demographic characteristics do not affect education-occupation match very much, especially in the 2005 National Graduates Survey. In the 2013 National Graduates Survey, age and gender do have statistically significant effects on education-occupation match.

The remainder of this paper is organized as follows. In the second section, this paper provides a literature review of previous studies on the topic of education-occupation match/mismatch. The data are described in the third section of the paper, which provides detailed information on the data sets as well as summary statistics. In the fourth section, the econometric model is presented. The empirical results are discussed in the fifth section of the paper. The final section summarizes the conclusions of my research.

2. Literature review

Education-occupation match/mismatch is a subject that has inspired much economic research recently. The main topics of this research are the determinants of education-occupation match and the consequences of education-job mismatch. Different studies use different measures of education-occupation mismatch. In addition, the data sources and econometric models vary from paper to paper. Therefore, the results of different studies are specific to their particular empirical analysis.

2.1 The measurement of education-occupation mismatch

The definition of education-occupation mismatch differs from study to study. However, there are three main types of definition – Job Analysis, Worker Self-Assessment and Realized Matches (Hartog, 2000). Job Analysis is a method that depends on the classification of jobs by professional job analysts. Job analysts classify the matched and mismatched fields of study in every occupational category. Worker Self-Assessment is a method that relies on the opinions of workers. For example, in the questionnaire of the Canadian National Graduates Survey, there is a question about the respondent's opinion of the correlation between their education and their job. Finally, Realized Matches is a method that depends on the required educational attainment of workers in every occupational category. The required educational attainment is defined to be the average or mode of the actual education levels of workers in specified occupational categories. If the educational attainment of the individual corresponds to the required educational attainment, this individual is considered to have an education-occupation match.

The definition that economists use in their studies depends on their data sources and their research methodologies. Wolbers (2003) and Nordin et al. (2010) use the Job Analysis method to define education-occupation mismatch. Some studies use the definition of Worker Self-Assessment (Garcia-Espejo and Ibanez, 2006; Robst, 2007; Boudarbat and Chernoff, 2012; Tani, 2012; Sharif and Dar-Brodeur, 2013; Bender and Roche, 2013). Quinn and Rubb (2005) and Mavromaras et al. (2013) use the method of Realized Matches to define education-job mismatch.

In addition, as noted in the introduction, there are two types of education-occupation mismatch. The first type involves the relationship between the field of study and the occupational category

(Wolbers, 2003; Garcia-Espejo and Ibanez, 2006; Robst, 2007; Nordin et al., 2010; Boudarbat and Chernoff, 2012; Bender and Roche, 2013). If the field of study of an individual is not related to his/her occupation category, the individual is deemed to be experiencing education-occupation mismatch. The second type concerns over-education and under-education (Quinn and Rubb, 2005; Tani, 2012; Sharif and Dar-Brodeur, 2013; Mavromaras et al., 2013). If the education level of an individual is higher than the requirement of his/her occupation, this individual is deemed to be over-educated. If the level of study is lower than the requirement of the job, the person is in a situation of under-education.

2.2 Data and methodology of studies

Among studies of education-occupation match/mismatch, some papers focus on the determinants of education-occupation match/mismatch. In these studies, education-occupation match/mismatch is always regarded as the dependent variable, and this dependent variable is always a dummy variable or categorical variable. In addition, all the determinants are the explanatory variables in the empirical models of these studies (Wolbers, 2003; Garcia-Espejo and Ibanez, 2006; Robst, 2007; Boudarbat and Chernoff, 2012; Bender, and Roche, 2013; Sharif and Dar-Brodeur, 2013). Thus, in these studies, the logit model or probit model (binary or ordered) is usually considered to be the econometric model of the studies.

Other papers not only consider the determinants of education-job match/mismatch, but also focus on the consequences of education-occupation mismatch. In studying the consequences, education-occupation mismatch is regarded as an explanatory variable (Wolbers, 2003; Robst, 2007;

Nordin et al., 2010; Bender and Roche, 2013; Mavromaras et al., 2013; Sharif and Dar-Broder, 2013). In these studies, researchers usually use a linear wage regression as their econometric model. In addition, some papers regard education-occupation mismatch as an individual characteristic when considering other topics, such as immigration (Quinn and Rubb, 2005; Tani, 2012). The data sources and econometric models of the studies reviewed in this section are summarized in Table 1.

2.3 Education and mismatch

The relationship between education and mismatch is one of the most important aspects of this topic. Most studies focus on the educational characteristics of the education-occupation match – particularly the level of education, the fields of study and the grades attained during study. Wolbers (2003) finds that the level of education has a positive effect on the education-job match in Europe. Robst (2007) also obtains the same result for education level in the US. In Boudarbat and Chernoff (2012), level of education is one of the most significant determinants of education-job matches in Canada. The higher the level of education of university graduates, the better the match the graduates have. However, for self-employed workers in the US, the education-occupation mismatch decreases when the workers have a higher level of education (Bender and Roche, 2013).

With respect to field of study, Garcia-Espejo and Ibanez (2006) find that better matches appear in the field of technical studies in Spain. Robst (2007) considers the relationship between field of study and occupation of college graduates in the United States, and finds that health professions have the lowest probability of mismatch. Robst (2007) also finds that occupation is more closely related to education if the field of study provides more specific knowledge and skills for jobs. In addition,

Boudarbat and Chernoff (2012) find that the health sciences have the highest education-occupation match in Canada. It is easier for graduates to find corresponding jobs if the college majors of these graduates provide more occupational knowledge and skills (Garcia-Espejo and Ibanez, 2006; Robst, 2007; Boudarbat and Chernoff, 2012). Moreover, this result applies to school-leavers in Europe as well (Wolbers, 2003).¹

In Garcia-Espejo and Ibanez (2006), high grades are found to increase the education-job match for university graduates in Spain. Boudarbat and Chernoff (2012) find that grades have a similar effect on the education-occupation match in Canada. University graduates who attain higher grades during schooling have a higher possibility of education-job match.

2.4 Employment and mismatch

The employment characteristics associated with mismatch and the consequence of mismatch are other important aspects of the topic of education-occupation match. While some studies focus on job characteristics that can be indicators of education-job match, other papers focus on the results and effects of education-occupation mismatch. Wolbers (2003) shows that full-time jobs and job tenure are positively related to job match in Europe. Meanwhile, individuals who have been unemployed for a long time have a higher probability of job mismatch. Boudarbat and Chernoff (2012) also find that full-time jobs are positively related to education-occupation match in Canada.

Nordin et al. (2010) show that an income penalty exists as a result of education-occupation

¹ Wolbers (2003) defines school-leavers as “individuals who are 15 to 35 years old, who have left initial education within the past five or ten years” (p. 253). He further excludes graduates from lower and upper secondary programs, and those whose tertiary program was general in nature.

mismatch in Sweden. In addition, Sharif and Dar-Brodeur (2013) find that there are earnings penalties for educational mismatches among all groups of individuals in Canada. For US self-employed workers, the income penalty of education-occupation mismatch is much greater than the income penalty for salaried workers (Bender and Roche, 2013). However, Mavromaras et al. (2013) observe that there is no significant income penalty for over-educated male graduates in Australia.

Considering the consequences of education-occupation mismatch, Europeans who have job matches have higher job satisfaction than those who have job mismatches (Wolbers, 2003). Garcia-Espejo and Ibanez (2006) also show that Spanish graduates who have education-job matches have better labour market achievements, especially with respect to the occupational hierarchy, the acquisition of job skills, and job satisfaction. The income level of people who are mismatched is lower than the level of people who have education-occupation matches (Garcia-Espejo and Ibanez, 2006; Robst, 2007; Nordin et al., 2010). In addition, Robst (2007) finds that people who are completely mismatched suffer larger wage effects than people who are only partially mismatched in the United States. Similarly, the earnings of US self-employed matched workers are much higher than the earnings of the salaried matched workers (Bender and Roche, 2013). However, Mavromaras et al. (2013) find that over-education has no significant influence on job satisfaction and job mobility in Australia. Mavromaras et al. (2013) suggest that being over-skilled, combined with over-education, has a negative wage effect for male university graduates.

2.5 Socio-demographic characteristics and mismatch

Socio-demographic characteristics are the third important focus of research on education-occupation match. In this area, the emphasis is often on gender discrimination, racial discrimination, and immigration. Wolbers (2003) shows that job mismatches more often appear for males than females in Europe. Similarly, Robst (2007) finds that women have a higher probability of education-occupation match than men in the United States. With respect to foreign-born individuals, in Canada foreign-born female individuals have a higher probability of being over-educated and a lower probability of being under-educated than male foreign-born individuals (Sharif and Dar-Brodeur, 2013).

With respect to other socio-demographic characteristics, Robst (2007) observes that disabled and unmarried university graduates are more likely to be mismatched in the United States. Bender and Roche (2013) find that age has a negative effect on education-job match in the US. However, some papers find that social characteristics – age, gender and work experience – have no significant effect on education-occupation mismatch (Nordin et al., 2010; Boudarbat and Chernoff, 2012).

Racial differences have also been found to have an effect on education-job mismatch in the United States (Robst, 2007). Boudarbat and Chernoff (2012) show that immigrants have a higher probability of suffering from education-occupation mismatch in Canada. Sharif and Dar-Brodeur (2013) also find that the probability of being over-educated for foreign-born individuals is higher than that for native-born individuals in Canada. Bender and Roche (2013) confirm that Asian workers are more likely to experience education-job mismatch than white workers in the United States. Furthermore, Tani (2012) finds that female immigrants who have limited education and

experience have a higher likelihood of education-occupation mismatch in Australia. Considering the effect of education-occupation mismatch on immigration, Quinn and Rubb (2005) suggest that Mexican people who are over-educated have a higher possibility of migrating to the US to achieve a better match. Nevertheless, immigrants who face education-occupation mismatch in their home country are more likely to experience the same mismatched situation in Australia (Tani, 2012).

2.6 Conclusion of the literature review

According to the studies I mentioned above, the most important focus of this research is to determine the factors correlated with education-occupation mismatch. Some papers focus on education and employment characteristics while other articles focus on other socio-demographic characteristics. Thus I want to combine education, employment and socio-demographic characteristics together in my research on education-occupation mismatch. However, there are few studies considering the situation of Canada. In addition, few studies consider the variations in education-occupation mismatch over time. Therefore, I will use Canadian data to examine the changes in education-job mismatch.

3. Data

The data that this paper use come from the Canadian National Graduates Survey. Specifically, it uses two different datasets from two different survey years – 2005 and 2013. The Canadian National Graduates Survey was carried out to consider the labour market situations of postsecondary graduates and university graduates. It includes information on education, employment and the social

background of the graduates. The respondents of the 2005 National Graduates Survey are graduates who completed their programs in 2000; the 2013 National Graduates Survey considers the graduates of the academic year 2009-2010.

3.1 2005 National Graduates Survey

In order to draw comparisons with Boudarbat and Chernoff (2012), this paper uses the public use file of the 2005 National Graduates Survey. Statistics Canada conducted this survey in 2005. It is a follow-up to the 2002 National Graduates Survey. This survey investigates the education and occupational situation of postsecondary graduates who received their degrees in calendar year 2000. The main purpose of this survey is to discover the relationship between graduates' postsecondary programs and their employment conditions – such as career satisfaction, unemployment, job qualification requirements. Every graduate in this survey is interviewed twice. The first interview is two years after graduation, and the second is five years after graduation. The total number of observations in this public use file is 11,200, which is much smaller than sample size of the master file of this survey. The number of observations in the master file is 34,304. The FOG master file is used by Boudarbat and Chernoff (2012).

Because this paper wants to consider the relationship between the programs of study and graduates' occupations, I have to impose some restrictions to assemble the sample dataset. In order to compare with the results of Boudarbat and Chernoff (2012), I impose the same restrictions as they do. Firstly, since Boudarbat and Chernoff (2012) consider the education-occupation mismatch among university graduates only, I exclude the 3,355 individuals with less than a Bachelor's degree.

Secondly, since I want to do research on the mismatch of educational programs and occupations, I choose only those graduates who held jobs the week before the interview. As a result, 827 more observations are lost. Furthermore, I choose only graduates who have received no additional education since 2000, which excludes 3,217 observations. Finally, I have to exclude all observations with missing values for the key variables to get a suitable sample dataset for my analysis, leading to the loss of 1,350 observations. The final sample size is 2,451 observations.

The summary statistics for the sample are presented in Table 2. According to Table 2, there is about a 71.4% probability that graduates have jobs that are closely related to their education, as indicated by the sample mean of “closely related” at the bottom of the table.

There are three main categories of individual characteristics included in the dataset. The first category is education characteristics. With the respect to field of study, graduates in *Architecture, engineering and related technologies (Engineering)* account for 19.2% of the sample, which is the biggest of all educational programs. The next most common programs are *Health, parks, recreation and fitness (Health sciences)* and *Business, management and public administration (Business)*, which account for 15.7% and 14.7% respectively. Additionally, graduates in *Visual and performing arts and communication technologies (Arts)* constitute the smallest group – only about 2.9% of the sample.

With aspect to level of education, about 73.4% of the graduates in the sample have a Bachelor’s degree only. Furthermore, 62.7% of graduates think that their grades are in the top 10% to top 50% of all students. Before beginning their programs of study, 50.9% of the graduates were in school. About 35.0% of the respondents in the sample worked before entering university. Among all the graduates, about 72.1% were full-time students while attending university.

The second category is employment characteristics. According to Table 2, about 93.0% of graduates in the sample have full-time jobs, and about 92.2% have permanent jobs. The most popular way for graduates to find a job is contacting the employer directly. This method was used by 27.1% of respondents.

The third category of variables is socio-demographic characteristics. Looking at gender, female graduates constitute about 55.7% of all observations. With respect to age groups, graduates under thirty constitute the most important age group. Other detailed statistical information is also provided in Table 2.

3.2 2013 National Graduates Survey

In order to examine recent trends in education-occupation mismatch, this paper also uses the public use file of the more recent 2013 National Graduates Survey – Class of 2009-2010. Statistics Canada conducted this survey in 2013. This survey focuses on the education and occupational situations of postsecondary graduates who completed their studies in 2010. The main purpose of this survey is also to discover the relationship between graduates' postsecondary programs and their employment conditions – such as job and career satisfaction, unemployment, and job qualification requirements. Every graduate in this National Graduates Survey was interviewed three years after graduation. The targeted population is graduates from Canadian public postsecondary education institutions who finished their programs during the academic year 2009-2010. The total number of observations in this public use file is 14,745.

In order to compare with the results from the 2005 National Graduates Survey, I impose the same

restrictions as on the 2005 data file. Firstly, I exclude individuals with less than a Bachelor's degree. Secondly, I choose those graduates who held jobs the week before the interview. In addition, the graduates in my sample have no additional education after graduation. Finally, I exclude all observations with missing data.

The summary statistics for this sample are included in Table 3. There are 4,075 observations in the 2013 sample. According to Table 3, 65.9% of graduates had found jobs that were closely related to their education, which is a smaller proportion than in the 2005 sample.

There are similarities and differences between the two samples among the three categories of individual characteristics. In the category of education characteristics, graduates who obtain Bachelor's degrees constitute the largest group in both samples. In both samples, most graduates were in school before entering their programs. In addition, the second largest group of graduates went to work before beginning their program of study. With respect to study status, in 2013 77.1% of graduates were full-time students while attending their program, which constitutes the largest group in the sample. It is the same situation as in the 2005 sample.

With respect to field of study, there are some differences between the two samples. In 2013, graduates in *Business, management and public administration (Business)* accounted for 16.2% of the sample, which constituted the largest group of the sample. However, this group of graduates constituted the third largest group in 2005. Additionally, the second most common program was *Architecture, engineering and related technologies (Engineering)* in 2013, which constituted 15.2%. In 2005, this group of graduates accounted for 19.2%, which was the biggest of all fields of study. With respect to the field of *Visual and performing arts and communications technologies (Arts)*,

graduates in this field constitute the smallest group in both samples.

In the category of employment characteristics, there are again some similarities and differences between the two samples. With respect to the method for obtaining employment, the most popular way for graduates to find their job is through job advertisements. This method was used by 35.9% of respondents in 2013. However, this method was the second most common method of finding a job in 2005. According to Table 3, about 92.8% of graduates have full-time jobs, and about 84.5% of graduates have permanent jobs. Thus graduates who hold permanent jobs account for a smaller proportion of the 2013 sample than of the 2005 sample. The situation with respect to full-time jobs is similar in the two samples.

In the category of socio-demographic characteristics, female graduates constitute about 56.3% of the 2013 sample. With respect to age groups, the categories provided are different in the 2013 data set. Graduates under twenty-eight constitute the most important age group. Other detailed statistical information is also provided in Table 3.

4. Econometric model

Since one purpose of my paper is to draw comparisons with the work of Boudarbat and Chernoff (2012), the model for the 2005 National Graduates Survey should be as close as possible to theirs. In Boudarbat and Chernoff (2012), the basic model is the binary logit model, even though the dependent variable has three categories in the data set. Since a large proportion of respondents indicate that their jobs are closely related to their education, it is better to combine “somewhat related” and “not related” together to be one category. Thus this paper also uses the binary logit

model. The analysis with the 2013 National Graduates Survey is also based on the same econometric model. However, because the 2013 National Graduates Survey contains more detailed information for some variables than the 2005 National Graduates Survey, there are some differences between the first and second econometric models.

The basic econometric model takes the logit model form

$$y_i^* = x_i' \alpha + w_i' \beta + z_i' \gamma + r_i' \eta + \varepsilon_i \quad (1)$$

$$y_i = \begin{cases} 1, & \text{if } y_i^* > 0 \\ 0, & \text{if } y_i^* \leq 0 \end{cases} \quad (2)$$

where y_i^* is the unobservable variable and y_i is the observed variable. y_i is a binary variable that equals one if education and occupation are closely matched and zero otherwise for individual i . x_i' is a vector of educational characteristics for individual i . w_i' is a vector of employment characteristics for individual i . z_i' is a vector of socio-demographic characteristics of individual i . r_i' represents additional control variables, and ε_i is a random error term. Each group of variables is discussed in turn below.

4.1 Education characteristics

The education variables reflect five aspects of an individual's education – field of study, level of education, grades, the major activity before university education and study status (full- or part-time). All five aspects are included in Boudarbat and Chernoff (2012). Using these five aspects, this paper can gain a comprehensive understanding of every individual's education characteristics.

For field of study, there are nine dummy variables. Each variable equals one if individual i is in

this field of study and equals zero otherwise. Additionally, the reference field is *Social and behavioral sciences and law (Social sciences and law)*. In Boudarbat and Chernoff (2012), the fields *Visual and performing arts and communication technologies (Arts)* and the field *Humanities* have significant negative coefficients. In addition, other statistically significant fields are expected to have positive coefficients as in Boudarbat and Chernoff (2012).

For level of education, there are two categories – *Bachelor's degree* and *Above Bachelor's degree*. Since *Bachelor's degree* is the reference category, there is just one binary variable in the model – *Above Bachelor's degree*. It equals one if individual *i* has this achieved this level of education and equals zero otherwise. According to Boudarbat and Chernoff (2012), this variable should have a positive coefficient.

In the model for the 2005 National Graduates Survey, there are two binary variables related to grades – *Top10%-50%* and *Below 50%*. Meanwhile, the reference variable for grades is a binary variable for the *Top 10%*, which equals one if individual *i* has grades in the top 10% of the class and equals zero otherwise. For the model of the 2013 National Graduates Survey, there are three binary variables related to grades – *Top 10%-25%*, *Top 25%-50%* and *Below 50%*. Again, the reference variable is a binary variable for the *Top 10%*. Since higher grades should lead to better results with respect to education-occupation match, the expected sign of the coefficients of all these variables is negative in both models.

To represent the major activity before beginning a university program, I include three binary variables in the model – *Going to school*, *Working* and *Working and going to school*. *Going to school* equals one if the individual is attending school and not working prior to beginning a university

program and equals zero otherwise; *Working* equals one if the individual is working and not attending school before beginning a university program and zero otherwise; *Working and going to school* equals one if the individual is both attending school and working before entering university and zero otherwise. The reference variable is *Not working or going to school*, which equals one if individual *i* is neither going to school nor working before the program and equals zero otherwise. According to Boudarbat and Chernoff (2012), the coefficients of all three variables have negative signs.

The last group of educational characteristics is related to study status. Two binary variables are included in the model: *Part-time* and *Mix of full-time and part-time*. In addition, the reference variable is *Full-time*, which equals one if individual *i* is a full-time student during the period of education and equals zero otherwise. Unfortunately, the categories of these variables in the public use file are more limited than the categories in the master file. Therefore, there are fewer variables related to study status in my models than in the model of Boudarbat and Chernoff (2012). In addition, the expected sign for the coefficients of these variables should be negative according to Boudarbat and Chernoff (2012).

4.2 Employment characteristics

The employment characteristics variables reflect three main aspects of employment – methods used to find the current job, employment status and permanence of employment. All these variables are the same as the variables used by Boudarbat and Chernoff (2012).

For the methods used to obtain jobs, there are six main binary variables in the model – *Job*

advertisement, *Contact employer directly*, *Campus placement agency*, *Employment agency*, *Head hunter* and *Other method*. Each variable equals one if individual i used the method to find the job and equals zero otherwise. The reference variable is the method *Referred by family, friends or teachers (Referred by others)*, which equals one if individual i found the job using this method, and zero otherwise. According to Boudarbat and Chernoff (2012), only the method *campus placement agency* has a statistically significantly positive coefficient.

Among the employment status variables, the variable *Full-time job* is included in the model. This variable equals one if the job of individual i is a full-time job and equals zero otherwise. In addition, the variable *Permanent job* included in the model indicates whether the job is permanent or temporary. This variable is a binary variable that equals one if the job of individual i is permanent and equals zero otherwise. These employment characteristic variables are the same in the models for the 2005 National Graduates Survey and the 2013 National Graduates Survey. Additionally, the variables in my models are the same as the variables in the model of Boudarbat and Chernoff (2012). The expected sign of their coefficients is positive.

4.3 Socio-demographic characteristics

The included socio-demographic variables reflect five main characteristics: age, gender, student loan, father's education and mother's education. The first three characteristics reflect the social backgrounds of the graduates, while the last two characteristics reflect the family background of the graduates.

In the public use file, the age variable has four categories, whereas it is a continuous variable in

the master file. Thus, there are three binary variables for age groups in my model, instead of the continuous age variable in the model of Boudarbat and Chernoff (2012). Each variable equals one if individual i is in that age group and equals zero otherwise. In the model of the 2005 National Graduates Survey, the age groups are *30 to 34*, *35 to 44* and *45 or more*, while the reference category is the age group *Less than 30*. In the model of the 2013 National Graduates Survey, the age group variables are *28 to 32*, *33 to 42* and *43 or more*, while the reference age group is *Less than 28*. Because the intervals between survey year and graduation year are different in the 2005 and 2013 National Graduates Surveys, the age groups of the two models are different. In Boudarbat and Chernoff (2012), the coefficient of age is not statistically significant.

The gender variable in my models is a binary variable – *female*, which equals one if individual i is female and equals zero otherwise. If the sign of this variable is positive, it implies that female graduates have a higher probability than male graduates of achieving education-occupation match. In addition, the variable *student loan* is a binary variable, which equals one if individual i received a student loan and equals zero otherwise.

The next two socio-demographic variables relate to the education of the parents. In the model of Boudarbat and Chernoff (2012), there is just one variable combining the education level of graduates' parents. But I include separate variables related to the education level of the father and mother of individual i in my models. However, the education level categories of my models are simpler than those used by Boudarbat and Chernoff (2012). In the 2005 National Graduates Survey, the categories are *Trade/vocational diploma, college or CEGEP* and *University diploma, certificate or degree*. The reference variable is the category *No post-secondary education*. In the 2013 National Graduates

Survey, the categories are the same as in the 2005 National Graduates Survey. All these variables are binary variables, which equal one if the parent of individual i has attained that education level and zero otherwise. Additionally, the variable *Immigrant* is included in the model of Boudarbat and Chernoff (2012). However, my models do not include this variable because the public use files of the 2005 and 2013 National Graduates Surveys do not provide this information.

4.4 Control variables

In the model of Boudarbat and Chernoff (2012), control variables include the province of employment of individual i , industry, and marital status. Because of the differences between the public use file and the master file of the 2005 National Graduates Survey, I can only include industry and marital status variables as control variables in my model. Industry is represented by a set of binary variables. There are six industry dummies in the model. Every variable equals one if individual i is employed in this industry, and zero otherwise. In addition, the variable *married* is also a binary variable that equals one if individual i is married and zero otherwise. Since the 2013 National Graduates Survey also only contains information on industry and marital status, the control variables are the same as in the model for the 2005 National Graduates Survey. Because these variables are not central to my analysis, they are not included in any of the tables.

5. Empirical results

According to Table 2, in the sample obtained from the public use file of the 2005 National Graduates Survey about 71.4% of graduates respond that their jobs are closely related to their

education. According to Boudarbat and Chernoff (2012), in the master file of the 2005 National Graduates Survey about 64.9% of graduates answer that their occupations and their education are closely related. In addition, as Table 3 shows, about 65.9% of graduates think that their jobs and their education are closely related in the sample obtained from the 2013 National Graduates Survey. All these results show that on average, most graduates do find jobs that are closely related to their field of study and their level of education. The econometric analysis that follows will provide some insight into which characteristics are associated with a higher probability of a match. In the remainder of this section, I first discuss the results for the 2005 National Graduates Survey. Then I turn to the results for the 2013 National Graduates Survey, highlighting the similarities and differences between the two sets of results.

5.1 2005 National Graduates Survey

Table 4 shows the logit coefficient estimates for the 2005 National Graduates Survey, while Table 5 presents the marginal effects for the reference individual of the 2005 National Graduates Survey. Since Boudarbat and Chernoff (2012) do not compute the marginal effects, this paper can only compare the logit model coefficient estimates of the sample with those of Boudarbat and Chernoff (2012). In addition, because Boudarbat and Chernoff (2012) use the master file and this paper uses the public use file, the differences between the results are likely due to the differences between the data sets. The results from Boudarbat and Chernoff (2012) may be more precise, because the master file contains more observations and information. The number of observations in the public use file is about one third of the sample size of the master file.

The predicted probability that the reference individual will obtain a close education-occupation match is 44.6%, which is statistically significant at the 1% level. As in Boudarbat and Chernoff (2012), the reference individual is a male respondent who graduated from the field *Social and behavioral sciences and law (Social sciences and law)* and obtained a Bachelor's degree. His grade is in the top 10% of the class, and he neither worked nor went to school before entering the program. The reference individual was a full-time student during the program. He was referred by others to obtain his job. However, his job is neither a full-time job nor a permanent job. This graduate is less than 30 years old. He has a student loan. In addition, the education background of his parents is less than post-secondary education. Since the predicted probability of the reference individual is lower than the sample average of a close education-occupation match, some characteristics of the reference individual may not correspond to the average characteristics of the sample respondents.²

5.1.1 Education characteristics

Among the education characteristics, field of study has a significant influence on education-job match. Compared with the reference field of study -- *Social and behavioral sciences and law (Social sciences and law)*, the field *Health, parks, recreation and fitness (Health sciences)* has the largest coefficient and the largest marginal effect, which means that it is the most likely to lead to education-occupation match. This is the same as the result of Boudarbat and Chernoff (2012). Robst (2007) also finds that health professions have the lowest probability of mismatch in the United States. The probability of a match in the field *Health sciences* is 27.5 percentage points higher than for the

² Any small differences between my reference individual and that of Boudarbat and Chernoff (2012) are due to the non-availability of certain categories in the public use file.

reference person in the field *Social sciences and law*. Furthermore, this marginal effect is statistically significant at the 1% level. In addition, if the field of study of the reference individual were *Mathematics/computer/information sciences*, his probability of education-job match would be 61.3%. This probability is 16.7 percentage points higher than that of the field *Social sciences and law*, and is statistically significant at the 1% level. The field *Education*, with the third highest marginal effect of 13.6 percentage points (statistically significant at the 5% level), has the third highest probability of education-occupation match, holding all else constant. However, the field *Education* and the field *Mathematics/computer/information sciences* have the second and third highest probabilities of obtaining an education-occupation match in Boudarbat and Chernoff (2012). The probabilities of a match in the fields *Engineering* and *Business* are also 9.5 percentage points and 7.5 percentage points higher than in the field *Social sciences and law*, differences that are statistically significant at the 5% and 10% levels respectively. However, Boudarbat and Chernoff (2012) find that the coefficient of the field *Engineering* is lower than that of the field *Business*, even though the effects of the two fields of study are higher than that of the reference field of study.

Only two fields of study have a lower probability of achieving education-job match than the field *Social sciences and law*: *Humanities* and *Visual and performing arts and communication technologies (Arts)*. More specifically, the jobs of graduates in *Humanities* are the least closely related to their education. The predicted probability that these graduates achieve education-occupation match is 22.8 percentage points lower than that of graduates in the field *Social sciences and law*. In addition, the marginal effect of *Humanities* is statistically significant at the 10% level, while that of *Arts* is statistically significant at the 5% level. Boudarbat and Chernoff (2012)

also find that the field *Humanities* and the field *Arts* have the lowest incidence of education-occupation match. Thus the empirical results with respect to field of study show that graduates in certain fields of study have a higher incidence of obtaining education-occupation match. In other fields of study, the probability of graduates obtaining a match is relatively low. This is consistent with earlier studies.

With respect to level of education, Table 5 shows that the marginal effect of *Above Bachelor's Degree* is not statistically significant, although its coefficient in the logit model is positive and statistically significant at the 10% level in Table 4. This indicates that the probability of achieving education-occupation match may not differ between graduates who obtain a *Bachelor's degree* or *Above Bachelor's degree*. However, Boudarbat and Chernoff (2012) indicate that a higher degree leads to a better education-occupation match. Other studies also indicate that a higher level of education leads to a higher probability of achieving education-occupation match (Wolbers, 2003; Robst, 2007; Bender and Roche, 2013).

With respect to grades, the results suggest, as expected, that graduates who have higher grades will enjoy a higher probability of achieving education-occupation match. If a student's grades are in the bottom 50% of the class, the probability of obtaining a job closely related to one's education is 18.2 percentage points lower than that of the reference individual who is in the top 10% of the class. However, this result is significant at only the 10% level. Boudarbat and Chernoff (2012) also show that graduates who are in the lower grade category will obtain a lower probability of education-job match. The result is also obtained for university graduates in Spain (Garcia-Espejo and Ibanez, 2006).

With respect to major activity before entering the university program, working before the program is associated with a higher probability of education-occupation match than just going to school before entering the program. The difference is about 0.6 percentage points. However, it is surprising that working and going to school together decreases the probability that graduates obtain a job closely related to their education; it is about 3.4 percentage points lower than just focusing on studying. In addition, all three categories of pre-education activity have a lower probability of achieving education-occupation match than that of the reference individual. The reason may be that the reference individual who neither went to school nor worked chose travelling before entering the university program. This process may have helped the graduate to find a suitable field of study and to regain the energy needed to achieve a better performance in the program. Thus this graduate can obtain the highest probability of achieving education-occupation match after graduation. Boudarbat and Chernoff (2012) also obtain similar results, although this study only shows the coefficients of the logit regression.

Studying a *Mix of full-time and part-time* leads to a decrease in the probability that graduates obtain a job that is closely related to their education. This result is similar to that of Boudarbat and Chernoff (2012). The probability is 7.5 percentage points lower than the probability of the reference individual, who studied *full-time*. However, there is no statistically significant difference between studying full-time and studying part-time. These results may show that changing studying status during the program leads to a decrease in the probability of education-occupation match. However, Boudarbat and Chernoff (2012) suggest that studying part-time leads to a decrease in education-job matches as compared to studying full-time. Overall, education-occupation match is mainly

influenced by what graduates studied in their university program and how graduates performed in the program.

5.1.2 Employment characteristics

With respect to employment characteristics, most methods used to find jobs do not have an effect that is statistically significantly different from the reference individual's method, which is *referred by others*. Among all methods, only the method *Campus placement agency* has a statistically significant coefficient at the 1% level. The probability of a match for individuals who found a job via this method is 19.7 percentage points higher than the probability of the reference individual. This shows that campus placement agencies play an important role in helping graduates to obtain education-occupation match. It would therefore be good for graduates if universities enhanced their campus placement agencies. Boudarbat and Chernoff (2012) also show that the method *Campus placement agency* has a significantly positive effect on education-occupation match.

Not surprisingly, compared to a part-time job, a full-time job is more strongly associated with education-occupation match. Other studies also show the same result (Wolbers, 2003; Boudarbat and Chernoff, 2012). If the graduate obtains a full-time job, the probability that the job is closely related to education is 23.1 percentage points higher than the probability of the reference individual who does not have a full-time job. In addition, the coefficient is statistically significant at the 1% level. However, it is surprising that the marginal effect of a permanent job is not statistically significant. This means that there is no difference in education-occupation match whether the job of a graduate is permanent or not. This result is the same as in Boudarbat and Chernoff (2012). Overall, some

employment characteristics have effects on education-occupation match.

5.1.3 Socio-demographic characteristics

With respect to socio-demographic characteristics, only one age group of graduates has a statistically significantly lower probability of education-occupation match than the reference individual. If the graduate is in the age category *35 to 44*, he has the lowest possibility of obtaining a job that is closely related to his education. The probability of a match is about 7.9 percentage points lower than that of the reference individual, who is less than 30 years old. Furthermore, this result is statistically significant at the 10% level. With respect to gender, female graduates have a slightly higher probability of achieving education-occupation match than male graduates; it is about 2.1 percentage points higher than for the male reference individual. However, neither the coefficient nor the marginal effect is statistically significant. It shows that there is no difference in education-occupation match between male and female university graduates. However, some studies find that females have a higher probability of education-occupation match than males (Wolbers, 2003; Robst, 2007).

In addition, having received a student loan has a positive effect on education-occupation match, although this indicator does not have a statistically significant effect in Boudarbat and Chernoff (2012). If a graduate has a student loan, the probability of this graduate obtaining education-occupation match is 9.7 percentage points higher than the probability of the reference individual, an effect that is statistically significant at the 1% level. Additionally, only one category of father's education has a statistically effect on education-occupation match of university graduates, an

effect that is negative at the 10% level of significance. Overall, age, gender and parents' education do not seem to affect the education-occupation match of university graduates very much. In Boudarbat and Chernoff (2012), age, gender, parents' education and the requirement of a student loan have no big effect on education-occupation match, while immigration status has a statistically significant and negative effect on the probability of a match. However, there is no result with respect to immigration status in this paper, because there is no information on immigration status in the public use file.

5.2 2013 National Graduates Survey

Table 6 presents the logit coefficient estimates for the 2013 National Graduates Survey, while Table 7 provides the marginal effects for the reference individual for the 2013 National Graduates Survey. The 2005 National Graduates Survey focuses on the situation of graduates who completed their education in calendar year 2000, while the 2013 National graduates Survey investigates the situation of graduates who graduated in 2010 after the academic year 2009-2010. Thus the interval between the graduation year and the survey year is different in the two surveys. Additionally, the sample sizes of the two public use files are different. Thus comparisons between the results for the two National Graduates Surveys must be done with care.

The predicted probability for the reference individual in 2013 is 15.6%, which means that the reference graduate has a probability of 15.6% of achieving education-occupation match. Since the predicted probability of the reference individual is lower than the sample average for a close education-occupation match, once again some characteristics of the reference individual do not correspond to the average characteristics of the sample respondents. The reference individual of the

2013 National Graduates Survey differs in only one respect from the reference individual of the 2005 National Graduates Survey: the age of the reference individual. The reference individual is less than 28 years old in the 2013 National Graduates Survey, while he is less than 30 years old in the 2005 National Graduates Survey.

Since the predicted probability for the reference individual is 44.6% for the 2005 National Graduates Survey, the predicted probability for the reference individual for the 2013 National Graduates Survey is 29.0 percentage points lower than that for the 2005 National Graduates Survey. In addition, the sample average of education-occupation close match for the 2013 National Graduates Survey is 5.5 percentage points lower than that for the 2005 National Graduates Survey. These results suggest that it may be harder for university graduates to achieve education-occupation match in the year 2013 than in the year 2005. The reason may come from the 2008-09 global economic recession. As the global financial crisis started to affect the Canadian labour market, the unemployment rate started to increase. Thus it was harder for graduates to find a job in 2013 than in 2005. University graduates have a lower incidence of obtaining education-occupation match, because the first goal of university graduates is to find a job whether it is related to their education or not.

5.2.1 Education characteristics

Among the education characteristics, field of study still has a significant influence on education-occupation match. As for the 2005 National Graduates Survey, the field *Health sciences* is most likely to achieve education-occupation match. This result is similar to that in the 2013 National Graduates Survey. If a graduate is in the field *Health sciences*, the probability of this graduate

achieving education-occupation match is 28.7 percentage points higher than that of the reference individual. Furthermore, the marginal effect is statistically significant at the 1% level. In addition, the field *Engineering* and the field *Mathematics/computer/information sciences* have the second and third highest probabilities of obtaining education-occupation match. If the reference individual studied in the field *Engineering*, his probability of education-occupation match would be 27.8%. This probability is 12.2 percentage points higher than that of the field *Social sciences and law*. The probability of a match in *Mathematics/computer/information sciences* is 10.2 percentage points higher than that of the reference individual in the field *Social sciences and law*. Furthermore, these marginal effects are statistically significant at the 1% level. However, the field *Mathematics/computer/information sciences* and the field *Education* are the second and third most likely to obtain a match in the 2005 National Graduates Survey.

The field *Agriculture* has a higher probability of achieving a match than the field *Social sciences and law*, while there is no statistically significant difference between two fields of study in the 2005 National Graduates Survey. Only one field of study has a lower probability of achieving education-occupation match than the field *Social sciences and law: Humanities*. The probability of a match in this field of study is 6.2 percentage points lower than that of the graduate in the reference field. In addition, the marginal effect is statistically significant at the 1% level. The sign of this result is the same as the one in the 2005 National Graduates Survey, although the marginal effect was much larger in 2005. However, there is no statistically significant difference between the fields *Arts* and *Social Sciences and law* in the 2013 National Graduates Survey, while university graduates in the field *Arts* have a lower probability of obtaining a match than in the field *Social Sciences and law* in

the 2005 National Graduates Survey. Overall, the results of the 2013 National Graduates Survey with respect to field of study show that graduates in certain fields of study still have a higher incidence of obtaining education-occupation match, but the magnitudes of the effects are different. In other fields of study, the probability of graduates obtaining a match is relatively low. However, the ranking of fields of study with respect to the probability of achieving a close match in the 2013 National Graduates Survey differs somewhat from that in the 2005 National Graduates Survey.

With respect to level of education, the marginal effect of the graduates who obtained a degree above a Bachelor's degree is not statistically significant. This result shows that the probability of achieving education-occupation match does not differ between graduates with a *Bachelor's degree* and *Above Bachelor's degree*. This result is similar to that from the 2005 National Graduates Survey. However, the result is different from other studies (Wolbers, 2003; Robst, 2007; Boudarbat and Chernoff, 2012). In these studies, the level of education has a positive effect on education-occupation match.

With respect to grades in the graduating class, the results suggest that the lower the grades the students get, the less likely it is that they achieve an education-occupation match. This result is similar to that in the 2005 National Graduates Survey. If a student's grades are in the *Top 25%-50%* of the class, the probability of obtaining a match is about 11.5%. This is 4.1 percentage points lower than the probability of the reference individual, whose grades are in the top 10% of the class. Furthermore, the effect is statistically significant at the 1% level. Additionally, if a graduate's grades are in the bottom 50% of the class, the probability of achieving a match decreases by 5.9 percentage points below that of the reference graduate. This result is statistically significant at the 5% level.

However, the marginal effect of the grade category *Below 50%* is much smaller in 2013 than in 2005.

With respect to major activity before entering the university program, there are no statistically significant differences between the four categories of major activity. This result is different from that for the 2005 National Graduates Survey. In the 2005 National Graduates Survey, graduates who were neither working nor going to school have the highest probability of achieving education-occupation match.

With respect to study status, studying *Part-time* leads to a decrease in the probability that graduates obtain a job that is closely related to their education. The probability is 3.4 percentage points lower than the probability of the reference individual, who was studying *full-time*. However, there is no difference between graduates who were studying *full-time* and a *Mix of full-time and part-time*. Thus among the three categories, studying *Part-time* has the lowest probability of achieving education-occupation match. In contrast, in the 2005 National Graduates Survey, there is no difference between studying *full-time* and *Part-time*, while studying a *Mix of full-time and part-time* leads to a decrease in the probability of obtaining a match. This difference suggests that focusing on studying may lead to a better match for university graduates in the recent labour market. Overall, education-occupation match is still mainly influenced by what graduates studied in their university program and how graduates performed in the program, even though there are some differences from the 2005 National Graduates Survey.

5.2.2 Employment characteristics

With respect to employment characteristics, most methods used to find jobs still do not have

statistically significant differences from the reference individual's method, which is *referred by others*. Among all the methods, there are only two that have statistically significant coefficients. The first one is the method *Contact employer directly*. The probability of achieving education-occupation match increases by 4.1 percentage points relative to the probability of the reference individual, who uses the method *referred by others*. The result is statistically significant at the 5% level. The second method is the method *Campus placement agency*. If a graduate obtains the job through the *Campus placement agency*, the probability of achieving education-occupation match is 8.0 percentage points higher than that of the reference individual. This result is statistically significant at the 10% level. According to these results, graduates achieve the highest education-occupation match through the *Campus placement agency*, which is similar to the situation of the 2005 National Graduates Survey. But the effect of the method *Campus placement agency* is considerably smaller in the 2013 National Graduates Survey. In addition, the method *Contact employer directly* becomes the second most effective method that can help graduates obtain a match in the 2013 National Graduates Survey, although this method does not have this effect in the 2005 National Graduates Survey. This difference shows that not only can the campus placement agency help graduates obtain a job that is closely related to their education, but also that contacting the employer directly is another good method in the recent labour market.

Compared to a part-time job, a full-time job is more closely associated with education-occupation match, which is similar with the result from the 2005 National Graduates Survey. It is not surprising to get this result, because other studies also obtain it (Wolbers, 2003; Boudarbat and Chernoff, 2012). The probability of achieving a match for an individual with a

full-time job is 12.1 percentage points higher than the probability of the reference individual, who does not have a full-time job. The result is statistically significant at the 1% level. But the marginal effect is much smaller in 2013 than in 2005. In addition, a permanent job is also better associated with a match. If a graduate obtains a permanent job, the probability increases 3.0 percentage points relative to that of the reference graduate. This result is statistically significant at the 10% level. However, having a permanent job is not significantly associated with a match in the 2005 National Graduates Survey. This difference shows that if a graduate can obtain a permanent job, the job is more likely related to this graduate's education in the recent labour market. Overall, some employment characteristics have significant effects on education-occupation match in 2013, but some of the effects differ in magnitude or statistical significance from 2005.

5.2.3 Socio-demographic characteristics

With respect to social characteristics, it is surprising that there are two age groups that have statistically significant and positive marginal effects in the 2013 National Graduates Survey. The probability of education-occupation match in the age group *28 to 32* is 4.0 percentage points higher than the probability in the reference age group *less than 28*, a difference that is statistically significant at the 5% level. Additionally, if a graduate is in the age group *33 to 42*, the probability of a match will increase 6.3 percentage points relative to that of the reference individual. This result is statistically significant at the 1% level. Furthermore, the age group *33 to 42* has the best match. These results are dramatically different from the results in the 2005 National Graduates Survey. In the 2005 National Graduates Survey, there is only one age group that has a statistically significant

and negative effect on education-occupation match. The reason for this big difference may come from the situation of the recent labour market. Since it is more difficult for graduates to find a job in 2013 than in 2005, the experience associated with age may become an important indicator to employers. Therefore, the age groups *28 to 32* and *33 to 42* have a higher incidence of achieving education-occupation match than that of the reference individual.

With respect to gender, female graduates have a higher probability of a match than male graduates in the 2013 National Graduates Survey, while there is no statistically significant difference between female graduates and male graduates in the 2005 National Graduates Survey. The probability of obtaining education-job match for females is 2.4 percentage points higher than that of males. This marginal effect is statistically significant at the 5% level. It suggests that female graduates have advantages in obtaining education-job match over male graduates in the recent Canadian labour market. Wolbers (2003) and Robst (2007) also show that females achieve a better match than males in Europe and in the United States.

Additionally, having received a student loan still has a positive effect on education-occupation match, but the marginal effect is much smaller in the 2013 National Graduates Survey. This result is statistically significant at the 10% level, while the result is statistically significant at the 1% level in the 2005 National Graduates Survey. With respect to parents' education, there is also one category of the father's education that has a negative effect on education-occupation match for university graduates, an effect that is statistically significant at the 5% level. If the father's education is *University diploma, certificate, or degree*, the probability of this graduate obtaining a match will decrease 2.6 percentage points. However, a different category of the father's education has a negative

effect in the 2005 National Graduates Survey: the category *Trade/vocational diploma, college, or CEGEP*. Overall, parents' education does not seem to matter very much for the education-occupation match of university graduates in the 2005 and 2013 National Graduates Surveys. Unlike the 2005 National Graduates Survey, in the 2013 National Graduates Survey more socio-demographic characteristics have statistically significant effects on education-occupation match, especially the characteristics – age and gender.

6. Conclusions

According to the descriptive statistics, fewer graduates consider that their jobs are closely related to their education in the 2013 National Graduates Survey than in the 2005 National Graduates Survey. In addition, the predicted probability of the reference individual achieving education-occupation match is lower in the 2013 National Graduates Survey. This suggests that for university graduates it is harder to find a job that is closely related to their education in the recent Canadian labour market.

Based on the analysis above, this paper can provide some insights into the main determinants of education-occupation match. Nearly all the education characteristics included in the econometric models have a significant influence on education-occupation match. Education-occupation match is mainly influenced by what graduates studied in their university program and how graduates performed in the program. Overall, the field *Health sciences* has the best match among all fields of study, while the field *Humanities* has the lowest probability of obtaining education-occupation match. In addition, individuals who have higher grades enjoy a higher probability of achieving a match.

However, there are some changes between 2013 and 2005. There is no difference between the field *Arts* and the reference field *Social sciences and law* in the 2013 National Graduates Survey, while the field *Arts* has a lower probability of obtaining a match in the 2005 National Graduates Survey. Additionally, the field *Agriculture* has a better match than the reference field *Social sciences and law* in the 2013 National Graduates Survey, while there is no difference between these two fields of study in the 2005 National Graduates Survey. This shows that the situation with respect to achieving a match in some fields of study has changed over time. In addition, the major activity before entering the university programs has no statistically significant effect on education-occupation match in the 2013 National Graduates Survey. However, in the 2005 National Graduates Survey, graduates who neither went to school nor worked have the best match.

With respect to employment characteristics, some indicators have statistically significant effects on education-occupation match. In the 2005 National Graduates Survey, the empirical results show that graduates can achieve a better match through a *Campus placement agency*. In the 2013 National Graduates Survey, not only the method *Campus placement agency* but also the method *Contact employer directly* seemed to help graduates achieve a better match. However, the method *Campus placement agency* still has the best match. These results suggest that universities should focus on the development of campus placement agencies to help graduates achieve education-occupation match. In addition, in the 2013 National Graduates Survey, not only a full-time job but also a permanent job can lead to a better match for graduates, while only a full-time job could increase the probability of achieving education-occupation match in the 2005 National Graduates Survey.

With respect to socio-demographic characteristics, most indicators do not matter very much for

education-occupation match in the 2005 National Graduates Survey. In the 2013 National Graduates Survey, more such characteristics have statistically significant effects on education-occupation match, especially age and gender. With respect to age, the results show that the age group *33 to 42* has the best match in the 2013 National Graduates Survey. It seems that in the recent nervous labour market, this group of university graduates has more advantages than others in obtaining education-occupation match. In addition, female graduates have a better match than male graduates in the 2013 National Graduates Survey.

Considering the data sets and the econometric model, this paper has some limitations. Since the data sets that are used in this paper are the public use files of the National Graduates Survey, the sample sizes are much smaller than those of the master files. Meanwhile, the categories of variables of this paper are less detailed than those of the master file. Thus the empirical results of this paper may be not as precise as the results of studies that use the master files. In addition, there is no immigration information in the public use file. Thus this paper cannot investigate the immigrant effects of education-occupation match. Finally, the difference in the time interval between graduation and the survey data makes comparisons between 2005 and 2013 less reliable, and they must be done with case.

Since immigrants have a lower probability of achieving education-occupation match in Boudarbat and Chernoff (2012), the effect of immigration status would be a worthwhile direction for further research. In addition, in human capital theory, experience is also an important indicator. It may be a good idea to investigate the relationship between experience and education-occupation match in future research. Although age may serve as a proxy for experience, it is not a perfect

measure of previous work experience. More research is clearly needed on this topic.

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Table 1 Data and Econometric Models of Previous Studies

Author (Date)	Data sources	Econometric model
Wolbers (2003)	2000 European Labour Force Surveys (LFS) plus special module on school to work transitions	<ol style="list-style-type: none"> 1. Logistic model for the determinants of job mismatches 2. Linear regression of achieved occupational status
Quinn and Rubb (2005)	1987-1999 Mexican MMP conducted by the University of Guadalajara and Princeton University	Nested logit model for immigration decision
Garcia-Espejo and Ibanez (2006)	2003 Spanish longitudinal Survey of university graduates who finished university in 1999	Logit model for the relationship between mismatch and labour achievements
Robst (2007)	1993 US National Survey of College Graduates	<ol style="list-style-type: none"> 1. Ordered logit model for the determinants of education-occupation mismatch 2. Income equation for the wage effects of mismatch
Nordin et al. (2010)	The data comprises individuals in the age-group 28-39 living in Sweden in 2003. Statistics Sweden constructed the data by adding education and income variables from the Swedish Register of Education and the National Tax Board to the register of the total population.	Income equation for the income penalty of mismatch
Boudarbat and Chernoff (2012)	Follow-up Survey of Canadian Graduates – class of 2000	Logit model of the determinants of education-job mismatch
Tani (2012)	1995-1996 and 2000-2001 Longitudinal Survey of immigrants to Australia	Probit model and Heckman model for education-job mismatch of immigrants
Bender and Roche (2013)	2003 US National Survey of College Graduates	<ol style="list-style-type: none"> 1. Ordered probit model for mismatch 2. Log annual earnings regression for wage effects of mismatch 3. Ordered probit model for job satisfaction
Mavromaras et al. (2013)	Household, Income and Labour Dynamics in Australia Survey – first seven waves	<ol style="list-style-type: none"> 1. Earnings equation for the wage effects of job mismatch 2. Pooled probit model and random effects probit model for job satisfaction and job mobility
Sharif and Dar-Brodeur (2013)	2001 Canadian Census Data	<ol style="list-style-type: none"> 1. Multinomial logit model for the determinants of mismatch 2. Income equation for the consequences of mismatch

Table 2 Summary Statistics of the 2005 National Graduates Survey

Variables	Mean (Std. Dev.)	Variables	Mean (Std. Dev.)
<i>1. Education characteristics</i>		<i>2. Employment characteristics</i>	
Field of study		Method for obtaining the employment	
Education	0.144 (0.351)	Referred by others	0.243 (0.429)
Arts	0.029 (0.169)	Job advertisements	0.266 (0.442)
Humanities	0.064 (0.245)	Contact employer directly	0.271 (0.445)
Social sciences and law	0.113 (0.317)	Campus placement agency	0.056 (0.231)
Business	0.147 (0.354)	Employment agency	0.031 (0.174)
Physical and life sciences	0.055 (0.227)	Head hunter	0.098 (0.298)
Mathematics/computer/information sciences	0.062 (0.240)	Other method	0.033 (0.180)
Engineering	0.192 (0.394)	Full-time job	0.930 (0.255)
Health sciences	0.157 (0.364)	Permanent job	0.922 (0.269)
Agriculture	0.038 (0.190)	<i>3. Socio-demographic characteristics</i>	
Education level		Age	
Bachelor's degree	0.734 (0.442)	Less than 30	0.438 (0.496)
Above Bachelor's degree	0.266 (0.442)	30 to 34	0.262 (0.440)
Grades		35 to 44	0.166 (0.372)
Top 10%	0.364 (0.481)	45 or more	0.135 (0.341)
Top 10%-50%	0.627 (0.484)	Female	0.557 (0.497)
Below 50%	0.009 (0.092)	Student loan	0.523 (0.500)
Major activity before entering the program		Father's education	
Going to school	0.509 (0.500)	No post-secondary education	0.526 (0.500)
Working	0.350 (0.477)	Trade/vocational diploma, college or CEGEP	0.140 (0.347)
Working and going to school	0.078 (0.269)	University diploma, certificate, or degree	0.333 (0.472)
Not working or going to school	0.063 (0.243)	Mother's education	
Study status		No post-secondary education	0.591 (0.492)
Full-time	0.721 (0.449)	Trade/vocational diploma, college or CEGEP	0.175 (0.380)
Part-time	0.155 (0.362)	University diploma, certificate, or degree	0.234 (0.424)
Mix of full-time and part-time	0.124 (0.330)	<i>4. Dependent variable</i>	
		Closely related	0.714 (0.452)
		<i>5. Observations</i>	
			2,451

Table 3 Summary Statistics of 2013 National Graduates Survey

Variables	Mean (Std. Dev.)	Variables	Mean (Std. Dev.)
<i>1. Education characteristics</i>		<i>2. Employment characteristics</i>	
Field of study		Method for obtaining the employment	
Education	0.137 (0.343)	Referred by others	0.210 (0.408)
Arts	0.041 (0.198)	Job advertisements	0.359 (0.480)
Humanities	0.056 (0.230)	Contact employer directly	0.160 (0.367)
Social sciences and law	0.134 (0.341)	Campus placement agency	0.033 (0.178)
Business	0.162 (0.368)	Employment agency	0.022 (0.148)
Physical and life sciences	0.061 (0.240)	Head hunter	0.066 (0.250)
Mathematics/computer/information sciences	0.065 (0.247)	Other method	0.150 (0.357)
Engineering	0.152 (0.359)	Full-time job	0.928 (0.260)
Health sciences	0.139 (0.346)	Permanent job	0.845 (0.362)
Agriculture	0.053 (0.223)	<i>3. Socio-demographic characteristics</i>	
Education level		Age	
Bachelor's degree	0.596 (0.491)	Less than 28	0.332 (0.471)
Above Bachelor's degree	0.404 (0.491)	28 to 32	0.312 (0.464)
Grades		33 to 42	0.219 (0.414)
Top 10%	0.391 (0.488)	43 or more	0.136 (0.343)
Top 10%-25%	0.427 (0.495)	Female	0.563 (0.496)
Top 25%-50%	0.164 (0.370)	Student loan	0.458 (0.498)
Below 50%	0.018 (0.134)	Father's education	
Major activity before entering the program		No post-secondary education	0.374 (0.484)
Going to school	0.448 (0.497)	Trade/vocational diploma, college or CEGEP	0.209 (0.407)
Working	0.416 (0.493)	University diploma, certificate, or degree	0.417 (0.493)
Working and going to school	0.087 (0.282)	Mother's education	
Not working or going to school	0.049 (0.217)	No post-secondary education	0.413 (0.492)
Study status		Trade/vocational diploma, college or CEGEP	0.226 (0.418)
Full-time	0.771 (0.420)	University diploma, certificate, or degree	0.361 (0.480)
Part-time	0.142 (0.349)	<i>4. Dependent variable</i>	
Mix of full-time and part-time	0.087 (0.282)	Closely related	0.659 (0.474)
		<i>5. Observations</i>	
			4,075

Table 4 Logit Regression Results of the 2005 National Graduates Survey

Variables	Coefficient (Std. Err.)	Variables	Coefficient (Std. Err.)
<i>1. Education characteristics</i>		<i>2. Employment characteristics</i>	
Field of study (Ref.= Social sciences and law)		Method for obtaining the employment (Ref.= referred by others)	
Education	0.546** (0.250)	Job advertisements	-0.061 (0.134)
Arts	-0.597** (0.292)	Contact employer directly	0.198 (0.140)
Humanities	-1.059*** (0.226)	Campus placement agency	0.807*** (0.266)
Business	0.302* (0.181)	Employment agency	-0.169 (0.270)
Physical and life sciences	-0.150 (0.234)	Head hunter	0.194 (0.185)
Mathematics/computer/information sciences	0.675*** (0.247)	Other method	0.193 (0.288)
Engineering	0.382** (0.193)	Full-time job	0.959*** (0.200)
Health sciences	1.167*** (0.222)	Permanent job	-0.184 (0.197)
Agriculture	0.033 (0.269)	<i>3. Socio-demographic characteristics</i>	
Education level (Ref.= Bachelor's degree)		Age (Ref.= less than 30)	
Above Bachelor's degree	0.218* (0.132)	30 to 34	-0.077 (0.137)
Grades (Ref.= Top 10%)		35 to 44	-0.328* (0.186)
Top 10%-50%	-0.154 (0.108)	45 or more	-0.152 (0.221)
Below 50%	-0.809* (0.480)	Female	0.086 (0.111)
Major activity before entering the program (Ref.= not working or going to school)		Student loan	0.389*** (0.103)
Going to school	-0.488** (0.236)	Father's education (Ref.= no post-secondary education)	
Working	-0.459* (0.236)	Trade/vocational diploma, college or CEGEP	-0.248* (0.151)
Working and going to school	-0.645** (0.280)	University diploma, certificate, or degree	0.025 (0.127)
Study status (Ref.= full-time)		Mother's education (Ref.= no post-secondary education)	
Part-time	0.014 (0.180)	Trade/vocational diploma, college, or CEGEP	0.117 (0.143)
Mix of full-time and part-time	-0.309** (0.153)	University diploma, certificate, or degree	-0.134 (0.139)
		<i>4. Controls: Industry, Marital status</i>	
		<i>5. Sample size</i>	2,451
		<i>6. Pseudo R²</i>	0.128

Note: 1. *** represents 1% significance. ** represents 5% significance. * represents 10% significance.

Table 5 Marginal Effects at Reference Individual of the 2005 National Graduates Survey

Variables	Marginal effect (Std. Err.)	Variables	Marginal effect (Std. Err.)
<i>1. Education characteristics</i>		<i>2. Employment characteristics</i>	
Field of study (Ref.= Social sciences and law)		Method for obtaining the employment (Ref.= referred by others)	
Education	0.136** (0.061)	Job advertisements	-0.015 (0.033)
Arts	-0.139** (0.067)	Contact employer directly	0.049 (0.035)
Humanities	-0.228*** (0.054)	Campus placement agency	0.197*** (0.062)
Business	0.075* (0.045)	Employment agency	-0.041 (0.065)
Physical and life sciences	-0.037 (0.057)	Head hunter	0.048 (0.046)
Mathematics/computer/information sciences	0.167*** (0.060)	Other method	0.048 (0.072)
Engineering	0.095** (0.048)	Full-time job	0.231*** (0.049)
Health sciences	0.275*** (0.052)	Permanent job	-0.045 (0.048)
Agriculture	0.008 (0.067)	<i>3. Socio-demographic characteristics</i>	
Education level (Ref.= Bachelor's degree)		Age (Ref.= less than 30)	
Above Bachelor's degree	0.054 (0.033)	30 to 34	-0.019 (0.034)
Grades (Ref.= Top 10%)		35 to 44	-0.079* (0.045)
Top 10%-50%	-0.038 (0.027)	45 or more	-0.037 (0.054)
Below 50%	-0.182* (0.096)	Female	0.021 (0.028)
Major activity before entering the program (Ref.= not working or going to school)		Student loan	0.097*** (0.025)
Going to school	-0.115** (0.058)	Father's education (Ref.= no post-secondary education)	
Working	-0.109* (0.058)	Trade/vocational diploma, college or CEGEP	-0.060* (0.036)
Working and going to school	-0.149** (0.066)	University diploma, certificate, or degree	0.006 (0.032)
Study status (Ref.= full-time)		Mother's education (Ref.= no post-secondary education)	
Part-time	0.004 (0.044)	Trade/vocational diploma, college, or CEGEP	0.029 (0.036)
Mix of full-time and part-time	-0.075** (0.037)	University diploma, certificate, or degree	-0.033 (0.034)
		<i>4. The predicted probability of the reference individual</i>	0.446*** (0.102)

Note: 1. *** represents 1% significance. ** represents 5% significance. * represents 10% significance.

Table 6 Logit Regression Results of the 2013 National Graduates Survey

Variables	Coefficient (Std. Err.)	Variables	Coefficient (Std. Err.)
<i>1. Education characteristics</i>		<i>2. Employment characteristics</i>	
Field of study (Ref.= Social sciences and law)		Method for obtaining the employment (Ref.= referred by others)	
Education	0.338** (0.170)	Job advertisements	-0.015 (0.099)
Arts	-0.060 (0.196)	Contact employer directly	0.282** (0.126)
Humanities	-0.573*** (0.178)	Campus placement agency	0.512** (0.229)
Business	0.457*** (0.129)	Employment agency	-0.311 (0.241)
Physical and life sciences	0.104 (0.171)	Head hunter	0.222 (0.165)
Mathematics/computer/information sciences	0.632*** (0.170)	Other method	0.029 (0.123)
Engineering	0.733*** (0.140)	Full-time job	0.729*** (0.151)
Health sciences	1.458*** (0.174)	Permanent job	0.212* (0.114)
Agriculture	0.432** (0.174)	<i>3. Socio-demographic characteristics</i>	
Education level (Ref.= Bachelor's degree)		Age (Ref.= less than 28)	
Above Bachelor's degree	0.074 (0.088)	28 to 32	0.275*** (0.102)
Grades (Ref.= Top 10%)		33 to 42	0.418*** (0.131)
Top 10%-25%	-0.068 (0.085)	43 or more	0.176 (0.158)
Top 25%-50%	-0.352*** (0.109)	Female	0.171** (0.081)
Below 50%	-0.544** (0.263)	Student loan	0.143* (0.076)
Major activity before entering the program (Ref.= not working or going to school)		Father's education (Ref.= no post-secondary education)	
Going to school	0.215 (0.182)	Trade/vocational diploma, college or CEGEP	-0.059 (0.106)
Working	0.153 (0.176)	University diploma, certificate, or degree	-0.217** (0.095)
Working and going to school	0.310 (0.212)	Mother's education (Ref.= no post-secondary education)	
Study status (Ref.= full-time)		Trade/vocational diploma, college, or CEGEP	0.069 (0.102)
Part-time	-0.285** (0.129)	University diploma, certificate, or degree	-0.005 (0.096)
Mix of full-time and part-time	-0.149 (0.130)	<i>4. Controls: Industry, Marital status</i>	
		<i>5. Sample size</i>	4,075
		<i>6. Pseudo R²</i>	0.146

Note: 1. *** represents 1% significance. ** represents 5% significance. * represents 10% significance.

Table 7 Marginal Effects at reference individual of the 2013 National Graduates Survey

Variables	Marginal effect (Std. Err.)	Variables	Marginal effect (Std. Err.)
<i>1. Education characteristics</i>		<i>2. Employment characteristics</i>	
Field of study (Ref.= Social sciences and law)		Method for obtaining the employment (Ref.= referred by others)	
Education	0.050* (0.028)	Job advertisements	-0.002 (0.013)
Arts	-0.008 (0.025)	Contact employer directly	0.041** (0.020)
Humanities	-0.062*** (0.022)	Campus placement agency	0.080* (0.042)
Business	0.070*** (0.023)	Employment agency	-0.037 (0.027)
Physical and life sciences	0.014 (0.024)	Head hunter	0.031 (0.025)
Mathematics/computer/information sciences	0.102*** (0.034)	Other method	0.004 (0.016)
Engineering	0.122*** (0.029)	Full-time job	0.121*** (0.029)
Health sciences	0.287*** (0.051)	Permanent job	0.030* (0.017)
Agriculture	0.066** (0.030)	<i>3. Socio-demographic characteristics</i>	
Education level (Ref.= Bachelor's degree)		Age (Ref.= less than 28)	
Above Bachelor's degree	0.010 (0.012)	28 to 32	0.040** (0.016)
Grades (Ref.= Top 10%)		33 to 42	0.063*** (0.023)
Top 10%-25%	-0.009 (0.011)	43 or more	0.024 (0.023)
Top 25%-50%	-0.041*** (0.015)	Female	0.024** (0.012)
Below 50%	-0.059** (0.028)	Student loan	0.020* (0.011)
Major activity before entering the program (Ref.= not working or going to school)		Father's education (Ref.= no post-secondary education)	
Going to school	0.030 (0.025)	Trade/vocational diploma, college or CEGEP	-0.008 (0.014)
Working	0.021 (0.024)	University diploma, certificate, or degree	-0.026** (0.013)
Working and going to school	0.046 (0.031)	Mother's education (Ref.= no post-secondary education)	
Study status (Ref.= full-time)		Trade/vocational diploma, college, or CEGEP	0.009 (0.014)
Part-time	-0.034** (0.015)	University diploma, certificate, or degree	-0.001 (0.013)
Mix of full-time and part-time	-0.019 (0.016)	<i>4. The predicted probability of the reference individual</i>	
			0.156*** (0.040)

Note: 1. *** represents 1% significance. ** represents 5% significance. * represents 10% significance.