

Examining the Wage Impact of Immigration on the Canadian Labor Market

by Ziad Quader

7843523

Major Paper presented to the  
Department of Economics of the University of Ottawa  
in partial fulfillment of the requirements of the M.A. Degree

Supervisor: Professor Louis-Philippe Morin

ECO 6999

Ottawa, Ontario

July 2016

## Examining the Wage Impact of Immigration on the Canadian Labor Market

by Ziad Quader

This paper examines whether the increase in the labor supply caused by the surge in the influx of immigrants that arrived into Canada since the late 1980s had any impact on the real earnings earned by the native Canadian workers. By segregating the national labor force on the basis of the education and experience of the employed workers, it is assumed that immigrants and natives having the same skills are perfect substitutes for production. Using a Pooled Cross Sectional estimation as well as a First Difference estimation method, it was found that in the long run, a 10% increase in the supply of immigrants would lead to a 1.6 % reduction in the weekly real wages earned by the competing native Canadian workers. In the short run, it was found that there was no discernable impact on the wages earned by native workers when labor supply increased due to immigration.

## I. Introduction

“The (immigration) framework is based on two principles...First, an effective immigration program must allow us to make effective choices...Second, those choices must be made to benefit the people of Canada.”

- *Managing Immigration: A Framework for the 1990s*

Employment and Immigration Canada, 1992

Immigration and immigrants have always been a cornerstone for the social and economic development of Canada. After the Second World War, Canada had seen a landmark shift in its policies that dictated who could enter the country. A shortage in the country’s stock of professional and technical workers compelled the government to overhaul its immigration policy first in 1967 by adopting a universal *points system*<sup>1</sup> for selecting independent immigrants regardless of their race or national origin.

More recently, during the late 1980s, the government increased the quota of immigrants allowed into the country to address the concerns relating to the shrinking growth rate of the national population (Russo, 2008). As the nation opened its gates to more immigrants each year since then, the total number of immigrants allowed into Canada grew by 52% during the first year this policy was implemented and has not ceased growing ever since (Li, 2003). Following the point system implementation in 1967, the immigration policy during this time continued to give more preference to immigrants who have the occupational skills and educational credentials that was considered to be required for the growth and development of Canada’s economy.

---

<sup>1</sup> A system used to assess a migrant’s eligibility for migrating to a host country, based on points awarded for a variety of factors such as the migrant’s language skills, education, family ties in the host country, to name a few.

One of the chief concerns, from an economic, social and even political perspective is that allowing an increasing number of immigrants to enter Canada every year may have detrimental effects on the labor market opportunities of the incumbent working population. According to the textbook neoclassical economic theory, the arrival of these immigrants is likely to flood the Canadian labor market with an excess supply of labor at the existing market wage rate. Because labor is in excess supply, profit maximising firms will now be able to satisfy their labor demand by paying a lower wage to the workers than before. This will in turn drive up the demand for workers, both for immigrants and for the incumbent native workers, until all workers are employed, but at a lower wage than before. Thus textbook economic theory predicts that, at least in the short run, the incumbent employed native workers will suffer from a reduction in their earnings. In the longer run though, when capital is no longer fixed in supply, the supply of capital may adjust and accordingly, by keeping the ratio of capital to labor constant, may overturn the initial adverse effect on wages.

The difficulty though, lies in being able to quantify these mechanisms with the actual Canadian labor market data. Empirically proving how the Canadian labor market actually responded to the influx of these immigrants, since increasing the quota during the late 1980s, first requires an understanding of how Canadian labor markets work in general. In this regard, I assume that the *skills* of the labor force are pivotal in determining how a labor market works. As a result, in this paper, I seek to examine whether the increase in the supply of workers in the Canadian labor market as a result of immigration had any impact on the real wages earned by the native Canadian workers since the late 1980s, by segregating the Canadian workforce on the basis of their skills.

What I eventually find is that the surge of immigrants coming to Canada since the late 1980s did indeed have a negative effect on the earnings of the native Canadian workers. Specifically, a 10% increase in the supply of immigrants for any given group of workers having a certain set of skills will lead to a 1.6 %

reduction in the weekly real wages earned by the native Canadian workers possessing the same set of skills. The magnitude of this impact is smaller than what was found by the leading study in this field for the Canadian labor market by Aydemir and Borjas (2007), which found that a 10% increase in labor force due to immigration results in a reduction of weekly wages of a given skill group by 3.2%.

Moreover, when attempting to validate the impact of immigration through different empirical specifications, I found that the aforementioned 1.6 % reduction in the weekly real wages is most likely to be present in the long run since there may be some wage stickiness that prevents immigration from having any effect on the natives' earnings in the short run. What sets this paper apart from the previous work in this topic is that it uses a combination of two different leading methodologies used in the literature in order to provide validation for the results. It also investigates the wage impact of immigration on a different time period and a different sample than what has usually been used by other authors. Hence, this paper contributes to the existing body of literature on this topic by finding new evidence that sheds some light into the empirical debate about the economic impacts of immigration in Canada. In other words, despite the government's intention to design immigration policies that would not harm the people of Canada, this paper finds evidence to the contrary, at least from an economic perspective.

The paper is structured as follows: section II provides a brief overview of the literature, highlighting the key empirical challenges that leading researchers have dealt with, and the solutions they have offered in order to find the ideal identification strategy to measure the wage impacts of immigration. It then presents an account of the works carried out specifically on the Canadian labor market and finally, how this paper seeks to contribute to this existing body of literature. Section III describes how the chosen sample was selected and modified from the data and discusses the salient characteristics of the chosen sample. Section IV presents the details of the estimation frameworks I have chosen to empirically test

my research question and finally, Section V discusses the main results and the degree to which it answers my research question.

## II. Literature Review

In this paper, I intend to examine how the inflow of immigrants into Canada since the late 1980s had any impact on the wages earned by Canadian born workers. Searching for the wage impacts of immigration in Canada first necessitates the modelling of immigrants and immigration in the economy, which involves making a number of assumptions about the dynamics of how immigrants and native born workers compete for the same job on the Canadian labor market. Once that is done, it must then be clarified how much of the variation in wages earned by these competing native workers is *solely* due to the influx of immigrants into the Canadian labor market, and not due to other changing labor market conditions or due to innate human capital characteristics of the native workers themselves, such as their education and labor market experience.

Addressing these empirical requirements has led to the growth of a large body of literature dedicated to discovering and developing the ideal identification strategy to properly measure the wage impacts of immigration. This section presents a brief discussion on the major breakthroughs in this field, focusing on the key empirical strategies conceptualized and developed by empiricists to answer this research question. Such identification strategies can be summarized under three broad headings: The *Spatial Correlations approach*, the *Factor Proportions approach* and the *Skill Cell Correlation approach*.

Of these three empirical techniques, the one that I use in this paper is largely based on the *Spatial Correlations* approach and the *Skill Cell Correlations* approach so this section will primarily discuss the economic literature pertaining to the discovery and development of these two techniques. Moreover, it

should be noted that, in most of the papers discussed in this section, the empiricists do not only try to measure the wage impacts of immigration but also the employment effects of immigration. However, since the latter is outside the purview of this paper, I have only focused on discussing the methodologies and results relating to the wage impact of immigration. Finally, almost all of the major breakthroughs in developing identification strategies have been discovered by empiricists studying the U.S. labor market. Accordingly, I have devoted the lion's share of this section to studies on the U.S. labor market and added a separate section which discusses the findings of empiricists replicating these studies for the Canadian labor market, as well as how this paper can contribute to the literature in this field.

### **i. Leading developments in the Literature to finding the ideal identification strategy**

As mentioned previously, searching for a wage impact first requires one to model immigration in the economy, specifically how immigrants and native workers are perceived by firms in the economy. Thus the earlier studies in this field modelled immigrants and immigration following the neoclassical input demand theory, estimating production functions and differentiating between labor inputs and capital (Dustmann, Frattini & Glitz, 2007). For instance, the concept of assessing the labor market impacts of immigration through substitutability between immigrants and native workers in production was first explored by Grossman (1982). In her study, she modelled the production relationship through a translog production function, where output is a function of capital, the native born labor, the foreign born labor and the second generation foreign born labor. Using cross sectional U.S. census data for 19 Standard Metropolitan Statistical Areas in 1970, Grossman (1982) measured the degree of substitutability between each of the aforementioned factors, and found that both the foreign born labor as well as the second generation foreign born labor were substitutes in production, with the second generation

foreign born workers being more substitutable with the native born workers. Calculating the long run wage elasticity to be -0.10, Grossman (1982) concluded that there is no serious impact on the native born worker's wages due to the influx of immigrants, but noted there may be some significant short run wage impacts due to the uneven distribution of immigrants across the U.S.

As noted in Card (1990), the then prevalent studies published during the 1980s, like Grossman (1982), all found small wage effects of immigration for the native workers. Card (1990) argued that this happened due to the immigrants tending to settle in locations that were already enjoying economic prosperity, thus leading to biased estimates of the impact of immigration on native workers' wages. What would be ideal, in his opinion, would be to investigate the labor market impact of immigration through a purely exogenous shift in labor supply due to immigration.

In his landmark natural experiment, Card (1990) was able to do just that, by finding this exogenous supply shift in the form of the Mariel boatlift in Cuba, where within a span of five months in 1980, a total 125,000 Cuban immigrants arrived in Miami solely because they were suddenly permitted to do so by their President, Fidel Castro. Card (1990) divided the labor market into four racial groups: whites, blacks, Cubans and Hispanics and studied the absolute and relative wages as well as employment and unemployment rates before and after the Mariel boatlift, the data of which was found in the Current Population Survey. He also controlled for common labor market trends between other cities by comparing the Miami labor market data to the average of the labor market data from the four cities of Atlanta, Houston, Los Angeles and Tampa-St. Petersburg, selecting these four cities since they have similar demographic and economic trends as Miami did before the Mariel boatlift.

Card (1990) found out that, despite the labor force in Miami increasing by 7% due to the Mariel boatlift, this exogenous shift in labor supply had no significant effect on the wages earned by the non-Cubans in the Miami labor force nor did it have a strong impact on the wages earned by the Cubans themselves. So

despite the expansion of the unskilled labor supply in Miami, since the Mariel boatlift immigrants were generally unskilled, these workers were successfully absorbed into the labor force without any downward pressure on the market wages.

However, finding a purely exogenous labor supply shift like the Mariel boatlift is quite difficult, thus it enabled researchers to search for other ways to solve the endogeneity problem that arises when immigrants self select themselves in regions with higher wages. Analysing the migrating decisions of post 1964 immigrants in the U.S.A, Bartel (1989) discovered that immigrants primarily tend to migrate to locations which already have an established population belonging to their ethnicity. Accordingly, this important discovery helped Altonji and Card (1991) to devise a new method to empirically examine the wage impact of immigration in the U.S. labor market.

Altonji and Card (1991) hypothesized that less skilled native born workers might be most adversely affected as a result of immigration so they divided their sample among the male native high school dropouts, black males and females and white females with only high school education or less. Using Census data from 1970 and 1980, the authors regress the averages of the labor market outcomes of the four 'less skilled' segments of the native workers across 120 Standard Metropolitan Statistical Areas (SMSAs) in the U.S. with the share of immigrants in each of these SMSAs. The cross sectional estimation equation for each SMSA had controls to capture the characteristics of each city, namely the log of the SMSA population and the mean of the age and education for the particular 'less skilled' group under consideration. In addition, Altonji and Card (1991) also specified a first differenced estimation equation that regressed the change in the labor market outcome of the less skilled natives to the change in the immigrant share in the labor force as well as the change in the control variables between 1970 and 1980.

Using the findings of Bartel (1989), Altonji and Card (1991) attempted to control for potential correlation between local economic conditions and immigrant inflows by using an instrumental variable for immigrant inflows in their first difference model specification, where the instrument would be the lagged share of immigrants in the total labor force for each defined group. Altonji and Card (1991) however themselves noted the possibility that the first difference analysis was more likely to capture the short run effects of immigration where capital stock and the industry / skill composition of labor demand would not be adjusted completely and that the out migration of natives to other cities that are less crowded by immigrants may weaken the labor market impacts of immigration as well.

What the authors eventually found was that the impact on wages is sensitive to model specification and estimation procedure. With their cross sectional specification, there was no significant impact on the log of weekly wages earned by the natives. While with their first differenced specification, with the use of the instrumental variable, they found a significantly negative impact on wages, finding that a 1% increase in the fraction of immigrants in an SMSA reduces the weekly wages of less skilled natives by roughly 1.2%. As the first differenced ordinary least squares estimates suggested a wage reduction of only 0.3%, the authors thus recommend the use of the instrumental variable procedure as they suspect the coefficient estimates of the Ordinary Least Squares are positively biased due to the endogenous immigration inflows.

Examining the wage impact of immigration necessitates addressing the question of how, if at all, immigrants are competing with natives as factors of production. Researchers have usually segregated the labor market on the basis of skills and then tested whether the market wages of natives possessing a certain set of skills are affected due to the inflow of immigrants with the same set of skills. Card (2001) postulated that local labor markets are divided on the basis of occupational groups, within which natives have to compete with immigrants. The share of the total population of a local labor market that is

expected to work in a given occupation exhibits the degree of competition for that occupation, and an inflow of immigrants who want to work in that occupation will tip the scales by expanding the share of the labor force competing for that occupation, thus creating a downward pressure on the market wage offered for that occupation. In this way, the out migration of natives (or even earlier immigrants) to other local labor markets will imply that the relative shares of the population working for an occupation will be unchanged, thus there will no longer be a significant downward pressure on the market wage for that occupation. But workers can move between occupations, so instead of just dividing the labor market by occupation, Card (2001) devised nationally based probabilities of working in each occupation for each person, based on the person's observed characteristics such as education, age, ethnicity, country of origin and length of time stayed in the country.

To address the estimation problem of potential correlation between local economic conditions and immigrant inflows, Card (2001) used the instrument variable known as an exogenous 'supply push component' for immigrant inflows, which is basically the product of the total immigrant inflows from a source country multiplied by a factor representing the existing share of immigrants in the total population in the host country within a given occupational group. This instrumental variable is once again based on Bartel's (1989) research that discovered that new immigrants settle in localities which have a dominant presence of immigrants belonging to their same ethnicity.

Across 175 of the largest cities (in terms of population) from the 1990 U.S. census, Card (2001) found that immigrant inflows in the late 1980s did indeed have a detrimental impact on the wage rate earned by natives. The strongest impact was felt by native laborers and less-skilled service workers in cities with a large immigrant population, where a 20% increase in the ratio of immigrants (which was the highest rate as seen in the data for the late 1980s) caused a 3% decline in the wages earned by these natives.

Concerns about the limitations of the spatial correlation approach as an identification strategy to examine the wage impact of immigration have been voiced by the authors who use it themselves, thereby enabling them to develop empirical strategies to address such issues, such as the use of the instrumental variable by Altonji and Card (1991). However, none of these concerns have been as loud as the ones raised by Borjas, Freeman and Katz (1992), which led to the development of a completely different approach to answer this research question: the factor proportions approach.

The factor proportions approach models immigrants and trade as factors leading to changing the distribution of the national supply of workers having certain skills, and then via simulation methods, applies an elasticity of substitution to estimate the effect of the changes in labor supply on the relative wages (Borjas, Freeman and Katz, 1996). Using the factor proportions approach, these authors systematically found much more significant negative wage impacts of immigration than was typically found in the Spatial Correlations Approach. While elaborating more on this approach is outside the purview of this paper, it is nonetheless useful to discuss the limitations of the Spatial Correlations Approach which were found by Borjas, Freeman and Katz (1996) which have important ramifications for the choice of the estimation model that is used in this paper.

Using the cross sectional spatial correlation approach on U.S. census data from 1980 and 1990, Borjas, Freeman and Katz (1996) found unstable estimates of the effects of immigration on earnings of native workers of each sex, causing them to cast a shadow of doubt over the efficacy of this estimation technique. Segregating the workforce by location and education, the authors then implemented a first difference approach to the spatial correlation method. Their results showed that the adverse effects of immigration on native's wages become more pronounced once the model controls for local labor market conditions, which the authors strongly recommended.

More importantly, at least for the purposes of this paper, Borjas, Freeman and Katz (1996) found that the effects of immigration tend to become more negative or less positive the wider the geographic area is considered, thus leading them to conclude that wage effects of immigration not only depend on model specification but also on the geographic area covered for the sample. To decipher this phenomenon, the authors offer two theories; first, the out migration of native due to inflow of immigrants (which may lead to biased downwards estimates) in any local labor market is diffused once a greater geographical area is considered and second, capital may adjust to immigration-induced changes in labor supply. This salient aspect of the sensitivities of the appropriate spatial unit in the spatial correlation had key ramifications for the evolution of the literature in this subject, the most important of which was the development of a new identification strategy for this purpose, popularly known as the Skill Cell Correlation Approach.

In light of the developments surrounding the search for the proper identification strategy for measuring the labor market impact of immigration, Borjas (2003) developed a new procedure where, instead of looking at local labor markets and even regional labor markets, he chose to consider the national labor market in an attempt to counter the effects of out migration by natives and other adjustment mechanisms of local labor markets to immigration. Revisiting the substitutability of immigrants and natives as different factors of production as was first outlined in Grossman (1982), he segregated the national labor market on the basis of "skill cells" where each skill represented a combination of a given education level and a given level of labor market experience. In other words, in contrast to Card (2001), immigrants and natives are now modelled as being perfect substitutes for production only if they have the same level of education and experience.

From a pooled panel dataset of U.S. Census data and Current Population Survey data from 1960 to 2001, Borjas (2003) regressed the variation of the share of immigrants in the total labor force belonging to a

particular skill group on the average wages earned by natives of that same skill group for each time period. What he eventually discovered was that a 10% increase in the share of immigrants on average will lead to a reduction in the wages of competing native workers by 3 to 4%. For particular education levels, he found that the high school dropouts were the most adversely affected by immigration, having their wages being reduced by 8.9%.

### iii. Studies on the Canadian labor market and relevance of my research

The number of published studies related to wage impacts of immigration in Canada has been quite small when compared to other countries. Most of them were written as PhD theses or working papers, but were not published in any peer reviewed journals. Of these, Laryea (1998) used data from the 1988-1990 Labor Market Activity Survey to carry out a random effects model to test the impact on wages. When considering the labor market as a whole and one divided by sex, there was no significant impact on wages but, when segregating the labor market by industry, the paper found some evidence of wage suppression in some specific industries. Recently, Tu (2010) used a two-stage instrumental variable regression analysis (like the one used in this paper) to examine the relationship between the growth of wages earned by native and the changes in the share of immigrants in local labor markets defined by skill and occupation. Using data from the 1991 to 2001 Canadian Census, Tu (2010) found consistently insignificant effects, and in some cases even a significant positive effect, of immigration on the native worker's wages in the Canadian labor market.

Probably the most significant contribution to the literature on labor market impacts of immigration in Canada was carried out by Aydemir and Borjas (2007), which used the Skill Cell Correlation approach of Borjas (2003) in the context of the Canadian, U.S. and the Mexican labor market. The unique aspect of this landmark study was that it utilized all available Canadian Census microdata files from the 1971 to

2001, which includes the confidential files that accounts for a much larger representation of the Canadian population than the files that are available to the public. The authors divided the Canadian labor market such that each employed worker belonged to one of five education groups and one of eight labor market experience groups at a given time period. The authors found a significant negative impact of immigration on the log of weekly wages earned by native Canadians which, after adjusting for the fact that the labor market increased by 25.8% during 1971 to 2001 due to immigration, the authors deduced that the wage elasticity of weekly earnings was -0.32. In other words, a 10% increase in labor force due to immigration results in a reduction of weekly wages of a given skill group by 3.2%. Despite the negative wage response, the authors found that international migration narrowed wage inequality in Canada (as opposed to the U.S. and Mexico) since the Canadian immigrants were disproportionately high skilled.

Now that we have discussed the evolution and current state of the literature on this topic, it is useful to talk about how this particular study can contribute to the literature. My study focuses on the Canadian labor market, where the last word on the wage impacts of immigration has been through the work of Aydemir and Borjas (2007). While there have been studies, such as Bohn and Sanders (2005) which found that the methodology adopted by Borjas (2003) does not lead to significant negative impact on the wages of the native workers, Aydemir and Borjas (2007) have maintained that their results are better since they use the confidential Canadian Census files, which represents a much larger share of the population and that the use of smaller samples leads to substantial attenuation bias in estimates of the wage impacts of immigration.

This paper is no exception, as it uses the Public Use Census Microdata files which obviously represent a much smaller share of the population than the confidential files do. However, this paper utilizes the data

from the 2006 Canadian Census which I found was absent not only in Aydemir and Borjas (2007) but also in the subsequent works which tried to replicate the study.

Moreover, Sweetman and Warman (2008) has argued that the negative impact on wages in Canada as found in Aydemir and Borjas (2007) are not validated once the same methodology is reapplied to different time periods. In addition, Tu (2010) noted that one of the drawbacks of Aydemir and Borjas (2007) was that, since their dataset stretched from 1971 to 2001, it masked the effects of the radical changes in immigration policy in Canada in the late 1980s. One of the unique aspects of this paper is that considers the time period of 1986 to 2006, which has not been done elsewhere in the literature. One must also note that the composition of immigrants, in terms of educational qualifications, race, ethnicity and language skills, have been quite different in these two decades than was the case in the decades before.

Another aspect in which this paper differs is that it excludes workers who are self employed in the sample. The income earned from being self employed is not necessarily through wages in the labor market. Rather, it is from the profits of running one's business so the mechanisms of immigrant and natives competing for wages should not directly affect a self-run business owner's income.

Finally, I use two different estimation techniques, the fixed effects approach as well as the first difference approach, to answer the same research question in this paper and then compare the results to see if the results are sensitive to model specification. While this approach has been used extensively for the U.S. labor market, such a side-by-side analysis has not been done for the Canadian labor market.

### III. Data

This paper uses national labor market data from 1986, 1991, 1996, 2001 and 2006 Canadian Census Public Use Microdata files<sup>2</sup>. The Canadian Census Public Use Microdata files contain random samples of anonymous responses to the long form Census questionnaire. For instance, the 2006 Census public use microdata file (PUMF) on individuals contains 844,476 records, representing 2.7% of the Canadian population, which were randomly drawn from a sample of one-fifth of the Canadian population. The Census data is appropriate for this study as it contains extensive demographic, social and economic information about the respondents such as their age, income, schooling and other salient characteristics.

The sample of workers used for this study are only male workers who are aged between 18 and 64, do not live in collective households, were not enrolled in school during the reference year and have positive wage income and positive weeks worked and hours worked per week in the reference year and reference week respectively. The dependent variable is the log of weekly wages earned, adjusted for inflation by using the national price level data from the Consumer Price Index<sup>3</sup>. Since I am seeking to study the impact on the market wage offered (i.e. by firms, organizations, etc.), all the self-employed income earners have been dropped from the sample. A person is defined as an immigrant if he reports himself as a landed immigrant or if he is classified as an immigrant or non-permanent resident by the Census survey.

Once the aggregate labor market has been specified, I have divided it into several sub-labor markets within which I assume that immigrant and native born workers compete for the same job. In this regard, I follow Borjas (2003) and Aydemir and Borjas (2007) by making the assumption that immigrants and native born workers with the same level of skills are perfect substitutes in production. Since skills are

---

<sup>2</sup> The 1981 census data is also used for Instrumental Variable purposes.

<sup>3</sup> Statistics Canada. Table 326-0002 - Consumer Price Index (CPI), 1992 basket, annual (1992 = 100)

acquired by workers both in school and in the workplace after they graduate from school, I will classify each skill level on the basis of both the education level and years of experience of a worker. This implies that, a Canadian immigrant with high school level education and less than 5 years of labor market experience will be competing for the same job(s) with a native born worker having the same education level and number of years of labor market experience.

To divide the labor market data between the workers on this basis of their skills, their education and experience levels will need to be grouped appropriately in order to observe the outcome of interest. Here, I will group the education level of an employed worker into five distinct categories: a) Having no education degree, b) Having a High School graduation degree, c) Having both a high school degree and a vocational degree or post-secondary certificate or diploma below the bachelor's level, d) Having a Bachelor's degree and, e) Having a post graduate degree. While the data does not provide any information on the actual labor market experience of a worker, the standard practice is to use an approximate measure of the number of years since he completed his education, defined as the worker's age minus his total years of education minus 6. The sample only includes workers who have between 1 and 40 years of work experience. Moreover, these years of experience are segregated into eight intervals such that every worker has either: a) 1 to 5 years of experience, or b) 6 to 10 years of experience, or c) 11 to 15 years of experience, or d) 16 to 20 years of experience, or e) 21 to 25 years of experience, or f) 26 to 30 years of experience, or g) 31 to 35 years of experience, or h) 36 to 40 years of experience.<sup>4</sup> A more detailed description of how the sample was chosen and arranged from the Canadian Census can be found in the *Appendix B: Data* section of this paper.

Hence, a sub-labor market here is defined as the national labor market for all employed workers who have a given level of education and a given level of labor market experience at a given point in time. I

---

<sup>4</sup> The 2006 census data had no individuals in the skill group of 36 to 40 years of experience and having a post graduate degree.

then define the entry of immigrants into each of these labor markets as the ratio of immigrants to the total labor force for each of these sub-labor markets. In other words, for a given level of education (denoted by 'i') and a given years of labor market experience (denoted by 'j') at a given point in time (denoted by 't'), the share of immigrants (denoted by  $\theta$ ), otherwise known as the *Degree of Immigrant Penetration*, for each of these labor markets is equivalent to:

$$\theta_{ijt} = \frac{I_{ijt}}{I_{ijt} + N_{ijt}} \quad \text{----- (1)}$$

where  $I_{ijt}$  is the number of immigrant workers in a given skill group and  $N_{ijt}$  is the number of native workers in that same skill group. In other words, the variable  $\theta_{ijt}$  measures the ratio of immigrant workers in the total labor force.

The various figures in the *Appendix: Descriptive Statistics* section of this paper show the trend of the share of immigrants in the Canadian labor force, for both the entire labor market as well as for the sub-labor markets, for males over time. Figure 1.0 shows that, even when we look at the aggregated labor force across all education and experience levels, we see that the degree of immigrant penetration in the Canadian labor market for males has increased by 4.1% from 1986 to 2006.

Now let's dig a bit deeper and consider the trend of the share of immigrants in each sub-labor market segregated by education level of the workers. As shown in Figure 1.1, we see that the degree of immigrant penetration over time seems to be highest for the labor market for workers with a post graduate degree, where the share of immigrants in the labor force is around 31% to 40% over time, followed by the labor market for workers with a Bachelor's degree, where the ratio is from 21% to 30%

over time. For all other education levels, the ratio of immigrants is clustered around 14% to 20%. Therefore, it seems that natives face stiffer competition from immigrants as they become more skilled. However, our methodological framework defined skills in terms of both education and experience, hypothesizing that there should be variations in the share of immigrants between different combinations of education levels and years of experience at different points in time. This is indeed what is found in the data, as exhibited in Figures 1.3 to Figure 1.6, which show the variations in the immigrant penetration in the labor market at each point in time for each education level and each interval of labor market experience (i.e., within each of the forty skill groups as defined in our framework). These graphs highlight a number of salient characteristics about the Canadian labor market and more specifically, about the competition between natives and immigrants vying for the same job.

What is evident is that there is substantial variation in the share of immigrants for each experience interval within a given education level, with the share of immigrants increasing significantly with the level of experience across each time period. For instance, for high school dropouts and high school graduates, as shown in Figure 1.3 and 1.4, the share of immigrants is clustered around 7% to 14% for work experience between 1 and 5 years. With each higher interval of experience, this ratio increases until it reaches around 24% for high school dropouts and between 20% to 25% for high school graduates. Similar patterns are evident for higher education levels, such as those with some college degree and those with a Bachelor's degree, but the degree of immigrant penetration for all experience intervals are relatively much higher, as shown in Figure 1.4 and Figure 1.5 respectively. The immigrant penetration behavior is bit different for post graduate degree holders though, as there is greater fluctuation between the time periods considered, as shown in Figure 1.6. For instance, the share of immigrants in the labor force for post graduate degree holders with 1 to 5 years of experience is as low

as 18% in 1986 and as high as 43% in 2006, even though these ratios eventually converge to around the same region when higher experience intervals are considered.

All this points to the fact that it is the highly educated and /or more experienced native workers, i.e. the highly skilled workers, that are more likely to be impacted by the immigrant induced supply shifts in the labor market, which is the same conclusion that was reached by Aydemir and Borjas (2007) who carried out similar data analysis for the Canadian labor market.

Now we consider the behavior of the real wages earned by native Canadians in each of our forty defined skill groups. We see that the data shows that, just like the share of immigrants in the labor force, there is also substantial variation in the real wages earned by native Canadians within each skill group. For every time period from 1986 to 2001, we see a similar pattern for the earnings profile: the log of weekly wages increases with the initial increments in experience before leveling off or decreasing a bit after some time. Also in accordance with the human capital theory, the skill groups with higher education levels have higher earnings. The anomaly is the wage data for 2006, which shows that even though the log of weekly wages is relatively higher than the previous years for workers with small to moderate levels of experience, it suddenly drops after hitting a certain experience interval, with the drop becoming steeper with each higher level of education. It should be reiterated that, as was shown in Figure 1.0, the degree of immigrant penetration for the entire aggregated labor market was the highest for the year 2006. Similarly, the degree of immigrant penetration was relatively higher than the other years in most of the forty sub-labor markets considered, as is evident in Figures 1.3 to Figure 1.6. Thus it's natural to ponder: can the increasing influx of immigrants be responsible for the decline in wages of the natives?<sup>5</sup>

---

<sup>5</sup> As elaborated in the *Appendix C: Data* section of this paper, the experience variable was calculated differently for the 2006 Census than it was for the previous time periods. This may be another explanation why the wage data for 2006 is different than the other years.

The following section will thus chalk out the methodologies for formally testing how much the former can explain the latter.

## IV. Methodology

In this paper, I will examine the wage impact of immigration in Canada over the span of twenty years from 1986 to 2006, by looking at the labor market data from two perspectives: first, carrying out a Pooled Cross Sectional analysis with each Census year's labor market data and then, carrying out a First Differenced analysis by looking at the aggregate change in the labor market data between each of these Census years. This section will discuss each methodology by looking at the intuition behind the methodological framework, the process of estimation with the data and the limitations with each method to answer the research questions as well as some econometric solutions to address these limitations.

### i. First method: the pooled cross sectional approach

In its basic essence, the first methodology of this paper looks at multiple closed labor markets (or equivalently, the same labor market at different points in time) that immigrants have entered and then tests whether their entry has had any impact on the wages earned by the native born Canadian workers. Due to the twin problems of immigrants self selecting themselves into labor markets with higher wage rates and native workers moving to other labor markets due to the entry of immigrants, instead of looking at cities or regional labor markets, I will consider the entire national labor market of Canada, as was done by Aydemir and Borjas (2007). That way, I will know how immigration affected the labor markets across all cities and regions in Canada.

Once the location of the labor market has been specified, I must assume how the immigrant and native born workers interact with each other in the workplace, which will then form the basis of how I will

divide the labor market. In this regard, as mentioned in the previous section, I will follow Borjas (2003) and Aydemir and Borjas (2007) by making the assumption that immigrants and native born workers with the same level of skills are perfect substitutes in production.

This paper will test whether the entry of immigrants into each labor market has had any impact on the wages earned by native workers working in the same labor market. Thus, the data be stacked from the multiple time periods in order to estimate the following fixed effects model:

$$w_{ijt} = \alpha + \beta \theta_{ijt} + \gamma_i + \eta_j + \pi_t + \mu_{it} + \phi_{jt} + \Omega_{ij} + e_{ijt} \quad \text{--- (2)}$$

where  $w$  is the log of weekly wages, adjusted for inflation, earned by a native Canadian worker with education level  $i$  (where  $i = 1, 2, 3, 4$  and  $5$ ) and  $j$  years of experience (where  $j = 1, 2 \dots 8$ ) at time period  $t$  (where  $t = 1986, 1991, 1996, 2001$  and  $2006$ ). In other words, I have divided the national labor market into 199 sub labor markets based on these skill groups.

Now, the wages earned by natives in each of these sub-labor markets at any given time are dependent not only on the ratio of immigrants in that market, but also on their innate human capital characteristics, i.e. their level of education and labor market experience. I will introduce fixed effects for the education level and years of labor market experience of the native worker. The vector of fixed effects indicating the education level of natives belonging to a given sub-labor market is denoted by  $\gamma_i$  and the vector of fixed effects indicating the labor market experience level of natives belonging to a given sub-labor market is denoted by  $\eta_j$ . In other words, these fixed effects will attempt to control for the differences in wages across the native workers which are attributable to their human capital

characteristics. Since I am looking at multiple labor markets across time, there will be differences in their wages based on which time period the data is from. Thus I also introduce a fixed effect to control for the time period, denoted by  $\pi_t$  to control for this difference in the wages. Now, looking at the labor market over different time period means that the wages of the native workers may be different based on their labor market experience at different points in time as well as their education levels at different points in time. So to control for the fact the effects of experience and education on the wage may change with time, I also introduce interaction fixed effects, denoted by  $\mu_{it}$  and  $\phi_{jt}$  to control for the change in the effects education and change in experience on wages over time, respectively. Finally, the same number of years of experience of a native worker may have different impacts on the wage rate for different schooling levels. Thus, a final interaction term, denoted by  $\Omega_{ij}$  between the years of experience and schooling levels will be introduced to control for this effect on the wage rate.

It should be noted that, by introducing these fixed effects we are attempting to control for all factors that may explain the wage rate other than the immigrant share. However, there are may be a plethora of factors unbeknownst to us that may explain the variation in wage rate but which we cannot include in our model because one, we do not know what they are and two, even if we do know what they are, it is not possible to measure them and so we cannot incorporate them into this model (for e.g. structural shifts in labor demand across Canada). If these omitted variables are correlated with the share of immigrants as well as the wages earned by natives, then this will lead to biased estimates of the wage impact of immigration. The severity of the bias will depend on the degree to which these omitted factors are correlated with the immigrant share variable in our estimating equation.

In order to correct for the bias that arises from omitted variables, following Altonji and Card (1991), I will use an instrument variable for the immigrant share variable where the instrument would be the lagged share of immigrants in the total labor force for each defined skill group. Dustmann, Frattini & Glitz

(2007) has noted that, when measured with a sufficient time lag, pre-existing immigrant concentrations are quite unlikely to be correlated to the present economic or labor market conditions and thus serve as an effective instrumental variable. In this paper, I am considering the entire national labor market instead of local labor markets so while there should be no correlations of the share of immigrants in each skill groups with the present economic or labor market conditions, the instrument variable will nonetheless be quite effective in addressing the bias that may arise caused by any omitted variables. So for both specifications in this paper, I will first carry out a standard Ordinary Least Squares (OLS) estimation and then I will carry out an Instrumental Variable (IV) Two Stage Least Squares estimation.

## ii. Second method: the first difference approach

Instead of just examining multiple ‘snapshots’ of the labor market at different points in time, one can also examine the dynamic effects of immigration inflows on the labor market. In other words, how much of the change in the wages earned by natives between successive time periods is caused by the fluctuations in the changes in the degree of immigrant penetration in the sub labor markets between these same time periods?

To do this, we will regress the change in the average wages earned by native workers belonging to a particular skill group between two periods of time, i.e. two successive Census years, on the change in the share of immigrant workers in the total labor force between the same two periods. As before, the data will be stacked from the multiple time periods in order to estimate the following first difference model:

$$\Delta w_{ijt} = \beta \Delta \theta_{ijt} + \Delta \pi_t + \Delta \mu_{it} + \Delta \phi_{jt} + \Delta e_{ijt} \text{ ---- (3)}$$

where  $\Delta w_{ijt}$  denotes the change in the average wage earned by natives in a given skill group between two successive time periods in our sample and let  $\Delta \theta_{sxt}$  denote the *immigrant supply shock*, i.e. the change in the ratio of immigrant workers in the same skill group between the same two successive time periods.

Both the first difference approach and the cross sectional fixed effects approach are different ways of looking at the same picture. As explained in Wooldridge (2002), when there are only two time periods in question, the two approaches should yield identical results, but when there are more than two time periods, as in our particular case, the efficiency of each estimator depends on the nature of the error terms; the Fixed Effects estimator is more efficient when error terms are serially uncorrelated and the First Difference estimator is more efficient when the error terms follow a random walk. However, if there are serious differences between the results obtained from these two estimators, then this implies that the models suffer from endogeneity problems caused by measurement error, time varying omitted variables or simultaneity. To correct for this, in addition to the standard OLS estimation, I have also carried out an Instrumental Variable Two Stage Least Squares estimation in this First Difference model, using the lagged share of immigrants as an instrument for the change in the share of immigrants in each skill group.

Finally, there is a limitation that relates not to any specific form of methodology, but to the research question in general. As explained by Card (2001), wages are only observed for those who are employed. Thus, if those natives who are earning higher wages are more likely to remain employed when demand falls due to immigrant inflows, then the estimated coefficients will be biased downwards. That is a drawback of this paper in that it only looks at the wage impacts of immigration and not the employment or labor force participation impacts.

## V. Results

Table 1.0 shows the results from equation (1), the *Pooled Cross Sectional Approach*, that looks at the arrival of immigrants into multiple closed Canadian labor markets at different points in time and then tests whether their arrival has had any impact on the wages earned by the native born Canadian workers. I have estimated the model first by using the standard Ordinary Least Squares (OLS) method and then by the IV Two Stage Least Squares Method using the lagged share of immigrants in the total labor force for each skill group as an instrumental variable for the current share of immigrants in the total labor force for each skill group. Both estimates were estimated from weighted regressions using the sample size used to compute the dependent variable as weights.

The OLS results in Table 1.0 show that the coefficient estimate of the immigrant share variable is equal to 0.420 with a standard error of 0.004 while the Two Stage Least Squares estimate finds the estimate to be equal to -0.230 with a standard error of 0.16. Before attempting to explain the conflicting results from these two methods, it would be useful to first provide a more meaningful interpretation of these values by converting it to an elasticity that gives the percentage change in the natives' wages associated with the percentage change in labor supply, following the approach used by Borjas (2003).

Let  $\lambda$  denote the percentage increase in labor supply of a skill group solely due to immigration. In other

words,  $\lambda_{ijt} = \frac{I_{ijt}}{N_{ijt}}$

The *wage elasticity* is then defined as:

$$\frac{\delta w_{ijt}}{\delta \lambda_{ijt}} = \frac{\beta}{(1 + \lambda_{ijt})^2} \quad \text{-----} \quad (4)$$

From the sample used in this study, it is known that between the year 1986 and 2006, immigration had increased the size of the labor force across all skill groups by around 20%. In other words, the mean

value of the % increase in immigrant supply across all skill groups, i.e.  $\lambda_{ijt}$ , is equal to 20%. Thus, according to equation (4), the wage elasticity of wages is equal to 0.29 for the OLS method. In other words, if there is a 10% increase in the supply of immigrants for any given skill group then this will result in an average increase in the weekly wages earned by natives belonging to that skill group by about 2.9%. On the contrary, the wage elasticity from the IV Two Stage Least Squares method is equal to  $-0.15$ , which implies that a 10% increase in the supply of immigrants for a given skill group will result in a *reduction* in the weekly wages earned by natives belonging to that skill group by about 1.6 % on average.

The first focal point of discussion is: why does the OLS estimate predict a positive wage impact of immigration while the Two Stage Least Square method result in either a negative impact on the wages? One possible reason is that immigrants are not randomly allocated across all the skill groups in the sample. In other words, there is an endogeneity problem that results in biased OLS estimates because the immigrants in this sample have been self-selected into certain skill groups / sub-labor markets that's more likely to have relatively higher wages than the others, thus reflecting a more positive impact on the natives' wages than what it actually should be.

This self-selection process is most likely to have been caused by two factors. As stated before, the immigration policy since 1967 changed its gears to give more preference to immigrants who have the occupational skills and educational credentials that was considered to be essential for the growth and development of Canada's economy. Figures 1.1 to 1.5 reinforce this fact, showing that the relatively larger shares of immigrants in the labor force are clustered around the sub labor markets that have the highest skill levels. The skill intensive nature of these jobs mean that these sub labor markets are more likely to have higher wages regardless of the degree of immigrant penetration in these sub labor markets. In other words, a highly skilled native is competing with a high skilled immigrant for the same

jobs, but the skill intensive nature of these jobs means that it will pay relatively higher wages than what is offered in the other sub labor markets. As a result, the effect of the share of immigrants in the labor force on the earnings of natives is overstated through standard OLS estimation.

This self-selection process may also be caused by the fact that the immigration policy may have been designed in a way that immigrants are intentionally put into skill groups that are complementary to the natives. Through the point system, immigrants that are brought in are highly educated and have the necessary skill sets that allow the natives to do better. For instance, engineers brought into Canada may help the science and technology sectors in Canada, thereby make these sectors becomes more productive, which will in turn creates a positive impact on the wages earned by natives. So once again, the positive impact on the natives' wages is not because of the labor market adjustments as a result of immigration but rather it is the selection process that allocates immigrants into sub labor markets that make the immigrants complementary factor of production to the natives (rather than acting as substitutes).

This is where the use of the IV Two Stage Least Square estimation proves to be useful. The instrument, i.e. the lagged share of immigrants in the labor force for each skill group, is assumed to have an impact on the current market wage rate for the natives but it will have a strong impact on the current share of immigrants in the labor force across all skill groups. In the first stage of the Two Stage Least Square estimation, we thus regress the current share of immigrants on the lagged share of immigrants. The coefficient in the first stage (also reported in Table 1.0) thus shows how much of the current share of immigrants is explained *only* by the lagged share of immigrants across all skill groups. The effect of the self-selection bias and all other omitted variables that may simultaneously impact both the immigrant shares and the wages of the natives are thus contained in the error term of the first stage process. In the second and final stage of this estimation process, we then regress the log of real weekly wages on this

estimated immigrant share from the first stage, and hence the resulting estimate of the impact of immigration on the natives' wages is free from the self-selection bias that was present in the standard OLS estimation. Therefore, the IV Two Stage Least square estimate gives us the more accurate estimate of the impact of immigration, showing that a 10% increase in the supply of immigrants for a given skill group will result in an average reduction in the weekly wages earned by natives belonging to that skill group by about 1.6%.

Table 1.1 shows the results from my second empirical specification, the *First Difference Approach*, where I examine the dynamic effects of immigration inflows on the labor market, in particular how much of the change in the wages earned by natives between successive time periods is caused by the fluctuations in the immigrant supply shock, i.e. the change in the ratio of immigrants in the labor force in each of the sub labor markets between the same consecutive time periods. Contrary to the Pooled Cross Section method, the standard errors of the Two Stage Least Squares estimate become much larger with the First Difference estimation. As shown in Table 1.1, the Two Stage Least Squares process estimates the coefficient of the immigrant supply shock variable to be equal to -0.022 with a standard error of 0.027.

Altonji and Card (1991) explained that the First Difference approach is more likely to capture the short run effects of immigration, in which the capital stock and labor demand for workers' skills have had not time to adjust fully. Thus it is more likely that the First Difference approach captures the short run effects of immigration while the Pooled Cross Section captures the long run effects. So why are there no significant negative wage impacts in the short run? One possible reason is that there may be *wage stickiness* in the short run, for e.g. due to fixed contracts, so that the labor market cannot adjust through a reduction in market wage when the labor supply expands as a result of immigration. Another possible reason, as explained in Dustman et. al (2007), could be the shape of the labor supply curve itself. From what we found, we may infer that natives' labor supply in the short run may be elastic such that natives

may not accept to work at the lower equilibrium wage caused by immigration and thus choose to be unemployed instead. Therefore, in the short run there will be labor market adjustments through the employment rate and not through the wages. From the results of the Pooled Cross Section method, we may additionally infer that labor supply for natives in Canada may be more inelastic in the long run such that the native workers are more willing to work at the lower market wage in equilibrium. However, it should not be noted that it is not possible to test the labor supply hypothesis empirically since I have only examined the wage impacts of immigration in Canada and not the impacts on employment.

On the other hand, Table 1.1 also shows the OLS estimate of the change in the immigrant share variable to be equal to 0.113 with a standard error of 0.004. In other words, the OLS coefficient is still significant and, by reapplying equation (4), we find that the wage elasticity is now equal to 0.08. In other words, a 10 % increase in the share of immigrants in each skill group will lead to a 0.8% increase in the wages earned by the natives in that skill group. The standard OLS method still yields a significant positive impact on wages due to immigration when the First Difference approach is used, because the presence of variable endogeneity due to the self-selection of immigrants into the certain high skill groups still persists even when a First Difference is used, and it is strong enough to result in a significant positive effect. Accordingly, the IV Two Stage Least Squares estimate should be preferred over the standard OLS estimate and thus we may conclude that there is no effect of immigration on the wages earned by natives in the short run, even though the Pooled Cross Section method showed us that it had a significant negative impact in the long run.

## VI. Conclusion

The government of Canada has long designed its immigration policy in such a manner that it allows the nation to achieve its economic, social and humanitarian objectives without sacrificing the needs of its resident population. However, the arrival of an increasing number of immigrants every year has routinely raised concerns about the detrimental effects it may have on the labor market opportunities of the incumbent working population. In this paper, I examined whether the increase in the supply of workers in the Canadian labor market as a result of immigration had any impact on the real wages earned by the native Canadian workers since the late 1980s, by segregating the Canadian workforce on the basis of their skills. What I eventually find is that the surge of immigrants coming to Canada did indeed have a negative effect on the earnings of the native Canadian workers. Specifically, a 10% increase in the supply of immigrants for any given group of workers having a certain set of skills led to a 1.6 % reduction in the weekly real wages earned by the native Canadian workers possessing the same set of skills. When attempting to validate the impact of immigration through different empirical specifications, I found that this negative impact on the weekly real wages is most likely to be present in the long run since there may be some wage stickiness that prevents immigration from having any effect on the natives' earnings in the short run. Hence, this paper contributes to the existing body of literature on this topic by finding new evidence that sheds some light into the empirical debate about the economic impacts of immigration in Canada. In other words, despite the government's intention to design immigration policies that would not harm the resident population of Canada, this paper finds evidence to the contrary, at least from an economic perspective.

## Bibliography

Altonji, J. G., & Card, D. (1991). The Effects of Immigration on the Labor Market Outcomes of Less-Skilled Natives. (J. Abowd, & R. Freeman, Eds.) *National Bureau of Economic Research, Immigration, Trade and Labor Market*, pp. 201-234.

Aydemir, A., & Borjas, G. J. (2007). Cross-Country Variation in the Impact of International Migration: Canada, Mexico, and the United States. *Journal of the European Economic Association*, 5(4), 663-708.

Bartel, A. P. (1989). Where do the new US immigrants live?. *Journal of Labor Economics*, 7(4), 371-391.

Bohn, S., & Sanders, S. (2005). Refining the estimation of immigration's labor market effects. *Unpublished manuscript. Department of Economics, University of Maryland.*

Borjas, G. J. (2003). The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market. *The Quarterly Journal of Economics*, 118(4), 1335-1374.

Borjas, G. J., Freeman, R. B., & Katz, L. F. (1992). On the labor market effects of immigration and trade. In *Immigration and the workforce: economic consequences for the United States and source areas* (pp. 213-244). University of Chicago Press.

Borjas, G. J., Freeman, R. B., & Katz, L. F. (1996). Searching for the Effect of Immigration on the Labor Market. *American Economic Review*, 86(2), 246-51.

Card, D. (1990). The impact of the Mariel boatlift on the Miami labor market. *Industrial & Labor Relations Review*, 43(2), 245-257.

Card, D. (2001). Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration. *Journal of Labor Economics*, 19(1), 22-64.

Dustmann, C., Frattini, T., & Glitz, A. (2007). The impact of migration: a review of the economic evidence. Centre for Research and Analysis of Migration, *Department of Economics, University College London*.

Employment and Immigration Canada. (1992). Managing Immigration: A Framework for the 1990s.

Grossman, J. B. (1982). The substitutability of natives and immigrants in production. *The Review of Economics and Statistics*, 596-603.

Laryea, S. (1998). The impact of Foreign-Born Labor on Canadian Wages: A Panel Analysis. *Vancouver: Research on Immigration and Integration in the Metropolis*.

Li, P. S. (2003). *Destination Canada: Immigration debates and issues*. Don Mills: Oxford University Press.

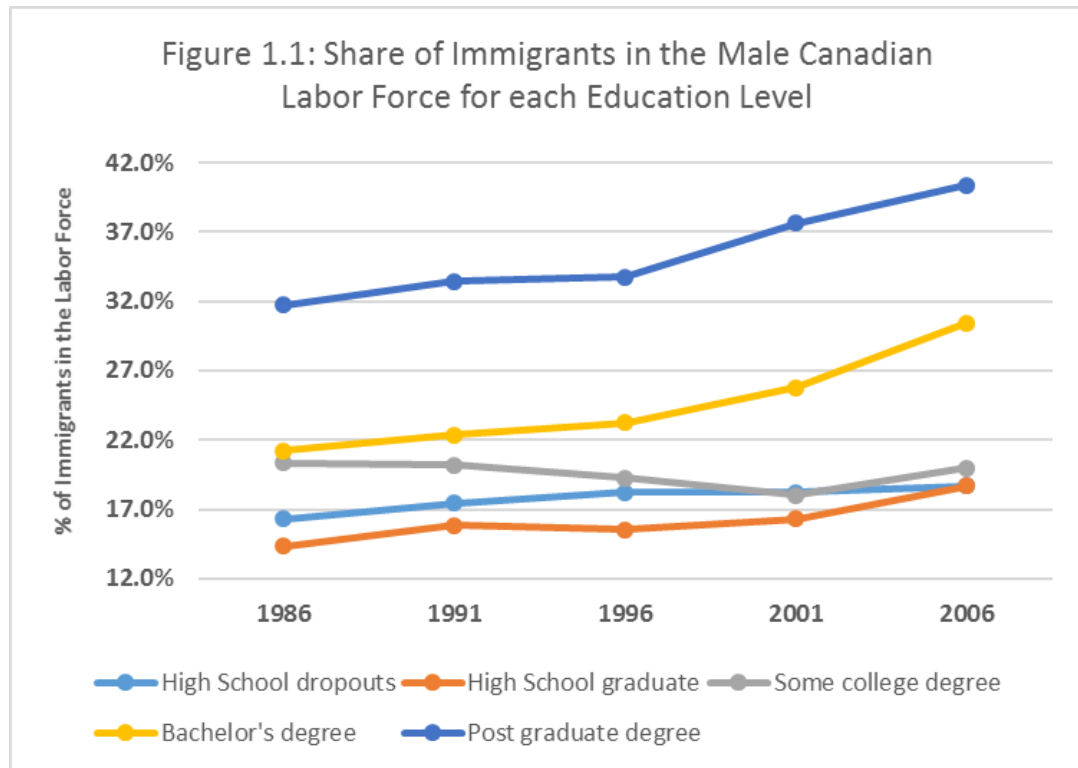
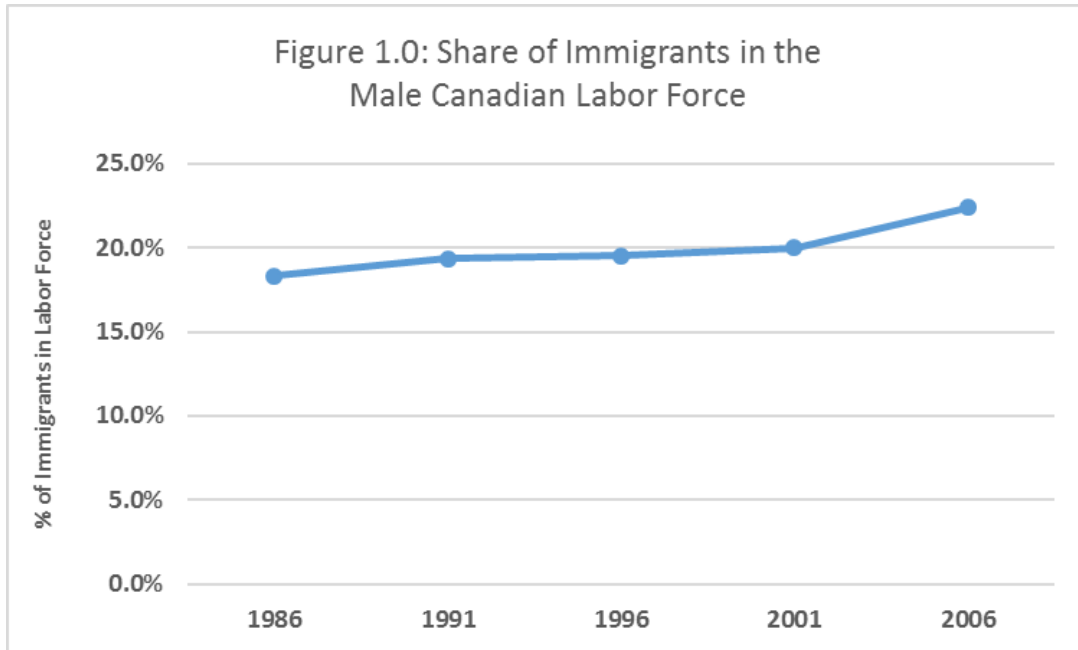
Russo, R. M. (2008). Security, Securitization and Human capital: The new wave of Canadian immigration laws. *International Journal of Human and Social Sciences*, 3(4), 295-304.

Sweetman, A., & Warman, C. (2008). Integration, impact, and responsibility: An economic perspective on Canadian immigration policy. *Immigration and integration in Canada: In the twenty first century*, 19-44.

Tu, J. (2010). The Impact of Immigration on the Labour Market Outcomes of Native-Born Canadians. *Bonn: Institute for the study of Labor*.

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. MIT Press.

## Appendix A: Descriptive Statistics



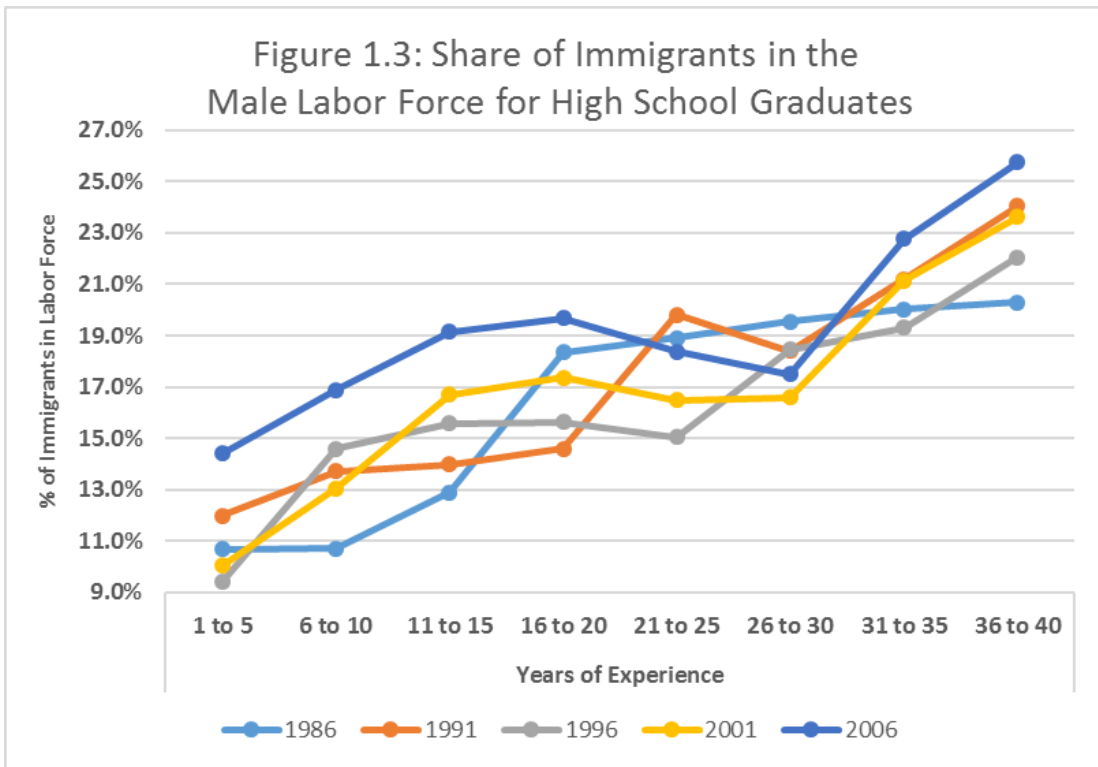
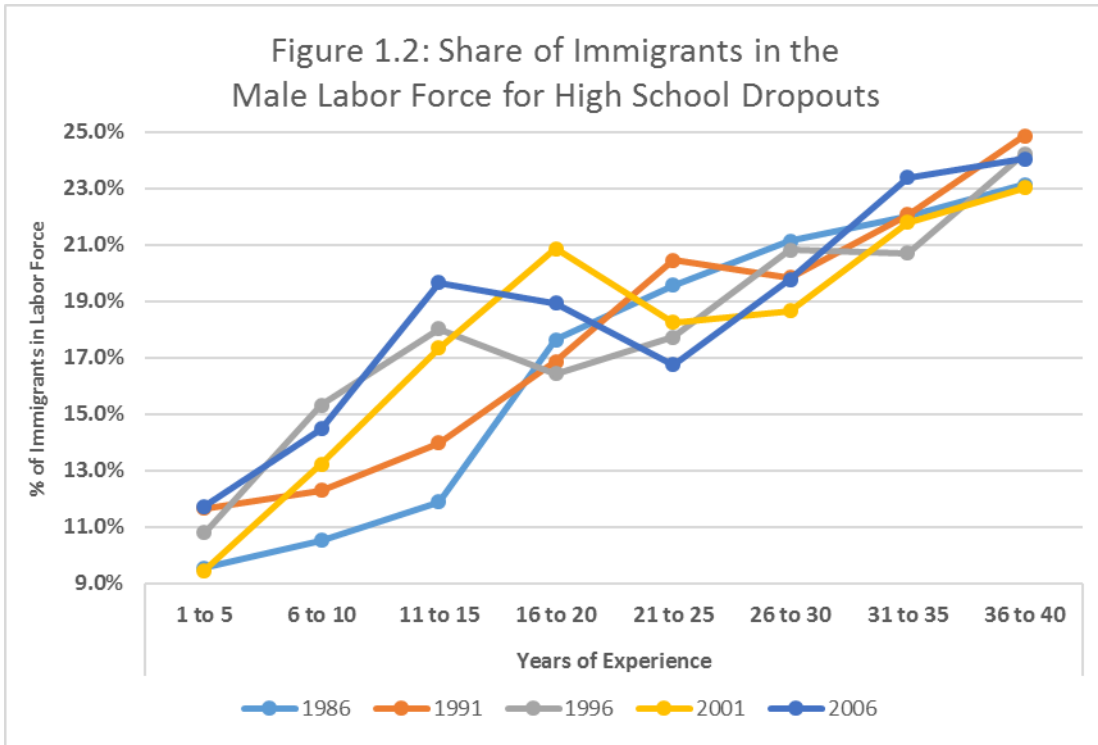


Figure 1.4: Share of Immigrants in the Male Labor Force for Some College degree

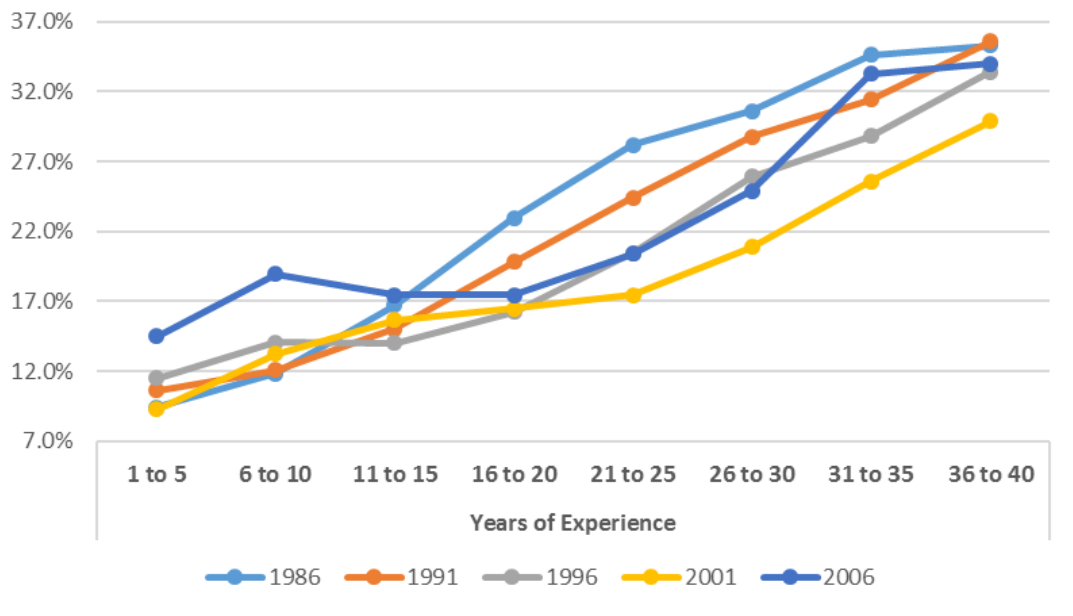


Figure 1.5: Share of Immigrants in Male Labor Force for Bachelor's degree holders

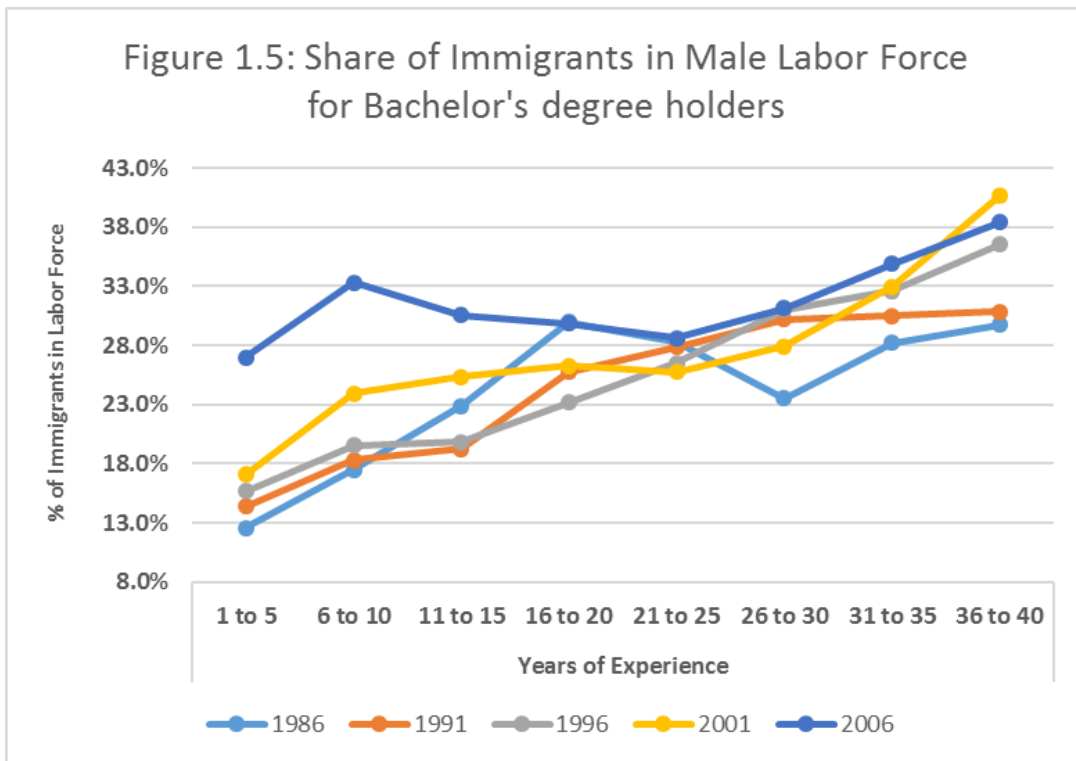


Figure 1.6: Share of Immigrants in the Male Labor Force for Post Graduate degree holders

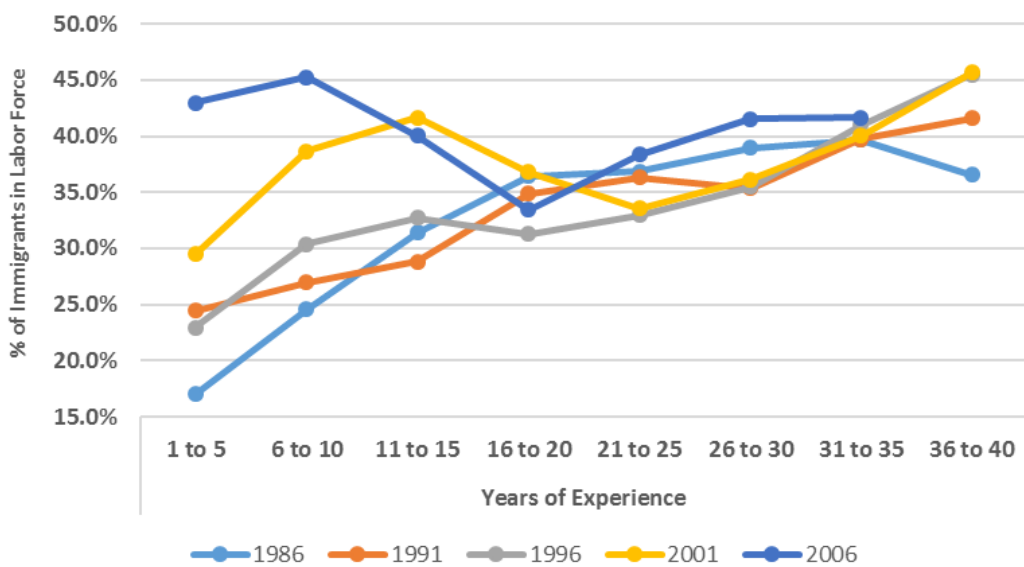
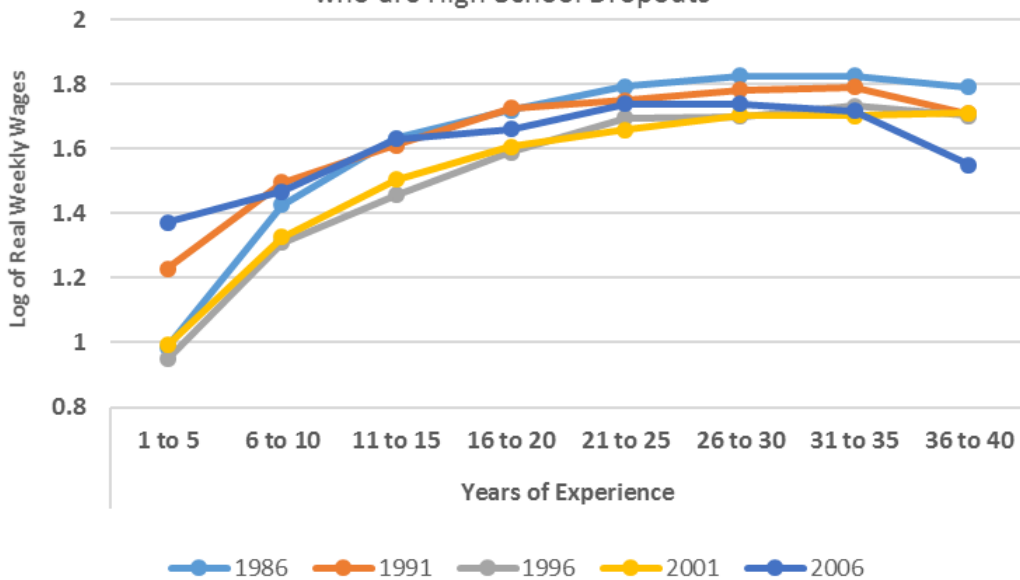
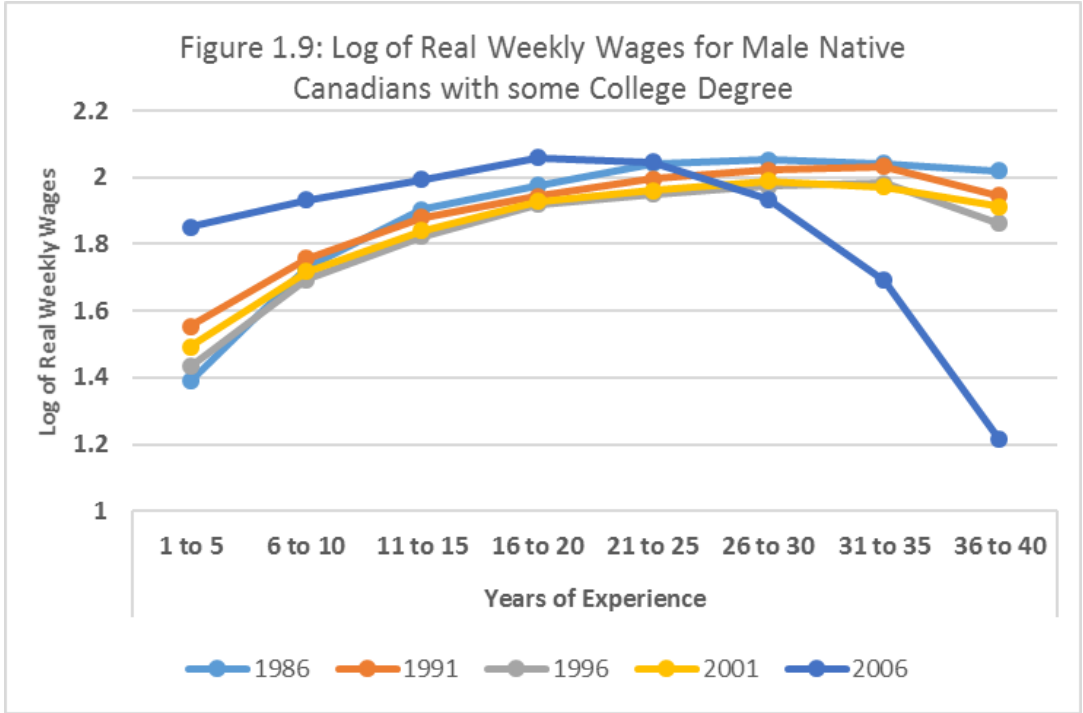
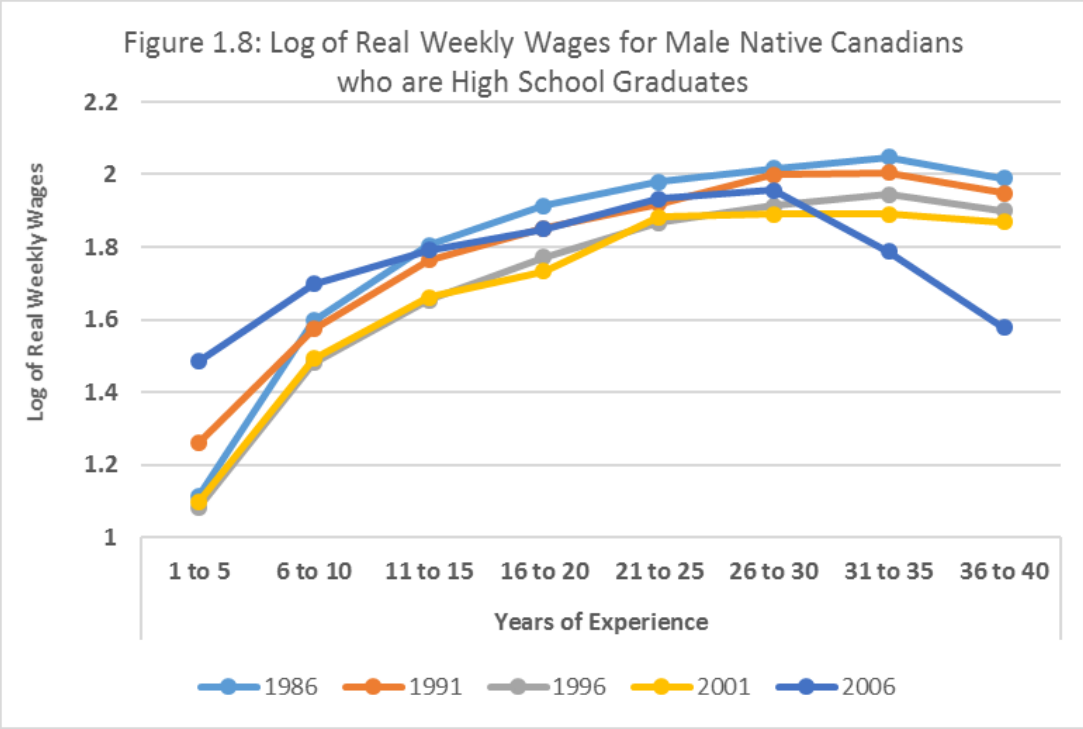
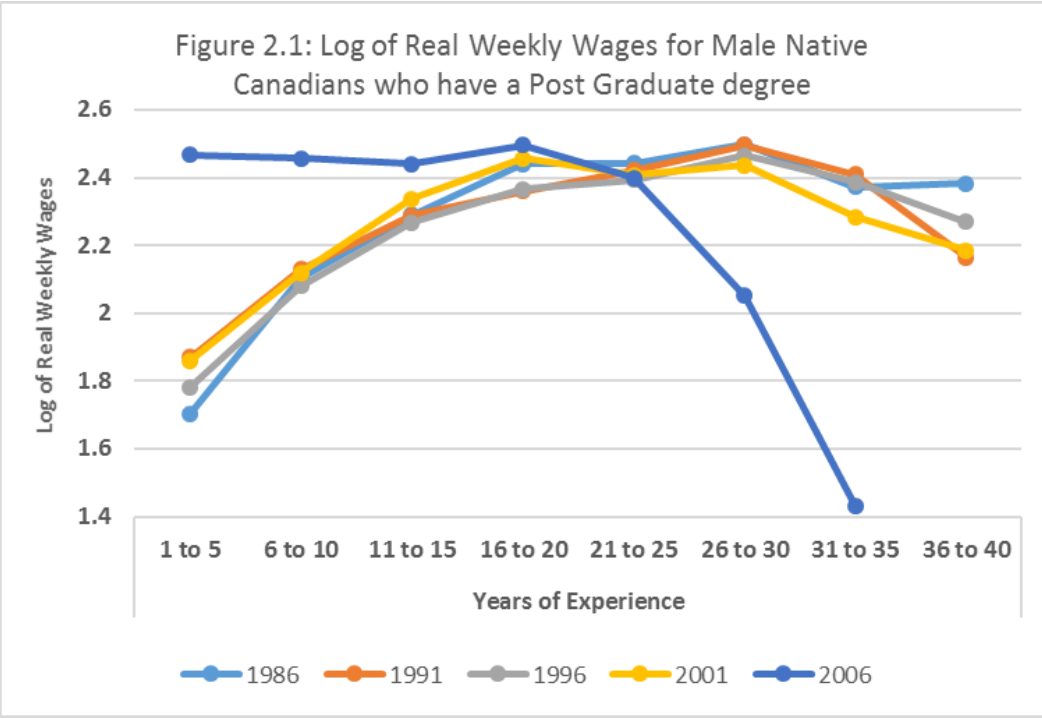
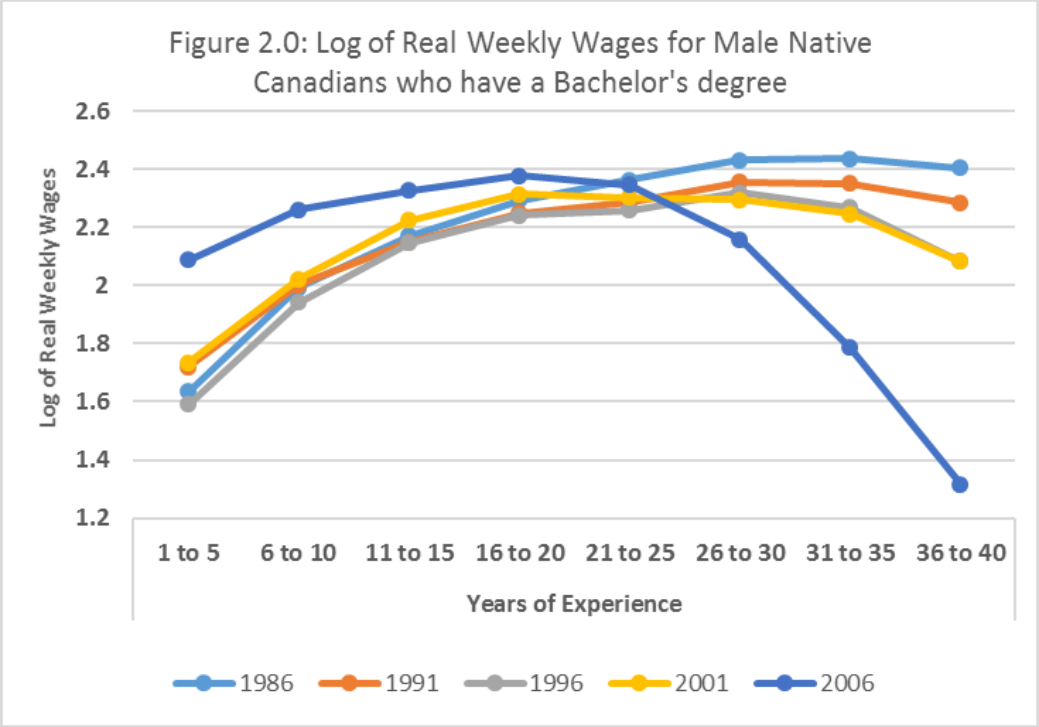


Figure 1.7: Log of Real Weekly Wages for Male Native Canadians who are High School Dropouts







## Appendix B: Results

Table 1.0: Pooled Cross Sectional Impact of Immigrant Penetration on the Log of Weekly Wages earned by Male Native Canadian Workers Nationally across all Skill Groups

Independent Variables	Dependent Variable	
	Log of Weekly Wages Earned by Male Native Canadians	
	OLS estimate	IV Two Stage Least Squares Estimate (2 <sup>nd</sup> stage)
Share of Immigrants in the Labor Force in each Skill Group	0.420*** (.004)	- 0.230*** (.016)

	Dependent Variable	
	Share of Immigrants in the Labor Force in each Skill Group	
		IV Two Stage Least Squares Estimate (1 <sup>st</sup> stage)
Lagged Share of Immigrants in the Labor Force in each Skill Group		0.289*** (0.001)
Value of F statistic (Square of t statistic) for Lagged Share of Immigrants in the First stage		47093.3

The table shows the coefficient estimate for the share of immigrants variable within each skill group from both regressions where the dependent variable is the log of weekly wages earned by native workers at a given point in time. A skill group is defined by the education level and labor market experience of the workers at each time period from which the data is taken from. Both regressions include controls for the time period and the education level and years of experience of the native worker, as well as the interactions between these three variables. The data is taken from the Canadian Census Public Use Microdata files. Both regressions have 199 observations. Both estimates were obtained from frequency based weighted regressions (by the sample size used to compute the dependent variable). The robust Standard errors are reported in parenthesis.

\*Significant at 10% \*\*Significant at 5% \*\*\* Significant at 1%

Table 1.1: First Difference Impact of Immigrant Supply Shock on the Log of Weekly Wages earned by Male Native Canadian Workers Nationally across all Skill Groups

Independent Variables	Dependent Variable	
	Change in Log of Weekly Wages Earned by Male Native Canadians	
	OLS estimate	IV Two Stage Least Squares Estimate (2 <sup>nd</sup> stage)
Change in Share of Immigrants in the Labor Force in each Skill Group	0.113*** (.004)	- 0.022 (.027)

	Dependent Variable	
	Change in Share of Immigrants in the Labor Force in each Skill Group	
		IV Two Stage Least Squares Estimate (1 <sup>st</sup> stage)
Lagged Share of Immigrants in the Labor Force in each Skill Group		0.289*** (0.001)
Value of F statistic (Square of t statistic) for Lagged Share of Immigrants in the First stage		47093.3

The table shows the coefficient estimate for the change in the share of immigrants variable, between two successive points in time, within each skill group from both regressions where the dependent variable is the log of weekly wages earned by native workers between the same two successive points in time. A skill group is defined by the education level and labor market experience of the workers at each time period from which the data is taken from. The data is taken from the Canadian Census Public Use Microdata files. Both regressions have 159 observations. Both estimates were obtained from frequency based weighted regressions (by the sample size used to compute the dependent variable). The robust Standard errors are reported in parenthesis.

\*Significant at 10% \*\*Significant at 5% \*\*\* Significant at 1%

## Appendix C: Data

*The Sample Population:* The data is taken from the 1981, 1986, 1991, 1996, 2001 and 2006 Public Use Canadian Census Microdata files that are available to Canadian post-secondary institutions. The sample of workers used for this study are only male workers who are aged between 18 and 64, do not live in collective households, were not enrolled in school during the reference year<sup>6</sup> and have positive wage income and positive weeks worked and hours worked per week in the reference year and reference week respectively. Since our dependent variable is the market wage offered, all the self-employed income earners are dropped from the sample.

*Definition of an Immigrant:* The data from 1991 census onwards classifies the population according to whether they are non-immigrants, landed immigrants, or non-permanent residents while the data prior to the 1991 census only reveals the information on when the respondents reported themselves being a landed immigrant in Canada. So a person is defined as an immigrant if he reports himself as a landed immigrant or if he is classified as an immigrant or non-permanent resident.

*Definition of Education:* From the census data, the *Highest degree / Certificate / Diploma* census variable is used to determine the education level of the workers. Then, these degrees are grouped so that workers are assumed to have an education level of any one of the following five categories: 1) Having no education degree, 2) Having a High School graduation degree, 3) Having both a high school degree and a vocational degree or post-secondary certificate or diploma below the bachelor's level, 4) Having a Bachelor's degree and, 5) Having a post graduate degree.

*Definition of Experience:* As done in the literature, work experience is defined as the worker's (*Age*) – (*Total Years of Schooling*) – 6. While the data on the total amount of years spent in school can be

---

<sup>6</sup> The 1986 census did not have any information on whether the individuals attended school during the reference year the sample for 1986 could not exclude those individuals who attended school during the reference year.

obtained from the 1986 census to the 2001 census from the '*Total Years of Schooling*' census variable, this data is not available in the 2006 census. To address this issue, I follow the methodology adopted by Aydemir and Borjas (2007) for the US labor market and assume that the total years of schooling attained, or the age of the worker when he entered the labor market, is 17 for workers with no high school degree, 19 for workers with only a high school degree, 21 for workers with both a high school degree and a vocational degree or post-secondary certificate or diploma below the bachelor's level, 23 for workers with a Bachelor's degree and 27 for workers with a post graduate degree. The analysis will be restricted to those workers who have between 1 and 40 years of experience.

To divide the labor market on the basis of experience, the workers were segregated into one of eight experience bands of five year intervals ( 1-5, 6-10, 11-15,16-20, 21-25, 26-30, 31-35, 36-40).

*Definition of Weekly Wages:* The weekly wages for the individuals were calculated by dividing the total annual wage income earned during the reference year by the number of weeks worked during the reference year. The wages were adjusted for inflation by using the Consumer Price Index with the base year of 1992.