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The Implications of Immigrants on the Wage Structure of Canada

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Abstract

Due to Canada's point system immigration policy, there is a drive to maintain more high-skilled immigrants. A wide variety of research has been conducted evaluating the wage impacts of immigrants on natives. Substitutability and complementarity between immigrants and natives are at the center of previous analysis because of their different wage implications. Rather than making restrictive assumptions on the substitutability between natives and immigrants, this paper builds a theoretical model and estimates the substitutability between natives and immigrants using a pooled time series of Canadian cross-sectional microdata on wage and employment from 1981 to 2001. According to the structural estimation in the paper, Canadian natives and immigrant workers are complements within detailed skill cells, which means the inflow of skilled immigrants increases the wages received by native workers. Natives and immigrants are imperfect substitutes in time and experience cells based on skill. The research also finds that high-skilled and low-skilled labor are imperfect substitutes, which is consistent with previous literature looking at the United States and the United Kingdom.

1. Introduction

In today's political climate there are a lot of arguments for and against skilled immigration. Some argue that skilled immigration will hurt native wages and some argue that it will help native wages. This study will provide data and numerical analysis to this argument using Canadian data. Canada currently has point based immigration policy. When applying to immigrate to Canada, an individual must obtain at least 67 points out of 100 to be qualified to immigrate. There are six selection factors that the points are rewarded from. Those selection factors are; language, education, work experience, age, arranged employment in Canada, and adaptability. Language can result in a maximum of 28 points if the individual is able to write, read, listen, and speak in English and French. Education can result in a maximum of 25 points if the individual has a minimum of secondary education equivalent to Canada's completed. Work experience can result in a maximum of 15 points if the individual has worked in Canada or abroad, while they were studying, or while being self-employed. Age can result in a maximum of 12 points and maximum points are given to individuals aged 18 to 35. If an individual is under 18 or over 47 years old, zero points are given. Arranged employment can result in a maximum of 10 points if the individual has a job offer of at least one year from a Canadian employer. Adaptability can result in a maximum of 10 points if the individual and their spouse's language level, past studies, and work are above a certain level.

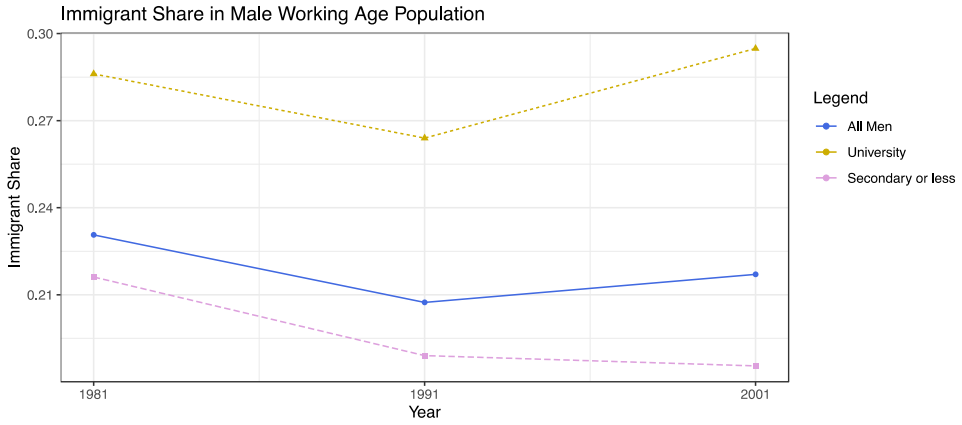

Figure 1. Immigrant shares in the male working age population. Source: IPUMS International.

It is easy to see that Canada is focused on bringing in more high-skilled immigrants to their labor market. The immigrant share of the working population had decreased from 1981 to 1991, but has been increasing over the past two decades. In 2001, 21.7 percent of the working age population were immigrants. Up from the previous decade with 20.7 percent of the working age population being immigrants. Looking at the university educated share and the secondary or less educated share, the share of university educated immigrants has increased while the share of secondary or less educated has decreased from 1981 to 2001. Since Canada's point system targets high-skilled workers this is not a surprise that the share of university educated immigrants is greater than the share of secondary or less educated.

Due to these trends, it is important to look at the impact of immigrants on native populations, especially the skilled immigrants. Extensive studies have been done with United States data, but the United States results cannot be extrapolated to other countries where immigration policy and market conditions are different. Canada's point-based system leads to better educated immigrants than native-born. This paper studies the impacts of immigrants on native wages using structural estimation in the Canadian context. When immigration is skill-based, a different effect on wages for native workers with different skill levels is expected. Conducting analysis on Canadian immigrants and how they have affected native wages will give a better understanding of how high-skilled immigrants affect native over time.

In this paper, a two-level CES production function approach will be used to look at substitutability between natives and immigrants in Canada and its wage implications. The paper is organized as follows. Section 2 gives a brief literature review and section 3 provides the detailed descriptive statistics. The theoretical framework of the analysis will be discussed in section 4 describing how the estimates of substitutability between natives and immigrants was determined. The estimated substitutability and the overall effect of immigration on the wage structure of Canada will be discussed in detail in section 5. Conclusions and recommended future research will be discussed at the end.

2. Literature Review

There is an abundance of research looking at how immigrants affect native wages and if immigrants and native are perfect or imperfect substitutes for each other. The majority of the research conducted has analyzed the United States. Existing literature debates if natives and immigrants are perfect substitutes for each other or not. This paper also relates to another stream of literature that studies how immigration policy affects the inflow of high-skilled immigrants. Literature on immigration policy and the substitutability between immigrants and natives is relevant to this paper.

To look closer at immigration policy implications on the wages of natives, Antecol, et. al[1] look at the immigration policies and skills of immigrants to Australia, Canada, and the United States. The paper found that labor market skills of immigrants play a much larger role in the immigrant's admission policies of Canada and Australia than the United States. The paper was aiming to identify the labor market effects of the government policy on immigration. It was found that Australian and Canadian immigrants are superior to United States immigrants in the terms of unobservable and observable characteristics. This suggests that the point systems of Canada and Australia successfully screen for some of the difficult to observe attributes related to labor market productivity compared to the United States' family-

based immigration policy. Borjas[2] also looks at the immigration policies of the United States and Canada conducting a comparison of the two countries. The paper identifies costs and benefits of Canada's skill-based point system compared to the United States' family-based policy. National origin mix differences can help explain the average skill level of foreign-born workers. Borjas finds that immigrants in Canada are, on average, higher skilled than those in the United States. The point system successfully alters the national origin mix of Canada, allowing more high-skilled immigrants to immigrate compared to the United States. The wage disadvantage in the United States for immigrants is greater than it is in Canada. This paper extends Borjas' study by evaluating the wage impacts of these high-skilled immigrants.

Hum and Simpson[4] look closely at the wage gap and economic assimilation of Canadian immigrants. The paper wants to answer the question of if immigrants narrow the wage gap as they become more attuned to local market conditions. It states that assimilation is better captured through wage gaps rather than differences in earnings. Human capital accumulation plays an important role in wage growth. The paper comes to the tentative conclusion that there is no evidence of economic assimilation for immigrant male workers. This paper differs from Hum and Simpson's because it focuses on the performance of native workers as immigrants assimilate into the local labor market.

In the literature, there is debate as to whether immigrants and natives are perfect substitutes for each other or not. Jaeger[5] argues that natives and immigrants are perfect substitutes. The elasticity of substitution between immigrants and natives of the same sex with similar skills is estimated to be perfect substitutes. The paper found that changes in the relative wages of immigrants and natives within groups changed little in the long run. The conclusion the paper came to be that natives and immigrants were nearly perfect substitutes within broad skill categories. On the other hand, two papers from Manacorda, et. al[5] and Chiswick, et. al[3] conclude that immigrants and natives are not perfect substitutes. Manacorda, et. al[5] make an assumption that immigrants and natives are imperfect substitutes. Chiswick, et. al[3] point out that natives are suspected to be relatively more intensive in country specific skills. For example, natives know the language and customs of the country they live in. Immigrants are more likely to be relatively more intensive in self-selection characteristics, such as the innate ability and entrepreneurship. An increase in the supply of immigrants relative to native labor would decrease the returns to skills immigrants are more intensive in and raise the returns to the skills natives are more intensive in. The paper found the relative earnings of adult male immigrants are lower the greater the labor supply of immigrants.

Manacorda, Manning, and Wadsworth's[6] paper discussing the impact of immigration on the structure of wages in Britain argue that natives and immigrants are imperfect substitutes. Manacorda, et. al[6] show that skilled immigration has primarily reduced the wages of previous immigrants, particularly those immigrants who are university educated. There was little effect on the wages of natives due to imperfect substitutability. Imperfect substitution of native and immigrants in Manacorda, et. al[6] helps solve the long-standing "puzzle" of previous research not finding any significant effect of increased high-skilled immigration on native wages in the UK. The wages of immigrants already residing in the UK saw the greatest effect of an increase in the number of high-skilled immigrants to the UK. This paper adds to the literature by finding imperfect substitutability of native and immigrant workers using Canadian data.

Sparber and Peri look at task specialization alongside immigration and wages to explain why natives and immigrants are imperfect substitutes. It is suspected that large inflows of lower educated immigrants may reduce wages of natives with comparable education levels. If workers specialize in their production tasks, natives will reallocate their task supply and this reduces downward wage pressure. The general finding from the paper is that immigrants specialize in occupations of manual and physical labor while natives specialize in communicative and language-based tasks. As long as natives and immigrants take on tasks that they have comparative advantage in they will be complements. Large increases in the manual task supply increases the wage of communicative task supply, rewarding natives.

This paper adds to previous literature by conducting analysis on the substitutability between natives and immigrants. Assumptions on substitutability are not used in this paper. Once the substitutability between natives and immigrants was determined, analysis on the wage implications of immigrants on natives was conducted. Canada's immigration policy was analyzed and interpreted with the estimated substitutability between natives and immigrants.

3. Data

Data was obtained from IPUMS International based on information on the wages, employment, and demographics of natives and immigrants. Data for census years 1981, 1991, and 2001 were obtained. The data is on the individual level and observations were limited to working males aged 26 to 65. Individuals were grouped into cells based on age, education, immigrant status, and time to estimate the average wage for each cell. The average wage was adjusted for inflation using CPI base year 2002. Only those who were currently employed were included in the dataset. Hourly

wage was used as the measure of wage instead of annual wage. This was calculated using total income and total hours worked. Data was cleaned to remove missing or unknown values resulting in 345,005 total observations.

Two education groups were used; university educated and secondary or less educated. Data on education for Canada consisted of 4 categories ranging from less than primary to university educated. A binary variable was created for individuals based on if they had university education or not. An individual's skill was also based on if they had university education or not. Those that had university education were considered high-skilled, those without university education were considered low-skilled.

The individuals in the study were grouped into five-year age cells for the three census years. The midpoints of the age intervals are 28, 33, 38, 43, 53, and 58. Individuals were also grouped into three-year experience cells. The first experience cell was one to three experience years and the last cell was capped at thirty-nine years of experience. In order to calculate this, experience was calculated by subtracting age by six and subtracting years of education from that. The result is the number of years of experience and that number was used to determine the experience category the individual belongs in.

Table 1 shows the male immigrant and native-born men ratios in Canada. Focusing on the first panel from Table 1, there was a decrease in the overall ratio of immigrants to natives in the male population from 1981 to 2001, down from 0.2998 to 0.2772. Note that even though there was an overall decrease, an increase from 1991 to 2001 was seen. Table 1 and Figure 1 show that there is an increase in the amount of university educated immigrant share over time. The ratio of immigrants to natives among university graduates increases from 0.4008 to 0.4182 from 1981 to 2001. The ratio of immigrants to native among those that have secondary or less education actually decreases from 0.2757 to 0.2277 from 1981 to 2001. This supports Canada's policy of trying to maintain a higher number of high-skilled immigrants.

Table 1. Male Immigrants and Native-Born Men in Canada

	1981	1991	2001
Immigrants/Natives in Population			
Total	0.2998	0.2616	0.2772
University	0.4008	0.3587	0.4182
Secondary or less	0.2757	0.2331	0.2277
University/Secondary in Population			
Total	0.2618	0.3237	0.4053
Native-born	0.2385	0.2938	0.3509
Immigrants	0.3466	0.4521	0.6443
Native-Immigrants Wage Differential			
Total	0.0211	0.0683	0.1285
University	0.1304	0.1558	0.2501
Secondary	0.0217	0.0789	0.1396
Return to University Education			
Total	0.3332	0.3468	0.3522
Native-born	0.3534	0.3645	0.3982
Immigrants	0.2950	0.3254	0.3012

Table 1 Sourced from IPUMS International. Calculated in R. Obtained the total number of immigrants and natives in Canadian population for each census year and calculated the ratio. The numbers of immigrants and natives that have had university education and secondary or less education was used to calculate the next two rows of calculations. Second panel numbers were obtained from the first panel and used, focusing on those that have had university education or secondary or less education. Native-immigrant wage differential was calculated by a regression of log wages on a native dummy and quadratic in age. Return to university education was similarly calculated with a regression on log wages with a university dummy variable and a quadratic in age.

The second panel of Table 1 illustrates changes in the level of educational attainment among workers. The level of education of natives has increased from 0.2385 to 0.3509 from 1981 to 2001. Immigrants see a higher increase in the level of education over time, increasing from 0.3466 to 0.6443. Nearly half of the immigrants in 2001 have university

level education. In 2001, there were approximately two university graduates to every three nongraduates in the immigrant population.

The third panel of Table 1 shows the aggregate native-immigrant wage differential using the estimated coefficient from a native-born dummy variable regression of the log male hourly wage. A quadratic term for age was included in the regression also. The wage differential increases over time indicating an increase in the immigrant wage penalty. The same is seen for university graduates, the differential increases. Those with secondary or less education also see an increase in the wage differential over time. Overall, the native wage premium has increased from 1981 to 2001.

The last panel of Table 1 estimates the return to university education for immigrants and natives. There is an overall increase in the return to university education for immigrants and natives. The return to university education was higher for natives than immigrants. Immigrants actually see an increase then a decrease in their return to university education.

Table 2. Immigrant-Native Population Ratio by Age, Year, and Education

	Age						
	26-30	31-35	36-40	41-45	46-50	51-55	56-60
University							
1981	0.2257	0.4025	0.4379	0.5463	0.5126	0.5449	0.4889
1991	0.2252	0.2740	0.3277	0.4443	0.4652	0.5309	0.6460
2001	0.2931	0.4099	0.4277	0.3975	0.4077	0.5133	0.6700
Secondary							
1981	0.1574	0.2444	0.2786	0.3356	0.3301	0.3637	0.3812
1991	0.1503	0.1604	0.2066	0.2771	0.3037	0.3502	0.4087
2001	0.1576	0.2102	0.2024	0.1965	0.2388	0.3099	0.4024
Ratio							
1981	1.4339	1.6467	1.5718	1.6278	1.5529	1.4982	1.2825
1991	1.4983	1.7082	1.5862	1.6034	1.5318	1.5160	1.5806
2001	1.8598	1.9500	2.1131	2.0229	1.7073	1.6563	1.6650

Table 2 Sourced from IPUMS International. Calculated in R. Total numbers depending on age, education, and immigrant status were used. Ratio in the third panel was calculated by taking the university educated ratio and dividing it by the secondary or less ratio. Ratios over 1 indicate a higher university educated immigrant share.

Table 2 illustrates the immigrant-native population ratio by age, time, and education level. The table has information on the ratio of immigrants to natives for each age, time, and education cell. The top left cell represents those aged 26 to 30 in 1981. The second and third cells represent those that were born 10 and 20 years later. Cohorts can be read on the diagonal of the table. Among graduates, the immigrant to native ratio averages approximately 35%. For all age groups, the share of immigrant to native university graduates tends to increase over time. Looking at secondary or less education, the average is approximately 25% and rises less over time compared to university graduates. The last panel of Table 2 is the relative immigrant-native share by education. A value of one would indicate immigrants are equally represented among university and secondary education levels. All of the values are greater than one indicating that immigrants in Canada are more educated than natives on average. This further supports the theory that Canada has increased the number of immigrants that are higher-skilled over those that are lower-skilled.

Table 3 represents the native-immigrant wage differential for each age, year, and education level cell along with their standard errors. The coefficients were similarly obtained to the native-immigrant wage differential from Table 1, subsets of the data were used in order to get the coefficients by age, year, and education level. Reading down the columns in Table 3, it can be seen the relative returns to a university education generally increases. Nearly every coefficient in the table is positive indicating that natives have a positive wage differential over immigrants regardless of their education level. University educated natives see a higher wage premium over immigrants than those with secondary or less education. University educated natives in the 26 to 30 year-old age range in 1981 have a 11.76% higher hourly wage than immigrants in the same age range and are university educated. The table implies that middle-aged working natives have the highest wage differential at the university education level. For those who have had secondary or less education, natives still have a positive wage differential, but the differential stays relatively consistent and is lower than those with university education.

Table 3. Native-Immigrant Wage Differential by Age, Year, and Education

	Age						
	26-30	31-35	36-40	41-45	46-50	51-55	56-60
University							
1981	0.1176	0.1614	0.1415	0.1555	0.1082	0.1251	0.0248
1991	0.2164	0.2507	0.1860	0.1098	0.1082	0.1099	-0.0159
2001	0.1233	0.2520	0.3284	0.3784	0.3114	0.1700	0.0419
Secondary							
1981	0.0557	0.0603	0.0221	0.0540	0.0074	-0.0234	-0.0476
1991	0.1845	0.1530	0.1014	0.0591	0.0141	0.0164	-0.0181
2001	0.1556	0.1802	0.1575	0.2269	0.1428	0.0745	-0.0108

Table 3 Sourced from IPUMS International. Calculated in R. Obtained by a regression of log wages on a native dummy and age quadratic. Subsets of the data were used and calculated by age, year, and education level. Estimated wage differential between natives and immigrants by age and year.

In summary, there is a slight overall decrease in the total immigrant population ratio, but there is an increase in the immigrant university education ratio. There is also an increase in the immigrant wage penalty. The share of immigrant to native university graduates increases over time. Immigrants are more educated than natives in all age groups on average. Natives have a positive wage differential regardless of their education level over immigrants.

4. Theoretical Framework

A two-layer nested constant elasticity of substitution (CES) production function was used to estimate the substitutability between natives and immigrants. The model of labor is disaggregated by skill, time, and experience. Immigrant and native workers are treated as different production inputs within each cell. The main task of this paper is to estimate the elasticity of substitution between them. The final output is produced using skilled and unskilled labor. Physical capital is omitted in the production function due to data availability. However, the current set-up can be easily extended to capture capital adjustment by another CES aggregator of labor and capital. The labor market is competitive, and workers are paid by their marginal product. The final output function is seen to be equation (1).

$$Y = (\beta\, L^{\delta} + (1-\beta)\, H^{\delta})^{1/\delta} \tag{1}$$

Where *L* indicates low-skilled labor and *H* indicates high-skilled labor. The elasticity of substitution between skilled and unskilled labor is estimated by $1/(1-\delta)$. Those workers that who have had university education is considered high-skilled workers and those with secondary or less education is considered low-skilled.

With high and low skilled labor, native and immigrant workers are two inputs in a CES aggregator seen in equation (2).

$$L_s = \left(\alpha N_s^{\rho} + (1-\alpha) M_s^{\rho}\right)^{1/\rho} \tag{2}$$

From equation (2), *s* indicates high-skilled (*H*) or low-skilled workers (*L*). *N* is the native worker, *M* is the immigrant worker, and α is the share parameter natives in the working population which captures the relative productivity between native and immigrant workers. The elasticity of substitution between native and immigrant workers is given by $1/(1-\rho)$. If $\rho = 1$, natives and immigrants are perfect substitutes. If $\rho \neq 1$, immigrants and natives are imperfect

substitutes or even complements. Any change in the relative supply of the native or immigrant worker share would change the native-immigrant wage differential.

The native-immigrant wage differential within a skill cell can be calculated by equation (3).

$$ln\left(\frac{W_N^S}{W_M^S}\right) = ln\left(\frac{\alpha}{1-\alpha}\right) + (\rho - 1)ln\left(\frac{N_S}{M_S}\right) \quad (3)$$

Where W is the wage, N is native, and M is immigrant. S indicates skill level where $S \in \{L, H\}$. The equation shows that wages of natives relative to immigrants depend on their relative supply. In the empirical part, equation (3) is estimated by OLS with fixed effects in the first stage to recover the underlying structure parameters, which are crucial inputs when evaluating the labor market impacts of immigrants. If $\rho = 1$, native and immigrant workers are perfect substitutes. There should be no effect of changes in the relative supply of natives to immigrants on their relative wages. Similar to how equation (2) was calculated, one can also compute the college wage premium within experience and year cells. The college wage premium is defined as the partial derivative of output with respect to skilled labor versus unskilled labor. Equation (4), which is estimated in the second stage, helps to identify the substitutability between skilled and unskilled labor which is another important structure parameter.

From equation (1), the wage differential for high-skilled and low-skilled workers within time and experience cells can be calculated.

$$ln\left(\frac{W_{ET}^H}{W_{ET}^L}\right) - ln\left(\frac{\left(\alpha_{HET}\, N_{HET}^{\rho} + (1-\alpha_{HET})\, M_{HET}^{\rho}\right)^{(1/\rho)-1} \alpha_{HET}\, N_{HET}^{\rho}}{\left(\alpha_{LET}\, N_{LET}^{\rho} + (1-\alpha_{LET})\, M_{LET}^{\rho}\right)^{(1/\rho)-1} \alpha_{LET}\, N_{LET}^{\rho}}\right) = ln\left(\frac{1-\beta}{\beta}\right) + (1-\delta)ln\left(\frac{H_{ET}}{L_{ET}}\right) \quad (4)$$

Where W is the wage, H indicates high-skilled, L indicates low-skilled, E indicates the experience level, and T indicates time. This was derived by taking the partial derivative of the output (Y) with respect to natives or immigrants at the high skill level at a particular experience level and time. Using the chain rule, this partial derivative can be calculated. The same partial derivative is then calculated but at the low-skill level. The ratio of the two wages results in equation (4). Parameters in equation (4) are identifiable because in $ln\left(\frac{W_{ET}^H}{W_{ET}^L}\right)$ and $ln\left(\frac{H_{ET}}{L_{ET}}\right)$ there are quantities directly observable in the data. Where $ln\left(\frac{\left(\alpha_{HET}\, N_{HET}^{\rho} + (1-\alpha_{HET})\, M_{HET}^{\rho}\right)^{(1/\rho)-1} \alpha_{HET}\, N_{HET}^{\rho}}{\left(\alpha_{LET}\, N_{LET}^{\rho} + (1-\alpha_{LET})\, M_{LET}^{\rho}\right)^{(1/\rho)-1} \alpha_{LET}\, N_{LET}^{\rho}}\right)$ can be recovered using estimates from the first stage.

5. Results

Running regressions with equations (3) and (4) are the basis of this study. Table 4 is the result from running equation (3). The dependent variable is the log of the weighted average native-immigrant wage differential and the weighted native-immigrant population ratio is the independent variable. This regression is the first step of the model and gives the elasticity of substitution between natives and immigrants within particular time, experience, and skill cells. It is important to note that the reported coefficient in the table needs one added to it before interpreting substitutability since the coefficient in equation (3) is $(\rho - 1)$. The substitutability between natives and immigrants is represented by ρ.

The first run of the regression was the most restricted and is seen in the first column. This basic specification in column (1) restricts the share parameter α to be the same across all skill cells. Therefore, there were no fixed effects included. There is no reason that they should be the same across skilled cells though. In columns (2) through (5), this restriction is relaxed by adding fixed effects to allow for more flexibility in the production parameters. The baseline estimate of elasticity of substitution between natives and immigrants is a $\rho = 0.997834$, which is not statistically significant from one and implies perfect substitutability between natives and immigrants. Natives and immigrants can be substituted within their particular time, experience, and skill cells in the work force and see no wage impact of immigrants.

Column two reports the elasticity of substitution between natives and immigrants with a year fixed effect, which allows the relative productivity between native and immigrant workers to vary across calendar years. This estimate of a $\rho = 0.992901$ still implies perfect substitutability between natives and immigrants within their detailed cells. There is no change in wages seen. Adding in only a fixed effect for experience also tells the same story. A $\rho = 0.95323$ still implies perfect substitutability, but now has significance at the ninety-fifth percentile. Natives and immigrants that have similar experience in the labor market are substitutes for each other and no change in wages are seen. Having a skill fixed effect in the model increases the significance level of the estimate. Now there is a change in substitutability of natives and immigrants. A $\rho = 1.112950$ implies that natives and immigrants are compliments to each other. Skilled immigrants compliment skilled natives causing an increase in wages. The specification in column (4), which includes a skill level fixed effect, is preferred to the previous columns because skilled and unskilled labor markets behave differently and are treated separately in the literature.

Table 4. Elasticity of Substitution Estimates Within Detailed Skill Cells

	(1)	(2)	(3)	(4)	(5)
log(Ratio)	-0.002166	-0.007099	-0.046770 *	0.112950 ***	0.144070 ***
	(0.018296)	(0.016686)	(0.020190)	(0.020920)	(0.035640)
Fixed Effects					
Year	. . .	YES	. . .	. . .	YES
Experience	. . .	. . .	YES	. . .	YES
Skill	. . .	. . .	. . .	YES	YES

Table 4 Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1. The coefficient of interest is the log of the ratio of natives and immigrants. The coefficient is labeled log(Ratio) with standard errors of the coefficients below in brackets. If the fixed effect was used in the regression run, it is labeled YES.

The last column of the table is the preferred specification in the paper with the most relaxed run of the regression and is selected as the substitutability used through the rest of the analysis. A $\rho = 1.14407$ once again implies complementarity between natives and immigrants. Including fixed effects for time, experience, and skill removes the interaction of these variables with the explanatory variable. Note that that substitutability between natives and immigrants, ρ, remains constant across skill cells, but the fixed effects allow the share parameter α to vary across time, experience, and skill cells. The estimates using the preferred specification find complementarity between natives and immigrants, which is consistent with findings from Sparber and Peri[7] using United States data. The complementarity between natives and immigrants means that an increase in skilled immigrants in the labor market result in an increase in the wage of native workers.

Table 5. Elasticity of Substitution Estimates Outside Detailed Skill Cells

	(1)	(2)	(3)	(4)
log(Ratio)	-1.07164 ***	-1.06065 ***	-0.68410 ***	-0.22021 .
	(0.05624)	(0.05667)	(0.14830)	(0.10755)
Fixed Effects				
Year	. . .	YES	. . .	YES
Experience	. . .	. . .	YES	YES

Table 5 Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1. The coefficient of interest is the log of the ratio of high-skilled workers at particular experience and time over low-skilled workers at particular experience and time cells. The coefficient is labeled log(Ratio) with standard errors of the coefficients below it in brackets. If the fixed effect was used in the regression run, it is labeled YES.

The second stage regression, equation (4), results are presented in Table 5. Using estimates for ρ and α from the first stage of the analysis, $ln\left(\frac{(\alpha_{HET}\, N_{HET}^{\rho} + (1-\alpha_{HET})\, M_{HET}^{\rho})^{(1/\rho)-1} \alpha_{HET}\, N_{HET}^{\rho}}{(\alpha_{LET}\, N_{LET}^{\rho} + (1-\alpha_{LET})\, M_{LET}^{\rho})^{(1/\rho)-1} \alpha_{LET}\, N_{LET}^{\rho}}\right)$, can be recovered. Thus, the second stage regression equation is estimated using quantities directly observed in the data and computed using estimates from the

first stage. Fixed effects were then added in to allow for more flexibility in the production function. Table 5 illustrates the elasticity of substitution outside of detailed skill cells, specifically the substitutability between high-skilled and low-skilled labor. The dependent variable is the log of the weighted average high-skilled versus low-skilled wage differential. The independent variable is the weighted high-skilled versus low-skilled population ratio. Similar to the first stage in the model, the estimated coefficient needs to have one added to it before interpreting substitutability due to the fact δ has one subtracted from it in equation (4). The substitutability between high-skilled and low-skilled workers is represented by δ. Fixed effects for time and experience were also included in the model.

The baseline estimate of substitutability between high and low-skilled workers was $\delta = -0.07164$. This means that high-skilled and low-skilled workers in particular time and experience cells are imperfect substitutes for each other. Once again, this is the most restricted specification. The second column adds in a time fixed effect letting year vary. Again, with a $\delta = -0.06065$ there is imperfect substitutability between high-skilled and low-skilled workers. Note that it has decreased though, moving toward perfect substitutability. Including an experience fixed effect, seen in the third column, a $\delta = 0.3159$ still implies imperfect substitutes. An increase in high-skilled workers decreases the wages of low-skilled workers, but the negative impact is mitigated because of the imperfect substitution. The estimated $\delta = 0.77979$ of the most flexible specification, column (4), dictates again imperfect substitution between high-skilled and low-skilled labor. Across all the specifications in the second stage, high-skilled and low-skilled labor are imperfect substitutes. The finding is quite robust.

The finding that there are positive wage impacts for natives from an increase in the number of high-skilled immigrant workers suggests that natives benefit from an increase in native workers instead of being hurt by it as some people believe today. Canada's current immigration policy of admitting more high-skilled workers than low-skilled workers and findings a positive wage impact for natives suggest that Canada should expand their current immigration policy to continue to push for more high-skilled immigrants in their workforce. Generally, the economic assumption for labor demand is downward sloping. This assumption does not allow for the case that natives would benefit from immigrant workers. This paper finds empirical evidence against this assumption. Canada's native workers, firms and corporations, and Canada as a nation can greatly benefit from an increase in high-skilled immigrant workers. They benefit from the finding of this paper that natives' wages increase as the number of high-skilled immigrant workers increase and technological advancement discussed in Hum and Simpson[4].

6. Conclusions

Canada's point system encourages high-skilled immigrants to join their labor force. While Canada has seen a slight dip in their population of immigrant workers, the number of university educated immigrant workers has increased. The number of secondary or less educated immigrants has decreased at the same time. Using a two-level CES production function approach to estimate the substitutability between workers provides a way to analyze how the wage structure is affected by an increase in the number of high-skilled workers in Canadas labor market.

It was found that the increase in high-skilled, highly educated immigrants has had an impact on the wage structure of Canada in a slightly different way than seen in the United States and United Kingdom. The finding that natives and immigrants are compliments within detailed time, experience, and skill cells tells the story that skilled immigrant workers compliment skilled native workers causing an increase in native wages. Moving outside of the skill cells, high-skilled workers are imperfect substitutes for low-skilled workers. An increase in high-skilled workers in the labor force results in a decrease in the wages of low-skilled workers who have the same experience level. The result that high-skilled and low-skilled workers are imperfect substitutes is consistent with previous literature from the United States and United Kingdom. Implications of skill-based immigration has a positive impact on the wages of natives no matter their skill level, but the workers that are low-skilled can see a negative impact on their wages.

By calculating the substitutability of natives and immigrants instead of using assumptions makes the argument of wage implications becomes stronger. Using this analysis method for other countries will be useful for future research. This research does have its weaknesses though. Due to time constraints, robustness checks were not able to be conducted. In future research, including women in the study due to their increasing presence in the work force would make this research stronger. Due to the completeness of data, the time frame the research uses is limited. Ideally, a larger time frame would be used to conduct the research. Data collection of education level in Canada is also limited. Having more detailed education level data would allow for further robustness checks on how different levels of high-skilled workers affect each other along with low-skilled workers. These are just a few ways that this research can be built upon to obtain a better understanding of how skill-based immigration policy can affect wage structures.

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8. References

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