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Job Displacement Effects of Immigration on Canadian-born: A Microeconomic Perspective

by

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This paper examines the job displacement effects of Canadian-born workers due to immigration in Canada. It considers both substitutability and complementarity relationships between Canadian-born workers and immigrants. These relationships have been examined by estimating a system of wage earnings equations involving Canadian-born, recent immigrant and older immigrant using a Generalized Leontief Production Function (GLPF). The coefficients estimated from GLPF have been used to estimate the Hicksian elasticity of complementarity. The estimated Hicksian elasticities suggest, on the aggregate, that there is no job displacement of native-born workers by immigration. However, there are some job displacement effects by industry.

I. INTRODUCTION

Immigration, the subject of repeated policy debates throughout the last two decades, has once again assumed a central position on the policy agenda. This debate has become more intense in recent years; the fear is over the potential job displacement and unemployment of native-born workers, and the consequence to the economy. Immigration has shaped the rate of growth of the Canadian population and its demographic composition; it also created much socioeconomic diversity within Canadian society. Historically, immigration has been an essential building block of the

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Canada, of strength that is the envy of the world. However, there is debate and fear over the immigration policy that new comers take job away from extant Canadian.

The recent immigrant incomes have been falling compared to their older counterparts helped to trigger the current policy debate regarding immigration policy in Canada. Studies (Coulson and DeVoretz 1993, Baker and Benjamin 1999) have shown that while earlier immigrants' income has caught up to their income to the level of extant Canadian, the recent immigrants' income has not. In light of this observation, Canada has amended the immigration policy and changed the point system for immigrants while giving priority on certain skill characteristics of immigrants.

Some Canadians view that either immigrants steal jobs from Canadian-born workers or immigrants are less skilled and put pressure on the public purse because they do not find jobs. In both of these polar opinions, immigrants are held responsible for unemployment. Conversely, others argue that there are skill shortages in Canada and immigrants relieve these bottlenecks and immigration therefore would expand job opportunities in general, resulting in an increased demand for labor and eventually leading to higher wages of Canadian-born workers. Therefore, the labor market substitutabilities or complementarities between Canadian-born workers and immigrants are of central concern in evaluating the validity of displacement fears in Canada.

This paper explores the labor market substitutability or complementarity one or the other between Canadian-born workers and immigrants. This kind of analysis may be used to answer important policy questions, including whether or not the inflow of immigrants hampered the economic progress of Canadian-born workers? Alternatively, we can shed light on whether or not the job opportunities available to native born worsened because of the existence of the large pool of (presumably) substitutable on immigrant workers.

The objective of this paper is to examine the empirically the job displacement effects of immigration on Canadian-born workers. The question of job displacement is analyzed in the context of a multifactor production function where the factors of production are

immigrants and Canadian-born workers. Assuming Leontief technology, the production function parameters are estimated to determine whether immigrant and Canadian-born workers are substitutes or complements. Then we derive a set of wage earnings function from the Generalized Leontief production function where relative supply of different inputs becomes explanatory variables. The estimated coefficients are used to calculate the Hicksian elasticity of complementarity.

The rest of the paper is organized as follows. Section II discusses the theoretical framework for analyzing the impact of immigration on the outcome of local labor market. Section III derives the econometric model specification to determine the substitutability or complementarity between Canadian-born and immigrants. The estimation result is presented in Section IV. Concluding remarks are given in Section V.

II. LABOR MARKET EFFECTS OF IMMIGRATION: THEORETICAL FRAMEWORK

An increase in the labor supply through increased immigration in a given labor market will lead to an increased competition for jobs among immigrants if immigrants themselves are substitutes in production. This would reduce the market wage for immigrants. Depending upon their skill requirements, employers are likely to substitute immigrant labor for the native worker since the former is now cheaper. This competition for jobs in the local labor market between natives and immigrants would tend to reduce the earnings potential of natives. If variation in the number of immigrants relative to the native-born workers across selected labor market demonstrates that a higher ratio of foreign-born to native-born worker is associated with a lower wage rate of native born, then immigrants and native born are substitutable labor inputs in production. In this case, foreign-born workers would affect adversely the earnings and job opportunities of native-born workers.

On the other hand, immigration flows could lead to increased wages for native born if immigrants and Canadian-born workers are complements in production. If there are skill shortages in the host

country and immigrants relieve these bottlenecks, it would expand job opportunities in general, resulting in an increased demand for labor and eventually leading to higher wages of native-born workers. In this case immigrants and native-born workers are employed in two distinct labor markets and they are complementary inputs in production.

The above analysis holds good if we assume that the product demand is fixed. But immigration has both demand and supply side effects in goods market. They demand goods and services, make expenditure and therefore the expenditure generated by the inflow of immigration causes the demand curve for goods and services to shift rightward. This will, in turn, cause an increase in the demand for labor and therefore an increase in wage/employment. When both demand and supply effects are present, the net effect on the native would depend on the immigrants' marginal propensity to spend and the chance of getting job relative to natives. If, for example, immigrants' relative expenditure is less than their relative employment, then the demand for labor will shift less than the supply of labor and therefore natives will loose jobs. However, this paper largely ignores the demand side effect and attempts to address the substitute/complement issue.

III. THE MODEL SPECIFICATION

We consider three inputs in the short-run aggregate production function[1]: Canadian-born (N), recent immigrants(R) and the older immigrants (O). Assume that natives, recent immigrants and older immigrants are a group of inputs and are weakly separable from the fourth input, capital (See Grossman 1982, Akbari and DeVoretz 1992). We assume that the production function h (N, R, O) is linearly homogenous and possesses the neoclassical properties. So, the necessary condition for profit maximization implies that

$$W_i = h_i(P_N, P_R, P_O) \qquad \text{i = N, R, O} \qquad (1)$$

$$\textit{where,} \qquad h_i = \frac{\partial h(N,R,O)}{\partial i}, \text{ and } \quad P_i = \frac{L_i}{N+R+O}$$

[1]A production function rather than the cost function is used to discern the underlying technology because, in this case, it is more reasonable to assume that the quantities are fixed rather than prices. Here we are dealing with input categories that cannot change very rapidly.

The determination of wage rates depends not only on the demand functions in (1) but also the relative supplies of labor supply in the local labor market. The measurement of substitutability or complementarity requires further specification of the production technology's structure. Following Borjas (1983), we consider the generalized Leontief production function:

$$h(L_N, L_R, L_O) = \sum_j \sum_i \gamma_{ij} (L_i L_j)^{1/2} \qquad \text{(i, j =N, R, O)} \qquad (2)$$

Where technology parameters are restricted so that $\gamma_{ij} = \gamma_{ji}$. (Young's theorem).

An important motivation for estimating (2) is to obtain the degree of substitutability and complementarity among native-born, recent immigrant and older immigrants. Since we are assuming that quantities, not factor prices, are exogenous, the appropriate measure of factor substitutability is the Hicks partial elasticity of complementarity. In the context of the Generalized Leontief production function, this is defined as (Borjas 1983):

$$\eta_{ij} = \frac{\gamma_{ij} \bar{w}}{2 w_i w_j (p_i p_j)^{1/2}} \qquad i \neq j \qquad (3a)$$

$$\eta_{ii} = \frac{(\gamma_{ii} - w_i)\bar{w}}{2 p_i w_i^2}, \qquad i = j \qquad (3b)$$

where $\bar{w} = p_R w_R + p_O w_O + p_N w_N$.

To obtain wage equations, we equate wage and marginal products for each type of labor input. However, to apply the model to micro data available, it is necessary to control the individual differences in productive skills. We assume that a vector of socio-economic variables can ap proximate the individual fixed effects. The empirical specification is then given by the following:

$$W_i = \alpha_i X_i + \sum_i \sum_j \gamma_{ij} (P_j / P_i)^{1/2} + \varepsilon_i \qquad \text{(i, j =N, R, O)} \qquad (4)$$

Moreover, the number of immigrants allowed into Canada is restricted by annual quota that is fixed in the previous year and is almost fully subscribed.

Where we have $\gamma_{ij} = \gamma_{ji}$, X_i is the vector of skill characteristic of the individual (a proxy of the socioeconomic characteristics) and ε_i is the random disturbance term. ε_i is assumed to have multivariate normal distribution with mean vector zero and constant variance matrix Ω.

The parameters that are of main interest are those with cross-equation constraints, $\gamma_{NR}^{N} = \gamma_{RN}^{R}, \gamma_{RO}^{R} = \gamma_{OR}^{O}, \gamma_{NO}^{O} = \gamma_{ON}^{N}$, where the superscript refers to the equation with dependent variable. If, for instance, γ_{NR}^{N} is greater than zero, it means that an increase in the share of recent immigrants relative to the native-born Canadians would increase the earnings of the Canadian born, and thus recent immigrants and Canadians are complementary inputs in the labor market. Such a finding would lend support to the view that the skill characteristics of immigrants are different from those of the domestic workforce and/or recent immigrants take jobs that native-born workers are unwilling to accept. On the other hand, a negative coefficient implies that labor types are substitutes in the labor market. Thus, recent immigrants have an adverse impact on the earnings and employment opportunities of the Canadian-born workers.

The data used to determine the substitutability or complementarity is drawn from a 20 percent sample of Public Use Micro Data File (PUMF) from Statistics Canada 1996 census. Although equation-by-equation OLS estimation might appear attractive, since the wage earnings function (4) is linear in parameters, these wage equations have the three cross-equation symmetry constraints ($\gamma_{NR}^{N} = \gamma_{RN}^{R}, \gamma_{RO}^{R} = \gamma_{OR}^{O}, \gamma_{NO}^{O} = \gamma_{ON}^{N}$). Even if these constraints hold in the population, for any given sample, equation-by-equation OLS estimates will not reveal such restrictions. For example, γ_{NR}^{N} in the *nth* equation estimated by OLS will not necessarily equal γ_{RN}^{R} estimated in the *rth* equation. In our context, while the OLS estimate of the coefficient of the variable $(P_O/P_R)^{1/2}$ is positive in the wage equation for the recent immigrant, in the wage earnings equation for the older immigrant the estimate of $(P_r/P_o)^{1/2}$ is negative (see Table A.1)[2]. We find that the Wald test, LR and LM tests also reject each of the hypotheses of cross equation

[2]See Berndt (1991) for some other specific example that does not support the use of OLS in this context.

restrictions. Therefore, to impose these cross-equation constraints, it is necessary instead to use a system estimator.[3]

IV. ESTIMATES OF ELASTICITY

Equation (4) was estimated using Full Information Maximum Likelihood or iterative Zellner's seemingly unrelated regression technique to take account of the cross equation correlations. A full set of estimation results are presented in Table A.3. Table I presents the estimated technology parameters and the corresponding elasticity estimates, η_{ij} and η_{ii}. Factors are substitutes if η_{ij} is negative in sign and complements if it is positive. From the table, it is clear that Canadian-born workers and recent immigrant are complements to each other. The estimated γ_{ij}, upon which η_{ij} is based, is highly significant. The corresponding Hicksian elasticity is .16, which implies that a 10-percentage increase in recent immigrants will increase the wage earnings of Canadians by 1.6 percent. This result is not surprising, because new immigrants have greater amount of human capital than the older one and differ much in their ethnic background than older immigrants. They also tend to work in a low-paying job despite their high human capital content. The high human capital content of new immigrants might be a good substitute for capital, which would be the source of complementarity to the Canadian born workers. Older immigrants and the Canadian-born workers are neither substitutes nor complements to each other. The estimate of γ_{NO}, the parameter measuring the substitution possibilities between new foreign-born workers and Canadian-born workers, is positive but insignificant. The reason could be high Canadian job market experience of old

[3]We will use Zellner's seemingly unrelated estimator (which is often shortened to ZEF) to estimate this system. The ZEF estimator uses equation-by-equation OLS to obtain an estimate of the disturbance covariance matrix Ω and then does the generalized least squares given this initial estimate of Ω, on an appropriately 'stacked' set of equations. Furthermore, one can update the estimate of Ω and iterate the Zellner procedure until changes from one iteration to the next in the estimated parameters and estimated Ω become arbitrarily small. This iterative Zellner-efficient estimator is typically termed as IZEF, and in this case it yields the parameter estimates that are numerically equivalent those of the maximum likelihood estimator.

immigrants and therefore they are substitutes in some sectors while complements in other sectors due to (possibly) old immigrants' assimilation into Canadian job market and their skills are that complementary to those of Canadian-born workers. Further disaggregating data by industry or occupation may clear the picture. For example, Roy (1987) was not able to distinguish whether foreign born and native born were substitutes or complements in aggregate because of the corresponding statistically insignificant coefficient. However, when Roy disaggregated his study by area of origin, he found significant substitution between third world immigrants and the native-born labor force.

TABLE I

HICKSIAN ELASTICITY OF COMPLEMENTARITY[4] USING FIML ESTIMATION

Technology parameter	Estimate	t-stat (coeff)	Elasticity of complementarity
γ_{nr}	1788.46	5.32	0.160
γ_{no}	461.23	0.74	0.025
γ_{ro}	-1746.99	-2.13	-0.348
γ_{nn}	-33775.01	-14.88	-1.388
γ_{rr}	-19841.10	-9.60	-12.897
γ_{oo}	-31071.83	-8.38	-7.333

The hypothesis that there is no displacement of native-born workers by immigrants cannot be rejected for both the earlier and recent immigrant flows. However, it is important to note that recent immigrants have a positive significant influence on the wage earnings of Canadian born, while the older immigrants have an insignificant-positive effect on the earnings of native born. Hence, pre- and post 1979 immigrants have a differential complementary effect with respect to the Canadian-born workers.

[4]The vector X in our model consists of the variables such as education (Educ), experience (Exper), marital status (never married is our base category), census metropolitan area (CMA=1), language (English spoken as the base category), sex (female=1). We also include an industry dummy (results not reported) that can capture the different capital-labor ratios across goods and service producing industries and partially control for omitted capital variable.

The regression also indicates that recent immigrants substitute for older immigrant workers as indicated by the negative and statistically significant corresponding coefficients, and the corresponding elasticity is -.348. Recent immigrants and older immigrants might have been competing for the same jobs in the Canadian labor market. All the own quantity factor price elasticity are negative as suggested by the theory, but are larger in absolute terms, ranging from -1.39 for the Canadian-born workers to -7.33 for the old immigrant workers, as compared to cross elasticities. This suggests that the relative increases in the supply of one type of labor can be absorbed only a large decline in its relative wage (if wages are free to adjust).

These findings are consistent with Roy (1997), Akbari and DeVoretz (1992). Roy concludes, on the basis of his estimated interaction term on the wage equations, that all foreign-born workers are neither substitutes for nor complements to the native-born workers. Akbari and Devoretz found no evidence to support the *economy-wide* displacement hypothesis. Our findings, however, are in contrast to the U.S. findings (circa 1970) of Grossman (1982). Grossman concludes that both second generation workers and foreign-born workers are significant substitutes for U.S.A-born workers. Laryea (1998) finds that old-foreign born immigrants are complements to the Canadian-born workers and new-foreign born are neither substitutes nor complements to the Canadian born. He found a negative but statistically insignificant coefficient for the recent immigrants.

Substitutability/Complementarity by Industry

We now check for substitutability or complementarity by industry. This analysis could reveal the substitutability/complementarity that might be concealed in the aggregate analysis as presented above. The two broad industrial groups are identified based on the Industry Canada classification. We focus on goods producing and service producing industries. If a group of foreign-born and Canadian-born workers are found to be substitutes in these industries, then it would imply that wages of Canadian-born labor are being depressed by that particular group of foreign-born workers.

The two industry groups, combined with the three types of workers (native-born, new and older immigrants), resulted in six equations that have been estimated using the full information maximum likelihood method. Table A.4 reports the full set of estimates of the parameters of interest and the corresponding elasticity estimates. Nine out of fifteen coefficients on which elasticities are based on appear to be significant. We find that new immigrants employed in goods and service producing industries are substitutes for Canadian-born workers employed in these industries, but they are complements across industries. For example, the new foreign-born employed in the service producing industry are complements to the Canadian-born employed in the goods producing industry and vice versa. But older foreign-born workers who are employed in the goods sector are complements to the Canadian-born in that sector while they are substitutes for the Canadian-born employed in the service sector. Older foreign-born workers employed in the goods sector are substitutes for the Canadian-born employed in the service sector, while those older foreign-born workers employed in the service sector are neither substitutes nor complements to the native born in the goods sector. Canadians employed in the production of goods are complements to their counterparts employed in delivering service. Recent and older immigrants are competing with each other in the goods and service producing sectors, those employed in the goods producing sector are substitutes to their counterparts in that sector, while neither one substitutes nor complements to other sector employed by their counterparts.

Let us now focus on the magnitude of the cross elasticities. The cross elasticity between Canadians and older immigrants in the service industry is -.174, which implies that a 10 percent increase in older immigrants would depress the Canadian-born wage by 1.7 percent. The elasticity of complementarity between Canadian-born workers in the goods sector and new immigrants in that sector is -1.26, indicating that there will be a decrease in the Canadian-born wage in the goods sector by 12.6 percent for a corresponding increase of recent immigrants by 10 percent. Similarly, the cross elasticity between Canadian-born workers in the goods sector and recent immigrants employed in the service sector is 1.32, implying

that for a 10 percent increase in recent immigrants in the goods sector, there will be a 13.2 percent increase in the wages of Canadian-born workers. The elasticity estimates of η_{ngrg} and η_{nsrg} are -1.26 and 1.16 respectively. If there is a 10 percent increase in labor employed from the pool of recent immigrants, there will be a decrease in the wage of the Canadian-born workers in the goods sector by 12.6 percent, but this will also increase the wage of the Canadian-born workers in the service sector by 11.6 percent. Moreover, more Canadians are employed in the service sector (61.6 percent), so relative benefits will go in favor of the Canadian-born workforce by admitting immigrants. The own wage elasticities are all negative, as suggested by theory. Immigrants have a sizeable impact on the determination of their own wage. For example, a 1 percent increase in recent immigrants reduces the wages of immigrants employed in that sector by 9.17 percent, whereas a 1 percent increase in older immigrants in the service sector reduces the wage of old immigrants by 4.68 percent in the service industry.

V. CONCLUSION AND FUTURE RESEARCH

This paper finds that there is no significant job displacement of Canadian-born workers by the inflow of immigrants into Canada. Recent immigrants are complements to Canadian-born while their older counterparts are neither substitutes nor complements to Canadian-born workers. Our findings that immigrants and Canadian-born workers are not substitutes but complements should prove useful to researchers trying to measure the extent of wage discrimination in the labor market. It is usually assumed that immigrants and Canadians are (perfect) labor substitutes. Our results indicate that measures of wage discrimination based on the assumption of perfect substitution may be seriously biased since immigrant and native-born Canadians are not, on average, substitutable inputs. It is important to emphasize the substantive implications of these results. The estimation of the derived demand functions implied by a generalized Leontief technology leads to our finding that Canadian-born labor is not significantly affected by the inflow of immigrants. In fact, there is evidence that the complementarities in production between native worker and older

immigrants have been helped by the presence of recent immigrants.[5]

However, when we disaggregate data by industry we found some evidence of job displacement mostly where immigrants and Canadian-born workers are working in the same industry. But they appear to be complements of each other across industries. Thus, although there is job displacement among the same class of workers within the industry, across industry they appear to be complements to each other and, on average, the job displacement effect is offset by the positive job creation effect created by the to inflow of immigrants. The net effect of immigration appears to be that the increase in labor demand matches the increase in labor supply caused by the immigration. However, it should be noted that the immigration is an endogenous choice and few opportunities exist where a truly exogenous immigration shock can be observed.

Most studies regarding the impact of immigration on the host country suggest that immigration confers little net gains in terms of per capita output to the host country, but its impact on the source country has been under researched. In recent years, a number of OECD countries have moved to favor the immigration of more skilled labor. This has raised concerns of a possible "brain drain" in less developed countries. One can study the impact of the emigration from Bangladesh on the Bangladesh economy taking into consideration of both the direct and indirect benefits accruing from emigration and the potential costs associated with it. Furthermore, the recent trend in developed country has been to reduce the number of immigrants to stimulate their domestic economy. So, one can also consider the potential impact of the reduction of emigration on the Bangladesh economy.

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[5]As a separate issue regarding immigration, this author investigates the contribution of immigrants in the Canadian economy from different parts of the world. He finds that the South Asian immigrant worker is more active in Canadian job market and the estimated average income of immigrant from South Asia is higher than all other immigrants in Canada. The Chinese immigrants, on the other hand, have lower wage income compared to all other immigrants. Though he did not investigate the performance of immigrant worker from Bangladesh separately, the result might suggest us to conclude that Bangladeshi citizen in Canada working as immigrant is doing relatively well. This paper is available upon request to author. This paper is under revision for publication.

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Appendix

TABLE A.1
SYMMETRY CONSTRAINED WAGE EQUATIONS USING OLS

Dependent Variable: Annual Wage Earnings

	Canadian-born		Older Immigrant		Recent Immigrant	
Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Constant	-29791.73	-12.23	-23870.07	-7.02	-21791.44	-11.83
Educ	1719.25	19.10	1298.20	15.03	788.00	12.43
Exper	902.23	10.29	597.25	5.61	372.26	4.99
$Exper^2$	-14.25	-8.33	-9.59	-5.04	-7.14	-4.67
Married	-4175.58	-6.44	-3122.12	-3.31	-1797.26	-3.18
CMA	5011.64	9.52	5906.52	8.04	1040.70	1.38
Language	844.78	1.19	1245.36	0.76	1367.11	1.79
Sex	-10389.89	-20.05	-9411.66	16.28	-5764.01	-13.39
YSM	-	-	139.09	3.69	530.49	13.58
$(P_r/P_n)^{1/2}$	-22433.04	-9.40	-	-	-	-
$(p_o/P_n)^{1/2}$	20739.67	5.53	-	-	-	-
$(P_n/P_o)^{1/2}$	-	-	638.79	1.00	-	-
$(P_r/P_o)^{1/2}$	-	-	-8342.72	-8.07	-	-
$(P_n/P_r)^{1/2}$	-	-	-	-	-207.02	-0.47
$(P_o/P_r)^{1/2}$	-	-	-	-	6238.34	4.94
Adj R^2	0.29		0.25		0.26	

TABLE A.2
WALD TEST FOR SYMMETRY CONSTRAINT

Null Hypothesis	Chi-square
$\beta_{rn}=\beta_{nr}$	83.93
$\beta_{no}=\beta_{on}$	27.87
$\beta_{ro}=\beta_{or}$	79.79

TABLE A.3
SYMMETRY CONSTRAINED WAGE EQUATIONS USING THE FIML

Dependent Variable: Annual Wage Earnings

	Canadian-born		Older Immigrant		Recent Immigrant	
Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Constant	-33775.01	-14.88	-31071.83	-8.38	-19841.10	-9.60
Educ	1898.72	23.60	1384.89	15.58	825.91	12.22
Exper	954.15	9.38	601.88	4.73	381.90	4.33
$Exper^2$	-14.70	-7.28	-9.68	-4.25	-7.27	-3.94
Married	-4414.65	-5.57	-3317.20	-3.06	-1949.78	-3.06
CMA	5121.06	9.12	5770.40	7.16	1318.10	1.99
Language	981.86	0.99	1422.05	0.67	1420.68	1.38
Sex	-10724.25	-17.84	-9667.75	-14.18	-5950.54	-11.84
YSM	-	-	156.48	4.40	537.79	13.70
$(P_r/P_n)^{1/2}$	1788.46	5.32	-	-	-	-
$(p_o/P_n)^{1/2}$	-	-	461.23	0.74	-	-
$(P_n/P_o)^{1/2}$	-	-	-	-	-1746.99	-2.13
Adj R^2	0.28		0.24		0.25	