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Samuel Laryea

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THE IMPACT OF FOREIGN-BORN LABOR ON CANADIAN WAGES: A PANEL ANALYSIS[1]

By

Samuel A. Laryea
Vancouver Centre of Excellence: Immigration
Department of Economics, Simon Fraser University
Burnaby, BC. V5A 1S6
E-mail: laryea@sfu.ca
Telephone: (604)-291-5348
Fax: (604)-291-5336

Abstract

This paper analyses the impact of foreign-born labour on wages in Canada using data from the 1988-1990 Labour Market Activity Survey. A random effects model was used to analyze the wage impacts by broad industry groups and also by gender. Results from the instrumented wage regressions show that for the total sample, the foreign-born and native-born workers are complements in production. This relationship also held for the male and female sub-samples. However, when the data was disaggregated by industry, wage suppression by immigrants was detected in the primary, transport and storage, wholesale and retail trade industries.

Keywords: Random effects, Foreign-Born, Wages

J.E.L. Classification: J31, J61

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Introduction

Canada's immigrant population has grown in recent years. According to the 1991 Canadian census, 4.3 million immigrants were living in Canada at that time and immigrants comprised 16.1% of Canada's population. However, between 1986 and 1991, Canada's immigrant population increased by 11%, compared with only 2% between 1981 and 1986. Furthermore, the labour force participation rate for immigrants also rose from 64.7% in 1986 to 65.2% in 1991. (See Statistics Canada Catalogue No. 96-311E).

These successive waves of immigrants have increased Canada's population and altered its ethnic and cultural composition. They have also contributed significantly to the social and economic development of the country. However, it is becoming increasingly clear that many Canadians perceive current immigration levels to be too high.[2] Though one could counter with anecdotal stories of successful immigrants, the pessimistic beliefs appear to reflect the views of many Canadians. Inherent in this pessimism over perceived high immigration levels is the belief that it could potentially lead to loss of Canadian jobs, wage suppression or increased unemployment insurance and welfare rolls, thereby putting pressure on the public treasury (Baker and Benjamin: 1995).

The labour market impacts of immigration has dominated the literature on the economics of immigration. And even in this regard, the discussion has focused on the job displacement or the employment effects of immigration. See for example Akbari and

DeVoretz (1992) and Marr and Siklos (1995). In this paper, I expand on the current literature by exploring the companion issue of how wages are affected using a panel data set in Canada. To do so, I estimate a random effects model using the 1988-1990 wave of the Labour Market Activity Survey (LMAS). The analysis is performed on both men and women across different industries. This industrial breakdown further introduces the possibility of testing for wage effects in industries which are often assumed to be immigrant entry level points. Furthermore, the longitudinal approach allows for the tracking of labor market activities of individuals over three years. This approach represents a significant improvement over the pure cross-sectional analysis using the census data, where one cannot exploit the extra efficiency provided by a time-series/cross-section connection. There is also a consistency issue if fixed effects are correlated with the exogenous variables.

This paper begins with a discussion of the theoretical framework used in examining the issue of substitutability. The next section discusses the dependent and independent variables used in alternative estimations followed by a discussion of the data, estimation equations and methods. I next present a discussion of the results and then provide the results from the instrumented wage regressions. The conclusion ends the paper.

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[2] For example, a survey conducted by Ekos Research Associates Inc. in February 1994 indicated that 53% of those interviewed thought immigration levels were too high, compared with 44% two years previously and just 31% in February 1989. (See Maclean's, 25th July, 1994, page 16).

I. The Theoretical Framework

This section draws from the discussion of production theory by Grossman (1982) Hamermesh (1993) and De New and Zimmermann (1994). In this framework, differences between the Canadian-born and foreign-born workers are modeled by treating them as separate production inputs with potential differences in productivity. However, differences in productivity can be magnified or diminished by the quality of production inputs, especially labor. To this end, a distinction is made between the quantity of labor (*L*) and quality of labor (*H*) in the analysis. *H* in this context therefore captures human capital, which can be proxied by the level of education or the total years of schooling.

If different individuals work in different sectors of the economy by combining the relevant factors to produce the sectoral output (Y_j), then the standard neoclassical production function could be specified as follows:

$$Y_j = F_j\,(L_j, H_j, K_j) \qquad (1)$$

where K denotes capital. The subscript *j* refers to the sector in which individual *i* is working. The production function summarized by equation (1) is assumed to exhibit constant returns to scale. This implies that if various factors or inputs are increased by a factor *k*, output will also increase k-fold.[3]

[3]Due to restrictions on international labor mobility, it is reasonable to assume that quantities are fixed rather than prices. This justifies the adoption of a production function rather than a cost function to discern the underlying substitution relationships. See Grossman (1982) page 597.

Under the conditions of profit maximization and perfect competition, the return to factors will equal the value of their marginal products. That is:

$$R_L^j = \frac{\partial F^j}{\partial L}(L_j, H_j, K_j) \; ;$$

$$R_H^j = \frac{\partial F^j}{\partial H}(L_j, H_j, K_j) \; ; \qquad (2)$$

$$R_K^j = \frac{\partial F^j}{\partial K}(L_j, H_j, K_j) \; ;$$

where *R's* represent the real rate of return to the various factors. From the above framework, any individual's (*i*) wage in a given sector (*j*) may be expressed as:

$$w_{ij} = R_L^j \; + \; R_H^j \, H_i \qquad (3)$$

Differentiating equation (3) with respect to L_j, the following expression is obtained:

$$\frac{\partial w_{ij}}{\partial L_j} \; = \; \frac{\partial R_L^j}{\partial L_j} + \frac{\partial R_H^j}{\partial L_j} H_i \qquad (4)$$

To determine the sign of equation (4), some assumptions have to be made regarding the second expression on the right hand side of equation (4). The first expression on the right hand side is unambiguously negative. That is, increasing the amount of labor employed in a particular sector will depress the real return to labor in that sector. However, the sign of the second expression depends on the relationship between L and H. Specifically, it hinges on whether L and H are q-complements or q-substitutes as discussed by Hicks (1970). Two factors are q-complements if $\delta R_x/dZ > 0$, and q-substitutes if $\delta R_x/dZ < 0$ and $X, Z = L, H, K$ and $X \neq Z$. Thus if L and H are q-complements, an increase in the stock of labor (L) will increase the productivity of human capital (H).

Hence if L and H are q-complements, $dw_{ij}/dL_j > 0$ is more likely the larger the value of H_i, but would be unambiguously negative if L and H are substitutes. An influx of immigrants, therefore, may increase the wages of well educated Canadians and decrease the wages of less qualified Canadians in particular.[4] Thus the central issue under investigation is not just the human capital content of immigration but whether the foreign-born are actually substitutes or complements for Canadian workers.

In the empirical analysis, the general framework of equation (1) - (4) is employed to estimate the impact of foreign-born labour on the wages of Canadians. The supply effect of foreigners is modeled by the share of foreign-born labor in each major industry to account for size differences between industries. If the foreign-born share is positive, then it implies that foreign-born workers and Canadian-born workers are complements in production. A negative relationship on the other hand, signifies that they are substitutes.

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[4] Although skill differences are not emphasized in this chapter, the production function in equation 4.1 could be modified as $Y_j = F_j(G_u(L_j^u, H_j^u), G_s(L_j^s, H_j^s), K_j)$, where G_u refers to unskilled workers and G_s refers to skilled workers. (See De New and Zimmermann 1994, page 180).

The magnitudes of these relationships can also be inferred from the wage elasticities using the estimated coefficients of the foreign share variables.

II. Dependent and Independent Variables

Based on the theoretical framework, the natural logarithm of hourly wages is employed as the dependent variable[5], and the standard variables used in earnings functions estimations are employed as independent variables. These include *experience*, *experience squared*, *marital status* and *years of schooling*, which reflect human capital acquisition.

Other explanatory variables to capture industry differences are included by way of dummy variables. The following industry classifications were used: *primary* (includes agriculture, forestry, fishing and mining) *communications*, *construction*, *finance & insurance*, *government*, *manufacturing*, *services*, *transport*, and *trade*.[6] The omitted category is government. The industry dummies have been included to account for size differences across industries. This is because theory suggests that production functions and complementarity/substitutability measures may be sensitive to absolute size. This implies that industries with large firms, for a variety of reasons, in particular technology, may use different techniques than industries with smaller firms and thus may experience

[5] The log linear specification is commonly used, because it facilitates the calculation of the wage elasticities.
[6] It was possible to use a lower level of aggregation for the industry dummies. For example in the LMAS data set there were about 51 industry classifications. However, due to the small foreign-born sample size,

different degrees of substitutability for the various inputs. Hence there could be a tendency for small firms to be both labour-intensive and free from institutional barriers such as unions, enabling easy job entry for immigrants. On the other hand, industries with large firms require more capital intensive techniques, and are less flexible in altering labour requirements due to the presence of institutional barriers (see Maki and Meredith 1987). Furthermore, a dummy variable for firm size is also incorporated following De New and Zimmermann (1994). Citing efficiency wage arguments, they postulated that larger firms were more likely to pay higher wages. That is, the bigger the firm the more difficult it is to effectively monitor the effort of workers; thus, higher wages serve as an incentive to minimize shirking. The variable *fsize* (firm size) takes on the value 1 for firms with 500 employees or more and 0 otherwise.

In addition to the above explanatory variables, the proportion of foreign workers was calculated for each industry classification in each year. Wages should respond positively to this variable if Canadian and foreign-born workers are complements and negatively if they are substitutes.

III. Data, Estimating Equations and Methods

In this section, three estimating techniques that are normally employed in panel analysis will be discussed.

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the use of the entire 51 industries often produced cells with very few foreign-born workers. Hence the data had to be aggregated using guidelines from the 1980 Standard Industrial Classification codes.

(a). The first technique is to combine all cross-section and time-series data and perform ordinary least squares regression on the entire data set. This is the pooled time-series cross-section model (TSCS pooled). This model is specified as:

$$w_{it} = \alpha + \beta' X_{it} + \varepsilon_{it} \qquad (5)$$

where w_{it} is the hourly wage rate of individual i in year t; X_{it} is a set of explanatory variables, α and β are a vector of parameters to be estimated and ε_{it} is the error term.

(b). A second procedure involves the recognition that omitted variables may lead to changing cross-section and time series intercepts. In the immigration context, a policy change such as a higher skill requirement for admission or the requirement of more accompanying human capital, could be interpreted as an omitted variable which would affect the magnitude of the constant term in the wage equation. Thus, differences across units can be captured in differences in the constant term. This is accomplished through the addition of dummy variables to the model to accommodate for these changing intercepts in a fixed effects model.[7] The fixed effects model is specified as

$$\begin{aligned} w_{it} &= \alpha_1 d_{1it} + \alpha_2 d_{2it} + \ldots + \beta' X_{it} + \varepsilon_{it} \\ &= \alpha_i + \beta' X_{it} + \varepsilon_{it} \qquad (6) \end{aligned}$$

[7] It should be pointed out, however, that nothing happened by way of significant changes in immigration policy within the time period under investigation (1988-1990), or to the business cycle to cause a shift in the intercepts and warrant the use of the fixed effects model.

where the α_i*'s* are individual specific constants, and the d_j*'s* are group specific dummy variables which equal 1 only when $j = i$.

(c). The third way of analyzing panel data gives rise to the random effects or the error components model. The fixed effects model is a reasonable approach when we can be confident that the differences between units can be viewed as parametric shifts of the regression function. In other settings, it might be more appropriate to view individual specific constant terms as randomly distributed across cross-sectional units. This would be appropriate if one believed that sampled cross-sectional units were drawn from a large population, as is the case for the Labour Market Activity Survey data set used for the panel estimation. The random effects model is specified as follows:

$$w_{it} = \alpha + \beta' X_{it} + \varepsilon_{it} + u_i \qquad (7)$$

where

$$\varepsilon_{it} \sim N(0,\sigma_\varepsilon^2);\ u_{it} \sim N(0,\sigma_u^2);\ COV(\varepsilon_{it}, u_j) = 0,\ \forall i, t, j;\quad COV(\varepsilon_{it}, e_{js}) = 0,$$
$$\text{if } t \neq s \text{ or } i \neq j;\ COV(u_i, u_j) = 0, \text{ if } i \neq j. \qquad (8)$$

Thus, the random effects model has an overall intercept (α) and an error term with two components: $\varepsilon_{it} + u_i$. The ε_{it} is the traditional error term unique to each observation. The

u_i is an error term representing the extent to which the intercept of the *i*th cross-sectional unit differs from the overall intercept.[8] (Kennedy 1992, p. 222).

Equation (7) is estimated by an implicit two-stage generalized least squares (GLS) technique. In the first stage, the variance components are estimated using the residuals from an ordinary least squares (OLS) regression. In the second stage, the estimated variances from the OLS regression are subsequently used to generate the GLS estimates. The generalized least squares estimation procedure is used in the context of the random effects model due to the error structure. The errors are apparently not homoskedastic. Use of the OLS procedure will therefore bias the estimated standard errors.

In the next section, the results for only the simple pooling model and the random effects model (i.e. "1-way" random effects model) are presented. Due to the presence of time invariant regressors such as industry dummies, marital status, firm size etc. the fixed effects estimator could not be computed. This constraint is imposed by the LIMDEP computer program which was used for all the estimations.[9]

Which of the simple pooling and the random effects models is better? A Lagrange multiplier test for the random effects model developed by Breusch and Pagan (1980) provides an answer. The test is based on the OLS residuals. For

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[8]Sometimes a third error is included, representing the extent to which the *t*th time period intercept differs from the overall intercept. This addition gives rise to the "2-way" random effects model. Greene (1990), does not prefer this variant of the random effects model. He cites amongst other reasons the cost in terms of degrees of freedom lost.

H_0: $\sigma_u^2 = 0$

H_1: $\sigma_u^2 \neq 0$

the LM test statistic under the null hypothesis, is distributed as chi-squared with one degree of freedom $\chi^2(1)$[10]. The 5% critical values from the chi-squared distribution with one degree of freedom is 3.842. Therefore, if the calculated LM test statistic is greater than 3.842 then the null hypothesis would be rejected. The rejection of the null hypothesis implies that the panel GLS model is appropriate and simple pooling has to be rejected. The LM test statistics will also be provided with the estimation results.

The following random effects panel model was estimated for the whole sample, then separately for both males and females, with the individual specific component in the error term:

$$\text{Ln WAGE}_{it} = \beta_0 + \beta_1 \text{ EXP}_{it} + \beta_2 \text{ EXP2}_{it} + \beta_3 \text{ EDUC}_{it} + \beta_4 \text{ MARRIED}_{it} + \beta_5 \text{ FSIZE}_{it} + \beta_6 \text{ FSHARE}_{it} + \beta_7 \text{ INDUSTRY DUMMIES} + \varepsilon_{it} + u_i \quad (9)$$

The standard time series-cross section (TSCS) pooled regression is also estimated for reference purposes.

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[9]See Greene W. H., (1992) *LIMDEP Version 6.0, User's Manual and Reference Guide,* (New York: Econometric Software Inc.), page 301.
[10] See Greene (1990) pages 491-492.

The data used in the estimation comes from the Labour Market Activity Survey (1988-89-90) or LMAS. In selecting the individual observations, only employed Canadian-born workers aged between 20 and 65 years were selected. This is to ensure that only those workers who are active in the labour force are selected. Furthermore, I worked with a 10 percent random sample of all cases and also limited my analysis to individuals who had a complete set of variables for all 3 waves (1988, 1989 and 1990). This yielded a sample of 1018 males (3054 observations over 3 year period) and 877 females (2631 observations over 3 year period).

All variables used in equation (9) are defined and sample means given in Table 1.

Table 1 Insert

The hypothesized signs from equation (9) are as follows:

(1). $\beta_1 > 0$, $\beta_2 < 0$: Wage profile is concave in experience.

(2). $\beta_3 > 0$: Education or schooling increases wages.

(3). $\beta_4 > 0$: Marriage implies more financial responsibility. That means greater effort on the part of individuals and thus higher wages.

(4). $\beta_5 > 0$: Increasing firm size means additional compensation, invoking efficiency wage arguments.

(5) $\beta_6 > 0$: If Canadian and foreign-born workers are complements in production.

(6). $\beta_6 < 0$: If Canadian and foreign-born workers are substitutes in production.

IV. Empirical Results

Tables 2 to 4 Insert

Tables 2 to 4 report the results of wage function estimations for the total sample, male sample and female sample. The standard time series-cross section (TSCS pooled) regression for each category is also included. The first and third columns of each table contain all the usual variables described in Table 1 together with average industry foreign-born share. In columns two and four, I once again include all the usual variables but this time disaggregate the effect of the foreign-born share by industry. The difference has to do with the overall impact of foreign-born labour share averaged across all industries versus industry specific impacts. This is because the overall average impact does not portray the entire story since positive wage impacts in one industry could be offset by negative impacts in others and vice versa. For example Akbari and DeVoretz (1992) detected some displacement of native-born workers in selected foreign-born labour-intensive industries, although their prior estimated cross elasticities suggested no economy-wide displacement of native-born workers by foreign-born workers.

The tables also contain the Breusch-Pagan Lagrange multiplier (LM) test statistics. At the critical level of χ^2 (1, 0.05) = 3.84, the LM test statistics are overwhelmingly significant. This supports the random effects model specification and rejects the TSCS simple pooling model; consequently, I will only focus on the random effects results in the interpretation.

The usual empirical finding of an “inverted-U” shaped wage profile, consistent throughout all the regression estimates, results from the positive and significant effect of experience, and the negative and significant effect of experience squared. This concavity in the wage profile compares with other Canadian studies, especially the earnings performance literature. See, for example, DeSilva (1992, 1997), Abbot and Beach (1993), Meng (1987), Bloom and Gunderson (1991), and Pendakur and Pendakur (1996). Years of schooling also have a significant and positive influence thereby adding to the human capital stock. In addition, marital status and firm size also had a positive and significant effect on hourly wage rates in the total sample equation. In the males equation, though, firm size was negative, contrary to theoretical predictions. It was however insignificant. The marital status variable was also positive and significant. For the female regression estimates, both the marital status and firm size variables were positive, but insignificant.

The key variable of interest in this study is the share of foreign-born labour in the various industries. A higher share should impact positively on wages if foreign-born workers and native-born workers are complements, and negatively if they are substitutes. Using the estimated coefficients on the foreign share variables and their means, the wage elasticities for each industry and for the total samples can be calculated. The wage elasticity is simply the product of the estimated coefficient and its mean. Table 5 summarizes the results from these calculations.

Table 5 Insert

With regard to the total sample, the wage elasticity on average is positive, meaning that the foreign-born and native-born are complements. The wage elasticity was estimated to be around 0.5. This means that a 1% increase in the flow of foreign-born workers into the country will increase the wage rates of native-born workers by about 0.5%. It should be noted that a standardized test was not conducted to directly test for the significance/insignificance of these elasticities, but rather my focus was on the significance of the estimated coefficients that went into calculating the elasticities. Thus, it would be more reassuring if the coefficients on the foreign share variables turned out to be significant. For males, the overall elasticity was negative (-0.55), meaning that foreign-born workers and natives are substitutes. For females, the elasticity was also positive (0.67), indicating a complementary relationship. This compares closely with the German results by De New and Zimmermann (1994). Using the same estimation techniques, they calculate the overall foreign share elasticity to be -0.35. Examining job displacement effects of Canadian immigrants by country of origin and occupation, Roy (1997) also found US immigrants and Canadians to be substitutes in the labour market. Specifically, a 10 percent increase in the number of immigrants from the United States would reduce the wage rates of native-born Canadians by 0.9%. He attributed this result to the similarities between the US and Canadian labour markets vis-à-vis technology in the work place, the institutional structure etc. Akbari and DeVoretz (1992) found foreign-born workers and native-born workers to be neither substitutes nor complements in production economy-wide in 1980 for Canada. However, the focus of their study was on employment effects and not wage effects; consequently it cannot be compared to this study. They also estimated share equations from a translog production function; hence their methodology is also different from that being adopted in this paper.

Wage elasticities calculated from aggregated data can mask industry specific effects; therefore, I replicated the tests for specific industries. Some of the theoretical issues that suggest that disaggregation by industry size have already been alluded to. These include scale effects and varying capital-labour ratios with implications on substitutability and wage effects in the various industries (see DeVoretz (1989, 15). Furthermore, studies by Hiebert (1997) also suggest that the foreign-born are often concentrated by industry. The figures for the total sample reveals that wage suppression occurs in the primary, communication, transportation, trade, and construction industries. In all these industries the wage elasticity is negative. On the other hand, there are wage increases in manufacturing, government, finance and insurance and the service industries. The wage elasticities are all positive, ranging from 0.0013 in finance and insurance to 0.0081 in the service industries.

For the male sample, wage suppression occurs in all industries with the exception of government, finance and insurance, and the service industries which all experienced wage gains. The results for females are similar to that experienced by males, except for wage increases in the manufacturing sector.

Endogeneity of Foreign-share Variable

The empirical analysis has been conducted so far on the premise that the proportion of foreign-born labour in the various industries is exogenous. However, the distribution of foreign-born workers in the various industries may be attributed to high wages, and therefore, stem from reverse causation. This implies that the foreign share variables could be endogenous. One way of handling this problem is to find suitable instruments[11] to confront the endogeneity issue of industry selection. To test for endogeneity, the Hausman specification test is used. The version of the Hausman test used here is in two stages. In the first stage, the foreign share variable is regressed on all the instruments and the predicted values are saved for the second stage. In the second stage, the predicted values for the foreign share variable are used in the wage regressions and t-test is used to test whether the fitted value of the predicted foreign share variable is significantly different from zero. According to the Hausman specification test, simultaneity is not a problem in the model if the coefficient on the predicted value (in this case foreign share) is not significantly different from zero.[12]

Tables 6 to 8 Insert

[11] These include industry dummies, industry growth rates and an overall time trend.
[12] Because this test is a large sample test, the critical value that must be used is derived from the normal distribution. At the 5% significance level, the corresponding critical level of this test is 1.96.

Table 6 to 8 summarizes the results from the instrumented wage regression. An examination of the foreign share variables (i.e. FSHARE and its industry counterparts FSPRIM to FSERV), especially for the random effects model, indicate that at the critical level of 1.96, the null hypothesis that the coefficients on the foreign share variables is zero must be rejected. This is because almost all the t-values with very few exceptions were greater than 1.96. Therefore, this indicates that simultaneity was indeed a problem and instrumentation was warranted.

Comparing the instrumented regressions with the non-instrumented ones, one observes a significant improvement in the results, both in terms of the absolute values of the estimated coefficients and the level of statistical significance. For example, looking at only the total sample (i.e. Table 2 and Table 6), the foreign share variable was estimated to be 0.063 and a t-value of 13.07 in the non-instrumented regression. However, referring to the instrumented regressions in Table 6, the coefficient of the foreign share variable in the random effects model has increased from 0.063 to 0.135, and the t-value is now 16.31.

The LM test statistics reported in Tables 6 to 9 are overwhelmingly significant and support the random effects specification in all cases, and I limit my interpretation of the instrumented wage equations to the random effects model. All the traditional human capital variables such as education, experience, marital status were all significant and obtained the expected signs. However, the variable of primary interest is the foreign share variables. For ease of interpretation the wage elasticities have also been calculated using the estimated coefficients form the instrumented regressions. The results have been summarized in Table 9.

Table 9 Insert

The results from Table 9 indicate that the wage elasticity for the total sample on average is 0.011. This means that foreign-born workers and native-born workers are complements. Specifically, a 1% increase in the number of foreign-born workers will increase the hourly wage rates of Canadians by 0.011%. For the male and female samples, a similar complementary relationship between foreign-born workers and native-born workers was discerned. The corresponding elasticities for males and females are 0.013 and 0.014. This implies that a 1% increase in the number of foreign-born workers will increase the hourly wages of Canadian male and female workers by 0.013% and 0.014% respectively.

When the wage elasticities were calculated for the various industries new patterns of complementary and substitution relationships between foreign-born and native-born workers appears. In all three different samples i.e. total, male and female samples wage suppression was observed in the primary, transportation and storage, and wholesale and retail trade industries, since the wage elasticities were all negative suggesting a substitution relationship. The elasticities were -0.011, -0.032 and -0.019 respectively for the total sample; -0.009, -0.059 and -0.019 respectively for the male sample and -0.006, -

0.017 and -0.022 respectively for the female sample. In all the other industries the wage elasticities were positive for all three samples.

V. Conclusions

This paper focused on the impact of foreign-born labour on native-born wage rates, using a longitudinal data set from the 1988-1990 Labour Market Activity Survey. The principal objective was to investigate any substitution and complementarity relationships between foreign-born and native-born workers by industries. The estimation is carried out for both males and females in addition to the overall sample in different industries. Furthermore, because of the probable endogeneity of the foreign share variable, an instrumental variable approach was used to deal with the endogeneity problem. The results indicate that years of experience, years of schooling, industry of employment, marital status and firm size have a significant impact on wages, using both the instrumented and non-instrumented regressions. Finally, immigration, which is proxied by the share of foreign-born workers overall and also in the various industries in which Canadians work, had an overall positive effect on Canadian/native-born wages for all three samples using the instrumented regressions. However, wage compression was detected in the primary, transportation and storage and the trade industries. Thus Canada-wide there appears to be a complementary wage-foreign-born relationship, but this relationship has been definitely masked by developments in specific industries.

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Table 1
Variable Definitions and their Sample Means

Variable	Variable Definition	Sample Means: Males	Female
WAGE	Hourly wage	1488	1136
LNWAGE	Natural Log of hourly wage	7.21	6.91
EDUC	Total years of schooling	12.94	13.46
EXP	Experience	20.49	18.46
EXP2	Experience Squared	554.8	468.8
MARST	Marital status, Married = 1; other = 0	81%	72%
FSIZE	Firm size, More than 500 employees =1; less than 500 = 0	41%	35%
PRIM	Agriculture, forestry, fishing & mining = 1; other = 0	9%	2%
MANUF	Manufacturing = 1; other = 0	25%	10%
CONST	Construction = 1; other = 0	8%	1%
TRANS	Transportation & storage = 1; other = 0	7%	2%
TRADE	Wholesale & Retail Trade = 1; other = 0	14%	15%
FINAN	Finance, Insurance & Real Estate = 1; other = 0	3%	6%
SERV	Health, Education, Religious, Business, Personal & Food Services = 1; other = 0	17%	51%
COMM	Communication & Utilities = 1; other = 0	6%	4%
GOVT	Federal, Provincial & Local Administration = 1; other = 0	11%	8%
FSPRIM	Foreign-born share primary industries	8.2%	8.3%
FSCOM	Foreign-born share communication industries	8.4%	8.4%
FSMAN	Foreign-born share manufacturing industries	9%	8.6%
FSTRANS	Foreign-born share transportation industries	8.2%	8.3%
FSGOVT	Foreign-born share government sector	8.2%	8.3%
FSTRADE	Foreign-born share trading sector	8.4%	8.3%
FSCONST	Foreign-born share construction industries	8.3%	8.4%
FSFIN	Foreign-born share financial sector	8.5%	8.5%
FSERV	Foreign-born share service industries	8.7%	9.3%
FSHARE	Average foreign-born share in all sectors	8.4%	8.4%

Source: Labour Market Activity Survey (1988-1990) and Author's calculations.

Table 2
Impacts of Foreign-Born Labour on Canadian Wages (Total Sample)
Dependent Variable: Natural Logarithm of Hourly Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.068	0.068	0.034	0.027
	(29.57)	(29.39)	(15.18)	(12.28)
EXP	0.022	0.022	0.017	0.017
	(11.08)	(11.09)	(6.356)	(6.414)
EXP2	-0.0003	-0.0003	-0.00024	-0.00024
	(-7.54)	(-7.55)	(-4.297)	(-4.438)
MARST	0.085	0.085	0.044	0.037
	(6.015)	(5.98)	(3.814)	(3.31)
FSIZE	0.167	0.167	0.018	0.016
	(13.6)	(13.6)	(3.101)	(2.892)
PRIM	-0.038	-0.082	-0.141	-0.25
	(-1.305)	(-0.908)	(-2.912)	(-4.672)
MANUF	0.036	-0.007	-0.047	-0.15
	(1.531)	(-0.127)	(-1.183)	(-3.577)
CONST	0.054	0.036	-0.079	-0.142
	(1.581)	(0.42)	(-1.39)	(-2.36)
TRANS	0.049	0.005	-0.014	-0.117
	(1.561)	(0.019)	(-0.273)	(-1.35)
TRADE	-0.233	-0.276	-0.33	-0.411
	(-9.745)	(-6.45)	(-8.272)	(-10.04)
FINAN	-0.182	-0.228	-0.208	-0.284
	(-5.895)	(-3.844)	(-4.006)	(-5.291)
SERV	-0.191	-0.313	-0.214	-0.414
	(-9.042)	(-3.76)	(-6.051)	(-10.11)
COMM	0.07	0.042	0.059	0.007
	(2.207)	(0.933)	(1.105)	(0.138)
FSHARE	0.053		0.063	
	(2.921)		(13.07)	
FSPRIM		-0.008		-0.023
		(-0.203)		(-2.311)
FSCOMM		-0.0038		-0.0073
		(-0.1)		(-0.771)
FSMAN		0.007		0.019
		(0.421)		(4.644)
FSTRANS		-0.0062		-0.017
		(-0.059)		(-0.657)
FSGOVT		0.015		0.026
		(0.866)		(5.935)
FSTRADE		-0.042		-0.064
		(-1.102)		(-6.737)
FSCONST		0.01		-0.0019
		(0.145)		(-0.11)
FSFIN		0.011		0.015

		(0.454)		(2.536)
FSERV		0.056		0.091
		(1.302)		(8.341)
CONSTANT	5.431	5.583	6.005	6.366
	(34.07)	(27.48)	(87.32)	(83.01)
N	5670	5670	5670	5670
R^2	0.244	0.245	0.182	0.168
σ_{ε}^2			0.01	0.009
σ_u^2			0.193	0.198
LM (d.f. = 1)			4848.78	4859.49

T-values are in parenthesis.

Table 3
Impacts of Foreign-Born Labour on Canadian Wages (Males Only)
Dependent Variable: Natural Logarithm of Hourly Male Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.046	0.046	0.023	0.015
	(16.58)	(16.42)	(9.41)	(6.573)
EXP	0.027	0.027	0.002	0.019
	(10.58)	(10.59)	(5.842)	(5.881)
EXP2	-0.00046	-0.00046	-0.00032	-0.00032
	(-8.902)	(-8.913)	(-4.801)	(-4.943)
MARST	0.093	0.093	0.038	0.034
	(4.703)	(4.694)	(2.742)	(2.649)
FSIZE	0.0003	0.0003	-0.00002	-0.00005
	(0.935)	(0.893)	(-0.284)	(-0.673)
PRIM	-0.0003	-0.067	-0.045	-0.158
	(-0.009)	(-0.649)	(-0.807)	(-2.634)
MANUF	-0.063	-0.163	-0.105	-0.249
	(-2.316)	(-2.612)	(-2.301)	(-5.248)
CONST	-0.803	-0.132	-0.125	-0.228
	(-2.304)	(-1.542)	(-2.125)	(-3.725)
TRANS	-0.109	-0.32	-0.154	-0.339
	(-2.993)	(-0.95)	(-2.488)	(-3.713)
TRADE	-0.225	-0.292	-0.269	-0.367
	(-7.408)	(-5.452)	(-5.245)	(-7.013)
FINAN	-0.065	-0.13	-0.041	-0.12
	(-1.341)	(-1.433)	(-0.507)	(-1.436)
SERV	-0.209	-0.397	-0.2003	-0.435
	(-7.297)	(-2.984)	(-4.113)	(-7.874)
COMM	-0.01	-0.065	-0.021	-0.091
	(-0.278)	(-1.206)	(-0.322)	(-1.412)
FSHARE	0.06		-0.066	

	(2.544)		(12.55)	
FSPRIM		-0.006		-0.016
		(-0.131)		(-1.809)
FSCOMM		-0.004		-0.011
		(-0.092)		(-1.233)
FSMAN		0.02		0.029
		(1.167)		(8.271)
FSTRANS		-0.062		-0.041
		(-0.476)		(-1.58)
FSGOVT		0.03		0.037
		(1.411)		(8.695)
FSTRADE		-0.031		-0.05
		(-0.596)		(-4.88)
FSCONST		0.003		-0.023
		(0.048)		(-1.692)
FSFIN		0.0068		0.011
		(0.167)		(1.425)
FSERV		0.079		0.102
		(1.081)		(7.038)
CONSTANT	5.827	6.083	6.222	6.648
	(28.34)	(22.74)	(75.23)	(75.54)
N	3054	3054	3054	3054
R^2	0.166	0.167	0.139	0.124
σ_ε^2			0.009	0.093
σ_u^2			0.165	0.17
LM (d.f. = 1)			2678.81	2690.94

T-values are in parenthesis.

Table 4
Impacts of Foreign-Born Labour on Canadian Wages (Females Only)
Dependent Variable: Natural Logarithm of Hourly Female Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.077	0.077	0.036	0.025
	(21.98)	(21.81)	(10.96)	(8.059)
EXP	0.019	0.019	0.014	0.014
	(6.842)	(6.85)	(3.596)	(3.783)
EXP2	-0.0003	-0.0003	-0.00023	-0.00025
	(-5.074)	(-5.089)	(-2.792)	(-3.092)
MARST	-0.0014	-0.002	0.012	0.005
	(-0.072)	(-0.093)	(0.703)	(0.349)
FSIZE	0.138	0.138	0.0024	0.0008
	(7.415)	(7.416)	(0.306)	(0.113)
PRIM	-0.299	-0.283	-0.397	-0.461
	(-4.62)	(-1.33)	(-3.639)	(-3.88)

MANUF	-0.153	-0.246	-0.263	-0.406
	(-3.718)	(-2.588)	(-3.803)	(-5.63)
CONST	-0.425	-0.453	-0.554	-0.641
	(-4.454)	(-1.858)	(-3.441)	(-3.776)
TRANS	-0.063	-0.295	-0.174	-0.388
	(-0.971)	(-0.476)	(-1.595)	(-2.196)
TRADE	-0.307	-0.371	-0.397	-0.5
	(-8.094)	(-5.375)	(-6.234)	(-7.654)
FINAN	-0.258	-0.315	-0.295	-0.38
	(-5.653)	(-3.559)	(-3.816)	(-4.781)
SERV	-0.151	-0.296	-0.182	-0.431
	(-4.591)	(-2.657)	(-3.282)	(-7.074)
COMM	0.082	0.033	0.086	0.017
	(1.576)	(0.439)	(0.984)	(0.195)
FSHARE	0.065		0.08	
	(2.415)		(11.87)	
FSPRIM		0.034		0.006
		(0.338)		(0.269)
FSCOMM		-0.0065		-0.013
		(-0.105)		(-0.995)
FSMAN		0.019		0.026
		(0.64)		(3.896)
FSTRANS		-0.073		-0.051
		(-0.3)		(-0.944)
FSGOVT		0.027		0.035
		(0.94)		(5.402)
FSTRADE		-0.037		-0.065
		(-0.645)		(-4.937)
FSCONST		0.021		-0.006
		(0.102)		(-0.132)
FSFIN		0.004		0.007
		(0.127)		(1.013)
FSERV		0.056		0.108
		(1.057)		(8.842)
CONSTANT	5.224	5.44	5.807	6.301
	(22.03)	(18.46)	(57.85)	(58.88)
N	2631	2631	2631	2631
R^2	0.259	0.26	0.194	0.171
σ_ε^2			0.01	0.009
σ_u^2			0.2	0.21
LM (d.f. = 1)			2238.48	2246.29

T-values are in parenthesis

Table 5
Wage Elasticities by Industries and Gender (Using Coefficients from Non Instrumented Regressions)

Variable	Total Sample Coefficient	Elasticity	Male Sample Coefficient	Elasticity	Female Sample Coefficient	Elasticity
FSPRIM	-0.023	-0.0019	-0.016	-0.0013	0.006	0.0005
FSCOMM	-0.073	-0.0061	-0.011	-0.00092	-0.014	-0.0012
FSMAN	0.019	0.0016	-0.029	-0.0026	0.026	0.0022
FSTRANS	-0.017	-0.0014	-0.041	-0.0034	-0.051	-0.0042
FSGOVT	0.026	0.0021	0.037	0.003	0.035	0.0029
FSTRADE	-0.064	-0.0053	-0.05	-0.0042	-0.065	-0.0054
FSCONST	-0.0019	-0.00016	-0.023	-0.0019	-0.0062	-0.00052
FSFINAN	0.015	0.0013	0.011	0.00093	0.0075	0.00064
FSERV	0.091	0.0081	0.102	0.0088	0.109	0.01009
FSAVERAGE	0.063	0.0053	-0.066	-0.0055	0.0803	0.0067

Table 6
Impacts of Foreign-Born Labour on Canadian Wages (Total Sample and Using Instruments for Foreign Share Variables)
Dependent Variable: Natural Logarithm of Hourly Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.072	0.072	0.028	0.028
	(32.72)	(32.76)	(11.75)	(12.41)
EXP	0.016	0.016	0.015	0.014
	(8.16)	(8.15)	(5.25)	(5.18)
EXP2	-0.0002	-0.0002	-0.0002	-0.0002
	(-4.73)	(-4.72)	(-3.75)	(-3.67)
MARST	0.062	0.062	0.024	0.026
	(4.03)	(4.03)	(1.79)	(1.99)
FSIZE	0.15	0.15	0.016	0.016
	(11.67)	(11.67)	(2.51)	(2.48)
PRIM	-0.004	-0.24	-0.121	-0.42
	(-0.143)	(-0.71)	(-2.61)	(-4.14)
MANUF	-0.092	-0.16	-0.18	-0.29
	(-4.04)	(-3.47)	(-4.86)	(-7.41)
CONST	-0.043	-0.005	-0.17	-0.12
	(-1.28)	(-0.055)	(-3.14)	(-1.97)
TRANS	0.029	-0.056	-0.073	-1.12
	(0.96)	(-0.03)	(-1.43)	(-2.22)
TRADE	-0.32	-0.37	-0.41	-0.54
	(-13.54)	(-6.27)	(-10.64)	(-12.84)
FINAN	-0.29	-0.58	-0.32	-0.82
	(-8.45)	(-1.19)	(-5.40)	(-5.73)
SERV	-0.201	-0.28	-0.21	-0.34
	(-9.68)	(-5.30)	(-6.06)	(-9.14)

COMM	0.012	-0.014	0.009	-0.037
	(0.37)	(-0.30)	(0.18)	(-0.66)
FSHARE	0.075		0.135	
	(2.73)		(16.31)	
FSPRIM		-0.109		-0.13
		(-0.63)		(-2.85)
FSCOMM		0.029		0.05
		(0.57)		(3.59)
FSMAN		0.022		0.031
		(1.86)		(9.44)
FSTRANS		-0.024		-0.39
		(-0.033)		(-2.002)
FSGOVT		0.013		0.024
		(0.76)		(5.11)
FSTRADE		-0.097		-0.23
		(-0.79)		(-6.77)
FSCONST		0.059		0.094
		(0.703)		(4.16)
FSFIN		0.15		0.27
		(0.54)		(3.52)
FSERV		0.03		0.05
		(1.44)		(8.80)
CONSTANT	5.21	5.21	5.44	8.58
	(22.56)	(0.75)	(64.62)	(4.59)
N	5670	5670	5670	5670
R^2	0.26	0.26	0.18	0.18
σ_ε^2			0.011	0.011
σ_u^2			0.19	0.196
LM(d.f. = 1)			4760.1	4761.39

T-values are in parenthesis.

Table 7
Impacts of Foreign-Born Labour on Canadian Wages (Male Sample and Using Instruments for Foreign Share Variables)
Dependent Variable: Natural Logarithm of Hourly Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.042	0.042	0.018	0.018
	(15.06)	(15.11)	(6.35)	(6.92)
EXP	0.025	0.025	0.023	0.022
	(9.86)	(9.83)	(6.56)	(6.23)
EXP2	-0.0004	-0.0004	-0.0004	-0.0003
	(-8.45)	(-8.42)	(-5.67)	(-5.31)
MARST	0.101	0.101	0.036	0.039
	(5.19)	(5.22)	(2.17)	(2.64)
FSIZE	0.17	0.18	0.011	0.007

	(11.32)	(11.29)	(1.39)	(0.96)
PRIM	-0.0024	-0.19	-0.053	-0.34
	(-0.076)	(-0.52)	(-0.96)	(-3.05)
MANUF	-0.077	-0.19	-0.11	-0.24
	(-2.91)	(-3.41)	(-2.55)	(-5.25)
CONST	-0.024	-0.042	-0.13	-0.12
	(-0.70)	(-0.429)	(-2.21)	(-1.91)
TRANS	-0.11	-1.56	-0.16	-2.03
	(-3.04)	(-0.73)	(-2.75)	(-3.77)
TRADE	-0.19	-0.33	-0.27	-0.43
	(-6.67)	(-4.17)	(-5.49)	(-7.95)
FINAN	-0.071	-0.42	-0.038	-0.49
	(-1.49)	(-0.63)	(-0.48)	(-2.68)
SERV	-0.18	-0.31	-0.19	-0.34
	(-6.47)	(-3.98)	(-4.11)	(-6.70)
COMM	-0.044	-0.105	-0.027	-0.095
	(-1.20)	(-1.94)	(-0.44)	(-1.51)
FSHARE	0.121		0.15	
	(3.47)		(14.58)	
FSPRIM		-0.072		-0.11
		(-0.36)		(-2.28)
FSCOMM		0.069		0.066
		(1.21)		(4.65)
FSMAN		0.025		0.029
		(1.93)		(8.93)
FSTRANS		-0.55		-0.72
		(-0.65)		(-3.37)
FSGOVT		0.031		0.037
		(1.46)		(6.84)
FSTRADE		-0.19		-0.23
		(-1.14)		(-5.62)
FSCONST		0.038		0.076
		(0.47)		(3.74)
FSFIN		0.17		0.23
		(0.44)		(2.35)
FSERV		0.039		0.046
		(1.12)		(5.24)
CONSTANT	5.32	10.04	5.58	11.71
	(18.12)	(1.22)	(53.34)	(5.70)
N	3054	3054	3054	3054
R^2	0.20	0.20	0.14	0.14
σ_ε^2			0.009	0.009
σ_u^2			0.166	0.168
LM(d.f. = 1)			2570.4	2566.84

T-values are in parenthesis

Table 8
Impacts of Foreign-Born Labour on Canadian Wages (Female Sample and Using Instruments for Foreign Share Variables)
Dependent Variable: Natural Logarithm of Hourly Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.077	0.077	0.026	0.028
	(21.79)	(21.84)	(7.66)	(8.67)
EXP	0.019	0.019	0.014	0.014
	(6.86)	(6.84)	(3.78)	(3.64)
EXP2	-0.0003	-0.0003	-0.0003	-0.0002
	(-5.09)	(-5.08)	(-3.09)	(-2.92)
MARST	-0.002	-0.002	0.004	0.007
	(-0.1)	(-0.096)	(0.24)	(0.46)
FSIZE	0.14	0.14	0.002	-0.0004
	(7.43)	(7.41)	(0.22)	(-0.054)
PRIM	-0.29	-0.42	-0.41	-0.59
	(-4.62)	(-0.46)	(-3.74)	(-2.58)
MANUF	-0.15	-0.25	-0.28	-0.41
	(-3.74)	(-2.92)	(-4.11)	(-5.69)
CONST	-0.43	-0.45	-0.57	-0.54
	(-4.46)	(-1.49)	(-3.53)	(-3.12)
TRANS	-0.063	1.04	-0.19	-0.77
	(-0.98)	(0.24)	(-1.78)	(-0.78)
TRADE	-0.31	-0.42	-0.41	-0.56
	(-8.11)	(-4.39)	(-6.46)	(-8.43)
FINAN	-0.26	-0.58	-0.30	-0.94
	(-5.66)	(-1.07)	(-3.92)	(-6.43)
SERV	-0.15	-0.28	-0.18	-0.36
	(-4.59)	(-3.68)	(-3.30)	(-6.19)
COMM	0.082	0.031	0.081	0.017
	(1.57)	(0.41)	(0.92)	(0.19)
FSHARE	0.111		0.17	
	(2.73)		(16.1)	
FSPRIM		-0.038		-0.068
		(-0.081)		(-0.64)
FSCOMM		0.072		0.069
		(0.89)		(3.77)
FSMAN		0.024		0.03
		(0.99)		(5.47)
FSTRANS		0.46		-0.21
		(0.27)		(-0.53)
FSGOVT		0.026		0.033
		(0.86)		(4.94)
FSTRADE		-0.17		-0.26
		(-0.94)		(-6.13)
FSCONST		0.021		0.082
		(0.079)		(1.33)

FSFIN		0.16		0.34
		(0.52)		(4.7)
FSERV		0.048		0.067
		(1.98)		(12.23)
CONSTANT	4.85	0.76	5.23	5.87
	(14.05)	(0.049)	(46.11)	(1.67)
N	2631	2631	2631	2631
R^2	0.26	0.26	0.17	0.17
σ_{ε}^2			0.009	0.01
σ_u^2			0.21	0.21
LM(d.f. = 1)			2243.4	2243.8

T-values are in parenthesis

Table 9
Wage Elasticities by Industries and Gender (Using Coefficients from Instrumented Regressions)

Variable	Total Sample Coefficient	Elasticity	Male Sample Coefficient	Elasticity	Female Sample Coefficient	Elasticity
FSPRIM	-0.13	-0.011	-0.11	-0.009	-0.068	-0.006
FSCOMM	0.05	0.004	0.066	0.006	0.069	0.006
FSMAN	0.031	0.003	0.029	0.003	0.03	0.003
FSTRANS	-0.39	-0.032	-0.72	-0.059	-0.21	-0.017
FSGOVT	0.024	0.002	0.037	0.003	0.033	0.003
FSTRADE	-0.23	-0.019	-0.23	-0.019	-0.26	-0.022
FSCONST	0.094	0.008	0.076	0.006	0.082	0.007
FSFINAN	0.27	0.023	0.23	0.019	0.34	0.029
FSERV	0.05	0.004	0.046	0.004	0.067	0.006
FSAVERAGE	0.135	0.011	0.15	0.013	0.17	0.014

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