Youth Unemployment and Immigration: A Case Study of Ontario, Canada

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Abstract

This study investigates the long-run relationship between youth unemployment and net immigration in Ontario, Canada where youth is defined as ages between 15-24. Two different models are estimated based on different definitions of youth. An Auto regressive Distributed Lag (ARDL) framework is used to establish the direction of causation between the variables. The study concludes a long-run relationship between youth unemployment and immigration. The estimation of the long-term coefficients shows that there exists a long-run relationship between youth unemployment and immigration, irrespective of the age cohort, showing that a 1% increase in immigration will lead to a 0.4% and 0.3% increase in youth unemployment for Model I and Model II respectively.

Youth unemployment is likely to be affected by other factors as well such as government austerity measures, adult unemployment rates and overall economic situation. Therefore this study can be further extended to include various other relevant variables. Given the specificity of our research question, time limitations and data availability these factors were not considered in our research. It can be further expanded to include other Canadian Provinces as well.

Key words: Immigration; Unemployment; Youth

INTRODUCTION

This study investigates the long-run relationship between youth unemployment and immigration in Ontario, where youth is defined as ages between ages 15-24 years. High unemployment rates can be a serious cause of concern for a country due to its social and economic implications. It may retard long-term economic growth and loss of valuable resources. Specifically, high unemployment is discouraging for young people and wastes human capital investments, education and skill attainment. In 2013, the overall unemployment rate in Canada was 7.1%[1], while the youth unemployment rate was hovering around 14%[2]. In contrast, Ontario which is the most populated province in Canada continues to experience youth unemployment rates between 16-17%[3]. This is closer to Atlantic Canada's youth unemployment rates and consistently higher than the national average. In fact, some cities in Ontario such as Oshawa and London are reporting youth unemployment rates above 20%. Through further analysis of the data it is apparent that youth between the ages of 15-19 experiences even higher unemployment rates in Ontario, as high as 23%[4] in 2013. It may be possible that this definition of youth is more appropriate given that many individuals between the ages of 20-24 are enrolled in undergraduate studies and thereby have opportunities for work through CO-OP placements and other initiatives such as federal government student employment programs. Therefore, for the purpose of our paper we will consider both youth age cohorts, 15-19 and 15-24, for a comprehensive study of the long-run relationship between immigration and youth unemployment.

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[1] Statistics Canada: Table 282-0087 – Labour force survey estimates (LFS), CANSIM (database).
[2] Statistics Canada: Table 282-0002 – Labour force survey estimates (LFS), CANSIM (database).
[3] Geobey, Sean (2013), p.6.
[4] Statistics Canada: Table 282-0002 – Labour force survey estimates (LFS), CANSIM (database).

Historically, we see that there has always been a gap between adult unemployment and youth unemployment rates, with the latter being higher than the former. Nearly six years after the onset of the financial crisis, the gap between Ontario's adult and youth unemployment is still wide. Actually, the youth unemployment rate has deteriorated in comparison to what was seen after the 1980's and 1990's recessions. This does not seem to be the case in other provinces, excluding Atlantic Canada. While adult unemployment rates in Ontario appear to be heading towards economic recovery and matching the national average, youth unemployment rate is still high which is disconcerting.

Green (2003), states that Canada perceives immigration as the answer to a number of economic problems. Therefore, it places a great deal of emphasis on its immigration policy as a means to ease fiscal burden in relation to the rising share of its aging population, respond to the need for additional human capital and skill and promote economic and regional growth across Canada. In 2013, approximately 250,000[5] immigrants were admitted into the country, which is the highest per-capita intake worldwide. Ontario has been and continues to be the province of choice for nearly half of the new immigrants to Canada. In the 1990's the number of immigrants into Ontario had more than doubled since the 1980's and by 2001 these figures were a staggering 148,000 or 60% of total immigrants admitted to Canada that year. Since then, the numbers have dwindled but are still impressive relative to the rest of the provinces, with 2012 bringing close to 100,000 immigrants to Ontario—around 40% of the total number of immigrants into Canada. As a result of this, some Canadians, such as those involved in *Immigration Watch Canada*, do not agree with the federal immigration policy and are concerned that this high influx of immigrants affects the labour market by taking jobs away from Canadian-born workers or putting stress on government funds due to low-skilled immigrants. Therefore, there is a belief that high unemployment is related to continuous inflow of immigrants. On the other hand, many studies show that immigrants benefit native workers by creating jobs through their spending on goods and services.

Within the existing literature, there are a number of studies that examine unemployment and immigration in Canada, with varying conclusions; however, the majority indicate some kind of positive effect of immigration on unemployment. Islam (2007) concludes that there is no effect of immigration on unemployment; rather, unemployment in Canada affects immigration inflows into the country and/or province. The common theoretical understanding among researchers on this topic is that specific economic conditions and changing immigration

elasticities are contributing factors to the net effects of immigration on unemployment. Contrary to the extensive research on immigration and unemployment, there are a limited number of studies on youth unemployment in Canada, with no research studies on the situation in Ontario in particular and none that consider its relationship to immigration inflows.

1. LITERATURE REVIEW AND CONTRIBUTION

In this section we review the key studies on youth unemployment in Canada and the world. Most of these studies investigate the issue in general and none of them focuses specifically on the probable relationship between youth unemployment and immigration. Surprisingly, we could not find any literature in this regard.

O'Higgins (1997) found that aggregate demand, youth wages and size of the youth labour force are the key determinants of youth unemployment (various age cohorts). In this study, O'Higgins points out that a fall in aggregate demand leads to a fall in labour demand for both youth and adults, however youth unemployment rates are higher as they are more cyclically sensitive. The paper also notes that an almost global drop in youth wages in OECD countries during the 1990's did not positively affect youth unemployment rates. Quite the opposite, youth employment also fell during this period, regardless of the fact that there was a decrease in the youth cohort size as well. In general, it seems that unemployment and wages move in the opposite directions. The study also found that a 10% increase in the youth population size, will raise its unemployment by 5%, however the aggregate labour market conditions have more of an affect. Therefore, a decline in the youth labour force cohort will not solve the youth unemployment problem itself.

Bell and Blanchflower (2010) also suggest that there is little evidence to support the claim that high youth wages are responsible for higher youth unemployment. The paper concludes that changes of labour demand may impact youth labour prospects. There is an increase in demand for low-skilled workers whereas the demand for skilled workers has declined. The authors found that over 20% of youth, aged 16-24, were employed in lower-earning jobs. This may be expected given they are just starting out in their careers, however the issue is that these same low-paying jobs have seen only a modest growth in employment opportunity and thus it is becoming more difficult to move to higher-quality jobs. The young are facing an increasingly polarized labour market.

Choudhry et al. (2012) analyzes the impact of the financial crisis on youth unemployment (15-24) and found that its impact is elevated in higher-income countries. The results also show that the financial crisis affects youth unemployment rates more than adult unemployment with

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[5] Statistics Canada: *Table 051-0037* –Labour force survey estimates (LFS), CANSIM (database).

effects lasting for five years after the start of the financial crisis.

Foot and Li (1984) attribute youth unemployment to the large cohorts of the Baby Boom generation who had finished entering into the Canadian labour market. The study aims to show that due to the Baby Boom generation moving into the labour force, the decline in the youth participation rate helps to stabilize and improve its unemployment rate. Foot and Li went on to acknowledge that the youth unemployment problem was emerging into a youth adult problem given the number of young adults by 1985, ages 25-34, exceeded the number of youth, ages 15-24. The downside of this study is that they assume there is no substitution between youth and young adults in the labour market.

Gunderson, Sharpe and Wald (2000) investigate youth unemployment (15-24) in Canada during 1978-1998. This study is quite interesting in that the cohort of youth is smaller than the one seen in the paper by Foot and Li (1984). The youth share in the labour market fell from 27% to just below 16% from 1976 to 1998. The study mainly looks at the relationship between youth and adult unemployment as well as demographic differences such as gender and education status such as full-time or part-time student, and non-student. The authors describe a U-shaped pattern in the ratio of youth-adult unemployment rates in Canada. The study found the diminished share of youth in the labour force population had a large and positive effect on the ratio of youth to adult unemployment. In addition to this, the youth labour market is heterogeneous as there are considerable variances between males, females, teenager, young adults, students and non-students. Gunderson et al. (2000) found that the recession seemed to aggravate youth unemployment for males that were not students while alleviating it for students. Reynolds (2012), found that the most recent recession had a larger impact on youth (15-24), and that youth is at a higher risk of labour-underutilization, temporary work and minimum-wage employment.

All the above mentioned studies look at various dimensions of youth unemployment but none of them explores the possible link among immigration and youth unemployment. It is in this background that our study aims to fill this gap in literature. This is the first study of its kind and contributes to the literature in four important ways. Firstly, it serves as a benchmark for future research. Secondly, it investigates the problem of youth unemployment following two different definitions one being more general and the other being more specific. Thirdly, it will create awareness of the issue of youth unemployment and begin a serious dialogue over the prevalence of high youth unemployment in Ontario. This discussion could lead to strategic thinking and ultimately a re-evaluation of related policy directives to better manage and improve the current trend of rising youth

unemployment in Ontario. Finally, this study can be further extended to investigate the impact of government policy actions regarding immigration, both at the federal and provincial level on youth unemployment.

2. THEORETICAL FRAMEWORK

We did not find any empirically-proven basis in the economic literature to explain the effects of immigration on youth unemployment of native born workers. Usually when a government invites immigrants it assumes that their skills will complement the skills of native workers. It is hard to draw a line between native-born workers and immigrants and so it is quite possible that immigrants may substitute indigenous workers. This might be particularly true if the number of job opportunities do not expand or labour market conditions do not allow the absorption of immigrant workers. In such a situation immigrants might accept jobs which do not even match their skill set, hence keeping others away from these jobs and/or displacing native workers, particularly the youth. Accordingly, the very relevant question here is what can we say that large influx of immigrants might be one possible explanation of high youth unemployment rates in Ontario?

Our study aims at capturing both short-run adjustments and long-run dynamics of the effects of immigration on the youth unemployment rates in Ontario. To model the linkages between immigration and youth unemployment we use the following model:

$$\ln(Yun)_t = \alpha_0 + \alpha_1 \ln(N)_t + \alpha_2 \ln(M)_t + \alpha_3 \ln(P)_t + \varepsilon_t, \qquad (1)$$

where:

t = time period between 1981-2013,

$(Yun)_t$ = youth unemployment at time period t,

$(N)_t$ = number of net immigrants in time period t,

$(M)_t$ = growth rate of manufacturing sector in time period t,

$(P)_t$ = general price level at time period t,

ε_t = error term.

All the variables are in natural-log-form. Here are the coefficients to be estimated. We are incorporating Ontario's manufacturing sector's employment rate because it plays an important role as far as this employment generation is concerned. During last decade it has shrunken by nearly 30%—or a loss of more than 300,000 jobs. The story is similar when we look at the real manufacturing output, which is down by almost 20% over the same time period. Hence, it might be an important factor in explaining youth unemployment. The general-price-level is taken in light of the economic theory, which emphasizes the relationship among unemployment and inflation.

In our study, we will estimate two models. In Model I, we will define the dependent variable, lnYun, as youth unemployment between the ages 15-24. In Model II will define the dependent variable more precisely, lnYun1, as youth unemployment between the ages 15-19. As explained earlier, although most of the previous studies

define youth between the ages 15-24, we are estimating these two models separately to ensure the exact nature and relationship concerning youth unemployment and net immigration to Ontario.

3. METHODOLOGY AND DATA

The traditional approach to determine the long-run and short-run relationships among variables have been to use the standard Johansen Cointegration and Vector Error Correction Methodology (VECM) framework, but this approach suffers from serious flaws as discussed by Pesaran et al. (2001). Instead, we adopt the Autoregressive Distributed Lag (ARDL) framework, popularized by Pesaran and Shin (1995, 1999), Pesaran et al. (1996), and Pesaran (1997) to establish the direction of causation between variables. The ARDL method, yields consistent results both for the long-run and short-run relationship and does not involve pre-testing the variables, which means that the test for the existence of relationships between variables is applicable irrespective of whether the underlying regressors' are purely integrated of order 0, defined as I(0), purely integrated of order one, defined as I(1), or a mixture of both. However, there is still a requirement that none of the explanatory variables is of I(2) or higher.

Another advantage of the ARDL approach is that it is a more robust technique for small samples consisting of 30 to 80 observations. It is extremely useful because it allows us to describe the existence of an equilibrium relationship in terms of long-run and short-run dynamics without losing the long-run information. This approach also eradicates any problems due to endogeneity. It consists of estimating the following equation:

$$\Delta \ln(Yun)_t = \beta_0 + \sum_{i=0}^{n} \beta_1 \Delta \ln(yun)_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta \ln(N)_{t-i}$$
$$+ \sum_{i=0}^{n} \beta_3 \Delta \ln(M)_{t-i} + \sum_{i=0}^{n} \beta_4 \Delta \ln(P)_{t-i} + \lambda_1 \ln(yun)_{t-i}$$
$$+ \lambda_2 \ln(N)_{t-i} + \lambda_3 \ln(M)_{t-i} + \lambda_4 \ln(P)_{t-i} + \epsilon t. \tag{2}$$

The first part of the equation with the β terms represents the short-run dynamics whereas the second part with the λ terms represents the long-run relationship. The decision rule is:

H$_0$: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$ (there is no long-run relationship),

H$_1$: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq 0$ (at least one is different from zero).

We start by conducting a bounds test for the null hypothesis of no cointegration. The calculated F-statistic is compared with the critical value tabulated by Pesaran (1997) and Pesaran et al. (2001). If the test statistics exceed the upper limit, the null hypothesis can be rejected regardless of whether the underlying order of integration of the variables is 0 or 1 and vice versa. However, if the test statistic falls within the bounds, the result is inconclusive and additional variables should be included before redoing the test. If a long-run relationship exists among the variables in Equation (2), then the next step is to calculate the long-run coefficients prescribed in Equation (1). The long-run coefficients are estimated by the ARDL approach to cointegration.

The long-run elasticities are computed as follows:

$$\alpha_1 = -\lambda_2/\lambda_1, \ \alpha_2 = -\lambda_3/\lambda_1, \ \alpha_3 = -\lambda_4/\lambda_1. \tag{3}$$

Where λ_1 is the lagged Error Correction Model (ECM) term, ECM$_{t-1}$, λ_2, λ_3 and λ_4 as seen in Equation (2) depict the long-run coefficients of ln$N$, ln$M$ and ln$P$ and α is the elasticity/ long-run coefficient. The ECM$_{t-1}$, indicates the speed of adjustment back to long-run equilibrium after short-run shock. The gap between the dependent and independent variables measured by the coefficient of ECM$_{t-1}$ must decrease. The absolute value of the adjustment parameter lies between zero and one. The larger the error correction coefficient, the faster it adjusts back to its long-run equilibrium after a short-run shock. After obtaining the long-run coefficients, α_1, α_2 and α_3 we can then proceed to calculate their standard errors and t-values[6].

Time-series data on youth unemployment, price level, manufacturing sectors employment rate and net immigrants to Ontario for the time period 1981-2013 is taken from Statistic Canada's Labour Force Survey and CANSIM Database. Manufacturing sector employment share is used as a proxy for manufacturing sector growth rate due to non-availability of data on manufacturing sector growth.

4. EMPIRICAL RESULTS

4.1 The Unit Root Test

Before we proceed with the ARDL bounds test, we need to test for the stationarity status of all variables to determine their order of integration. This is to ensure that none of the variables are I(2) stationary in order to avoid spurious results. According to Ouattara (2004) in

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[6] These standard errors and t-values for α_1 can be found by applying the following formula and similarly standard errors for other coefficients can be calculated

Var(α_1)=$(1/\lambda_1)^2$var(λ_2)+$(\lambda_2/\lambda_1^2)^2$var($\lambda_1$)
$+2(1/\lambda_1)(\lambda_2/\lambda_1^2)$cov($\lambda_1\lambda_2$);
Se α_1=(Varα_1)$^{-1/2}$ and t= α_1/Se α_1.

the presence of I(2) variables the computed F-statistics provided by Pesaran et al. (2001) are not valid because the bounds test is based on the assumption that the variables are I(0) or I(1). Therefore, the implementation of the unit root test is necessary. We investigate the order of integration of each variable by conducting the Augmented Dickey Fuller (ADF) test for stationarity. The results of ADF test statistic are reported in the Appendix, Table A1. A summary of the unit root results regarding the order of integration based on the ADF tests has been tabulated in Table 1.

Table 1
Order of Integration

Variable	With intercept	Intercept and trend	No intercept and trend
lnYun	I(1)	I(1)	I(1)
lnYun1	I(1)	I(0)	I(1)
ln$N$	I(1)	I(1)	I(1)
ln$M$	I(1)	I(1)	I(1)
ln$P$	I(0)	I(1)	I(1)

According to ADF, the unit root test shows that all the dependent variables are I(1) and none of the variables are of I(2). Therefore, the ARDL approach to cointegration can be applied and is an appropriate technique.

4.2 The Bounds Test

In this step, we estimate Equation (2) through the OLS procedure to examine the presence of a long-run relationship between net immigration and youth unemployment. In order to select the optimal lag length for each variable in both models, we use the lag length information criteria such as Akaike's Information Criteria (AIC) and Schwartz Bayesian Criterion (SBC). We decide to use a maximum lag length of 2 in both models due to the fact that we are using annual time series data and our sample size is not very large. This lag selection is endorsed by the preference of the majority of the lag length criterion as well, shown in the Appendix—Table A2. The cointegration relationship among the variables lnYun, lnYun1, ln$P$, ln$N$ and ln$M$ is examined using the ARDL bounds testing approach. The results are summarized in Table 2.

Table 2
Results of Bounds Test

Model	F-statistic	Decision
Model I (lnYun, ln$N$, ln$M$, ln$P$)	4.532829*	Cointegrated
Model II (lnYun1, ln$N$, ln$M$, ln$P$)	4.501712**	Cointegrated

Note. * The bounds are I (0) =2.459 and I (1) = 3.625, **The bounds for I(0) and I(1) are 3.219 and 4.308, respectively.

As we can see from the results of Table 2, the value of the F-statistics in both models is above the upper bounds of the critical values of standard significant levels

provided by Pesaran and Pesaran (1997) for k=3, where "k" indicates the number of regressors. This implies that the null hypothesis of no cointegration is rejected at 5%. These values support the existence of cointegration or a long-run relationship between the variables in both our models.

4.3 Ardl Model Estimation and Long-Run and Short-Run Results

In the next step, we estimate the ARDL model, selecting the optimal lags for each variable by implementing Hendry's General to Specific Procedure. The results of the ARDL for Model I and Model II are presented in tables below, where "D" denotes difference form.

Table 3
Ardl (1,2,0,1) Model I Variable Is D (LnYun))

Variable	Coefficient	t- statistic
lnYun(-1)	-0.486255* (0.098472)	-4.937974
ln$N$(-1)	0.189619* (0.082587)	2.296002
ln$M$(-1)	-0.081652** (0.048457)	-1.685033
ln$P$(-1)	-0.11154 (0.138753)	-0.080385
D(lnYun(-1))	0.481360* (0.234555)	3.300899
D(ln$N$(-1))	-0.258664* (0.119432)	-2.165788
D(ln$N$(-2))	-0.249840* (0.125447)	-1.991597
D(ln$P$(-1))	2.839145** (1.791728)	1.584585

Note. *significant level of 1%, ** of 10% respectively, in parentheses is standard error.

Table 4
Ardl (1,2,0,1) Model II (Dependent (Dependent Variable Is D (LnYun1))

Variable	Coefficient	t- statistic
lnYun1(-1)	-0.433898* (0.095087)	-4.563180
ln$N$(-1)	0.150745* (0.071779)	2.100116
ln$M$(-1)	-0.098068* (0.041601)	-2.357309
ln$P$(-1)	0.12389 (0.130763)	0.928311
D(lnYun1(-1))	0.410278* (0.234555)	2.878547
D(ln$N$(-1))	-0.283652* (0.098096)	-2.891566
D(ln$N$(-2))	-0.219345* (0.106023)	-2.068843
D(ln$P$(-1))	3.236863* (1.791728)	2.170554

Note. *significant level of 1%, in parentheses is standard error.

It is evident from the results presented in Table 3 and Table 4 that all the coefficients are highly significant except the one related to P, which is the price level. This suggests that it might not be a factor that influences youth unemployment for the youth age cohort. Another very important finding is that the ECM, which shows how quickly the variables should converge to equilibrium, is statistically significant with a negative sign. This further confirms the existence of a stable long-run relationship.

4.3.1 Long-Run Results: Model I

Based on the ARDL Model I, presented above, the results of long run relationship among immigration and youth unemployment are given as follows:

$\ln Yun = 0.3899N - 0.02293P - 0.1679 M$,
$Se = (0.14453)(0.01412)(0.06879)$,
$t = (2.6977)(-1.6241)(-2.4407)$.

These long-run results show that coefficients on N and M are highly significant. However, coefficient of P is significant level of 10%. Net immigration has a direct positive relationship with youth as well, while the manufacturing sector's employment share and overall price level has an inverse relationship with youth unemployment. The long-run elasticities, as per Equation (3) of youth unemployment with respect to price level, manufacturing sector employment and net immigration are shown in Table 5.

Table 5
Long- Run Elasticities in Model I

Variable	ln$N$	ln$M$	ln$P$
Long-run elasticity	0.389957944	-0.167920124	-0.0229385

The results show a positive relationship between youth unemployment and immigration. That is a 1% increase in net immigration leads to almost a 0.4% increase in youth unemployment. The elasticity related to the manufacturing sector on the other hand has a negative relationship with youth unemployment, -0.1679. That is a 1% increase in the manufacturing sector's employment reduces youth unemployment by about 0.17%. Similarly, price level also has an inverse relationship with youth unemployment which is in line with the Phillips curve. That is a 1% increase in price leads to a 0.02% decrease in youth unemployment.

4.3.2 Long-Run Results: Model II

On the basis of the ARDL Model II, presented in Table 4 the results of long-run relationship among immigration and youth unemployment are given as follows:

$\ln Yun1 = 0.3474 N + 0.2797P - 0.1679 M$,
$Se = (0.16324)(0.19875)(0.07387)$,
$t = (2.1280)(1.4072)(-2.27291)$.

These long-run results show that coefficients on N and M are significant at 1% level of significance. However, the coefficient of P is not significant, depicting the fact that price level might not be influencing youth unemployment

in Model II. Net immigration has a direct relationship with youth unemployment while the manufacturing sector's employment share has an inverse relationship with youth unemployment. The respective long–run elasticities, based on Equation (3) are presented in Table 6.

Table 6
Long- Run Elasticities in Model II

Variable	ln$N$	ln$M$	ln$P$
Long-run elasticity	0.347420361	-0.226011643	0.279763908

The results show that 1% increase in net immigration leads to 0.34% increase in youth unemployment. The long-run elasticity related to the manufacturing sector is -0.2260. This means that a 1% increase in the manufacturing sector's employment reduces youth unemployment by about 0.22%. The elasticity is related to the price level however is 0.2797, which means 1% increase in prices leads to 0.28% increase in youth unemployment between the ages of 15-19.

4.3.3 Short-Run Dynamics: Model I

In short-run the results in Model I show that $D(\ln Yun(-1))$, $D(\ln N(-1))$ and $D(\ln N(-2))$ are highly significant while $D(\ln P(-1))$ is significant at 10%. It shows that net immigration in period t-1 and t-2 is significantly affecting youth unemployment in Model I. It can also be seen that the manufacturing sector's employment share does not have any lagged effects on youth unemployment. Price level in period t-1 has a positive impact on youth unemployment.

4.3.4 Short-Run Dynamics: Model II

Similar to Model I, the short-run results in Model II reveal that $D(\ln Yun1(-1))$, $D(\ln N(-1))$, $D(\ln N(-2))$ and $D(\ln P(-1))$ are all significant. It shows that net immigration in period t-1 and t-2 is significantly affecting youth unemployment. It can be seen that the manufacturing sector's employment share does not have any lagged effects on youth unemployment. Price level in period t-1 has a positive impact on youth unemployment.

4.4 Comparing Model I and Model II

The long-run elasticity of immigration in Model I is slightly higher than Model II, 0.39 and 0.35 respectively. Both indicate a long-run impact of immigration on youth unemployment. The long-run elasticity related to manufacturing sector is higher for Model II, -0.22% versus -0.16% which indicates that youth ages 15-19 are more adversely affected by the reduction in less-skilled employment opportunities such as that of the manufacturing sector. Another interesting and opposite affect found between these two model is difference in the long-run price elasticities. The coefficients of ECM (-1) or lnYun(-1) and lnYun1(-1) are -0.48 and -0.43 for Model I and Model II respectively. This implies that 48% and 43% of disequilibrium in youth unemployment due to previous

year's shock is corrected or adjusted back to the long-run equilibrium in the current year for Model I and Model II respectively. This shows that the speed of adjustment in both cases is high and almost identical, with the latter adjusting at a slightly slower pace. The net immigration in both models seems to affect youth unemployment by 2-lags.

4.5 Diagnostic Tests

In this section we applied a series of diagnostic tests to the ARDL Model I and II. The results of both models show that there is no evidence of autocorrelation or heteroskedasticity effect in the residuals. The models also pass the Jarque-Bera normality test at 5%, suggesting that the errors are normally distributed. Finally, to check the stability of the models, we apply the Cumulative Sum technique (CUSUM). The results indicate that the statistic CUSUM is within the critical bounds, implying that all coefficients in both ARDL models are stable during the sample period of 1981-2013. The results have been tabulated in the Appendix.

CONCLUSION AND POLICY IMPLICATIONS

The objective of this study is to examine the relationship between immigration and youth unemployment in Ontario, where we define youth as either 15-24 or 15-19 years of age. Through the Bounds test for cointegration, it is found that a long-run relationship exists between youth unemployment and immigration for both models. In applying the error-correction version of the ARDL approach, the error correction coefficient in the long-run for both models is highly significant and carries a negative sign. This confirms a cointegration relationship between the variables. The results show that the speed of adjustment for youth unemployment is corrected by approximately 48% and 43% in the following year for Model I and Model II respectively. The estimation of the long-term coefficients shows that there exists a long-run relationship between youth unemployment and immigration, irrespective of the age cohort, showing that a 1% increase in immigration will lead to a 0.4% and 0.3% increase in youth unemployment for Model I and Model II respectively. There were no striking differences between the two definitions of youth unemployment, except for the contrary long-run relationship found between youth unemployment ages 15-19 and prices. The short-run analysis for both models was quite similar with the most important results being that net immigration for period t-1 and t-2 significantly affects youth unemployment for both models. Finally, in applying all the diagnostic tests to both Model I and Model II we found no issues with heteroskedasticity and autocorrelation in the residuals. The residuals are normally distributed and both models are stable.

However, youth unemployment is likely to be affected by other factors as well such as government austerity measures, adult unemployment rates and overall economic situation. Therefore this study can be further extended to include various other relevant variables. Given the specificity of our research question, time limitations and data availability these factors were not considered in our research.

In conclusion, given our findings that there exists a long-run relationship between youth unemployment and immigration, irrespective of the definition of youth, various policy measures can be suggested to help curb the youth unemployment rate in Ontario. There is a need to clearly define the goals and objectives of immigration policy. There is a need to re-evaluate costs and benefits relating to immigration policy. This phenomenon is particularly disturbing due the fact that most of the time young people have to work to finance their education and if sufficient job opportunities are not available, it might be difficult for them to pursue higher degrees and to get better jobs in long-run. Similarly if high youth unemployment rates persist it might lead to social and economic problems. There is a need to introduce incentives for employers to hire youth, review Canada's Foreign Workers Program which takes away job opportunities for youth, and more provincial/federal sponsorship for training/skill attainment for youth.

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APPENDIX

Table A1 Results of ADF Test Model I and Model II

Variable	Intercept	Intercept and trend	No intercept or trend
lnYun	-3.9469* (0.0049)	-4.9154* (0.0022)	-0.0721 (0.6506)
ΔlnYun	-4.4803* (0.0013)	-4.4089* (0.0077)	-4.5625* (0.0000)
ln$Yun1$	-2.6624 (0.0920)	-4.5335* (0.0055)	0.1866 (0.7334)
Δln$Yun1$	-3.8418* (0.0066)	-3.8089* (0.0300)	-3.6459* (0.0007)
ln$N$	-1.9970 (0.2866)	-1.7315 (0.7128)	0.6702 (0.8556)
Δln$N$	-4.0192* (0.0042)	-4.6356* (0.0045)	-3.8885* (0.0003)
ln$P$	-6.7754* (0.0000)	-2.1042 (0.5228)	2.6309* (0.9971)
Δln$P$	-4.3619* (0.0017)	-4.6943* (0.0037)	-2.2396* (0.0264)
ln$M$	-1.1125 (0.6981)	-3.3544 (0.0783)	-1.0901 (0.2436)
Δln$M$	-3.9040* (0.0055)	-3.8253* (0.0285)	-3.7670* (0.0005)

Note. In parentheses is *p*-value, Δ is difference operator, * denotes stationary of 5% (rejection of null).

Decision Rule

Ho: Has unit root (non-stationary).

ADF *t*-stat > critical values in abs value then reject Ho. Therefore no unit root and stationary.

Table A2
Results of Lag Selection Criteria Model I

Lag	Log*L*	LR	FPE	AIC	SC	HQ
0	34.25005	NA	1.46×10^{-6}	-2.086210	-1.897618	-2.027145
1	183.1088	246.3869	1.55×10^{-10}	-11.24888	-10.3059*	-10.95356
2	205.7441	31.22116*	1.05×10^{-10}	-11.70649	-10.00916	-11.17491
3	221.1991	17.05382	1.32×10^{-10}	-11.66891	-9.217204	-10.90106
4	247.8350	22.04344	9.58×10^{-11}*	-12.4024*	-9.196339	-11.3983*

Note. * indicates lag order selected by the criterion.
LR: Sequential modified LR test statistic (each test of 5% level).
FPE: Final prediction error.
AIC: Akaike information criterion.
SC: Schwarz information criterion.
HQ: Hannan-Quinn information criterion.

MODEL II

Lag	LogL	LR	FPE	AIC	SC	HQ
0	33.96621	NA	1.49×10^{-6}	-2.066635	-1.878043	-2.007570
1	185.6101	250.9968	1.31×10^{-10}	-11.42139	-10.4784*	-11.12606
2	207.9491	30.81245*	9.05×10^{-11}*	-11.85856	-10.16123	-11.3269*
3	223.2175	16.84785	1.15×10^{-10}	-11.80810	-9.356401	-11.04026
4	245.5074	18.44684	1.12×10^{-10}	-12.2418*	-9.035819	-11.23779

Note. * indicates lag order selected by the criterion.
LR: Sequential modified LR test statistic (each test of 5% level).
FPE: Final prediction error.
AIC: Akaike information criterion.
SC: Schwarz information criterion.
HQ: Hannan-Quinn information criterion.

Table A3
Results for Serial Correlation Model I

Breusch-godfrey serial correlation LM test	
F-statistic 0.887677	Prob. *F*(2,20) 0.4272
Obs*R-squared 2.445864	Prob. Chi-square(2) 0.2944

Note. **Decision Rule**
Ho: Residuals are not autocorrelated (If *p*-values > 5% cannot reject null).
Since *p*-value of chi-square 0.2944 >0.05 then cannot reject null and so residuals are not autocorrelated.

Model II

Breusch-godfrey serial correlation LM test	
F-statistic 0.691552	Prob. *F*(2,20) 0.5124
Obs*R-squared 1.940415	Prob. Chi-Square(2) 0.3790

Note. Since *p*-value of chi-square 0.3790 >0.05 then cannot reject null and so residuals are not autocorrelated.

Table A4
Results for Heteroskedasticity Model I

Heteroskedasticity test: Breusch-Pagan-Godfrey	
F-statistic 0.181249	Prob. *F*(8,21) 0.9910
Obs*R-squared 1.937634	Prob. Chi-square(2) 0.9829

Note. **Decision Rule**
Ho: Residuals are homoskedastic (If *p*-values > 5% cannot reject null).
Since *p*-value of chi-square 0.9829 >0.05 then cannot reject null and so residuals are homoscedastic.

Model II
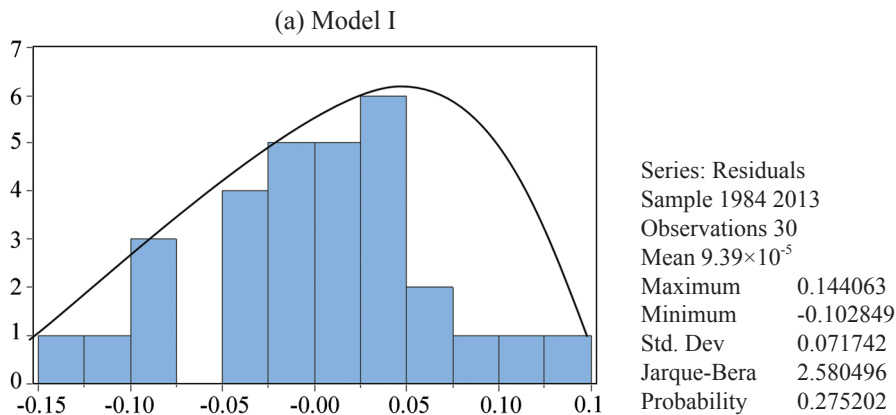
Heteroskedasticity Test: Breusch-Pagan-Godfrey	
F-statistic 0.704282	Prob. $F(8,21)$ 0.6847
Obs*R-squared 6.346252	Prob. Chi-square(2) 0.6085

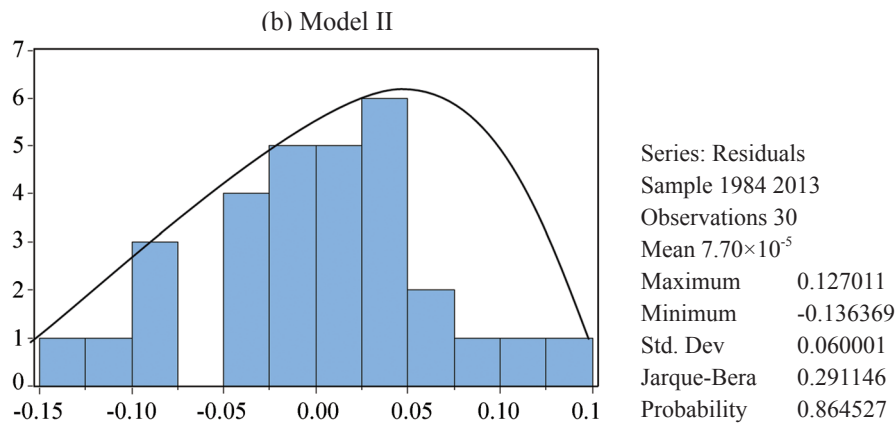*Note.* Since p-value of chi-square 0.6085 >0.05 then cannot reject null and so residuals are homoskedastic.

(a) Model I

| Series: Residuals	
Sample 1984 2013	
Observations 30	
Mean 9.39×10^{-5}	
Maximum	0.144063
Minimum	-0.102849
Std. Dev	0.071742
Jarque-Bera	2.580496
Probability	0.275202

Note. **Decision Rule**
Ho: Residuals are normwally distributed (If p-values > 5% cannot reject null).
Since p-value is 0.2752>0.05 then cannot reject null and so residuals are normally distributed.

(b) Model II

Series: Residuals	
Sample 1984 2013	
Observations 30	
Mean 7.70×10^{-5}	
Maximum	0.127011
Minimum	-0.136369
Std. Dev	0.060001
Jarque-Bera	0.291146
Probability	0.864527

Note. Since p-value is 0.8645>0.05 then cannot reject null and so residuals are normally distributed.

Figure 1
Results of Normality Test Model I (a) and Model II (b)
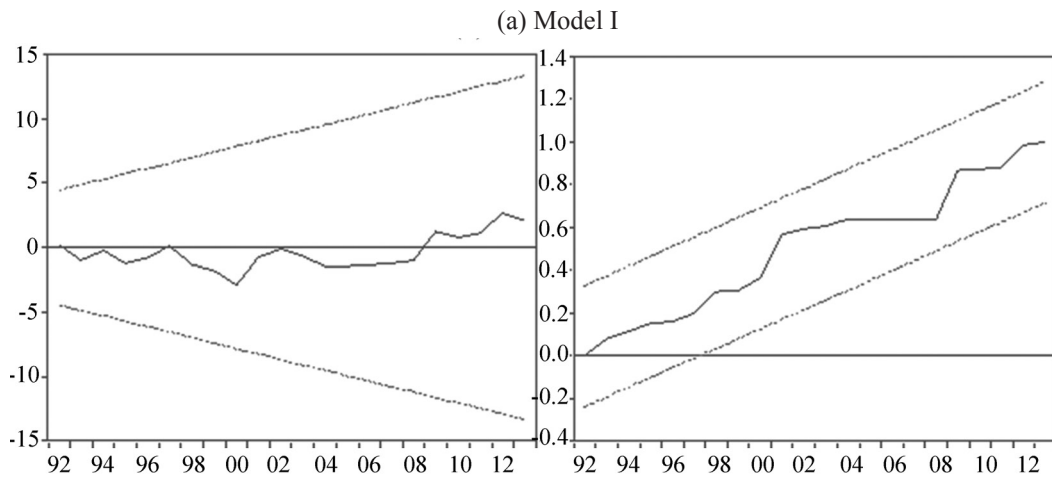
(a) Model I

Note. Left side: Solid line is CUMSUM, dotted line is 5% significance.
Right side: Solid line is CUSUM of Squares, dotted line is 5% significance.
Decision Rule: Blue line needs to be in between the 5% level of significance for the model to be stable, therefore Model I is stable.
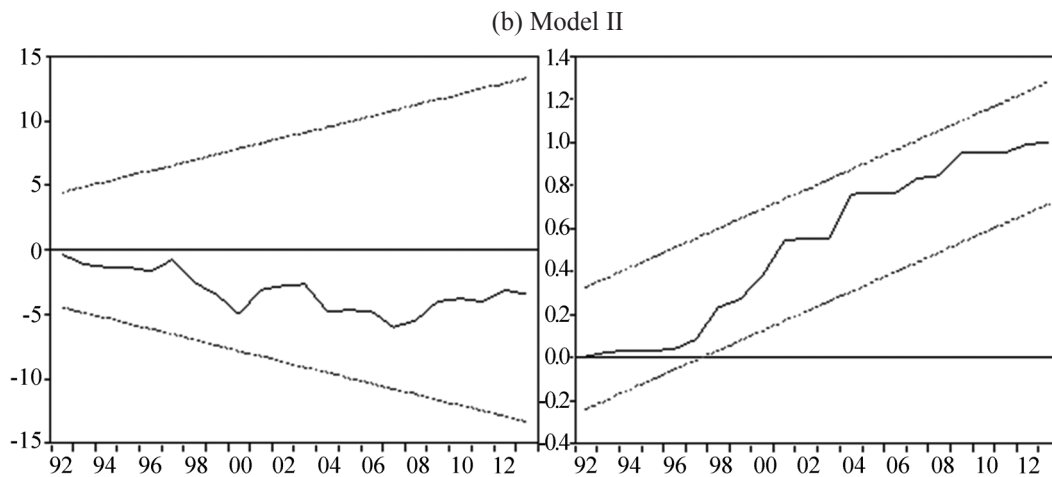
(b) Model II

Note. Left side: Solid line is CUMSUM, dotted line is 5% significance.
Right side: Solid line is CUSUM of squares, dotted line is 5% significance.
Model II is stable.

Figure 2
Results of Stability Tests Model I (a) and Model II (b)