Studies in Economics and International Finance
ISSN: 2583-1526
Vol. 1, No. 2, 2021, pp. 121-136

ARF INDIA
Academic Open Access Publishing
www.arfjournals.com

THE CAUSAL EFFECT OF INTERNATIONAL MIGRATION ON NATIVE-BORN AND FOREIGN-BORN UNEMPLOYMENT, WAGES AND ECONOMIC GROWTH: PANEL VAR ESTIMATION

T. Lakshmanasamy[1]

[1]*ICSSR Senior Fellow and Formerly Professor, Department of Econometrics, University of Madras, Chennai, India. E-mail: tlsamy@yahoo.co.in*

ARTICLE HISTORY

Received : 27 August 2021
Revised : 30 September 2021
Accepted : 21 October 2021
Published : 30 December 2021

TO CITE THIS ARTICLE

Lakshmanasamy, T. (2021). The Causal Effect of International Migration on Native-Born and Foreign-Born Unemployment, Wages and Economic Growth: Panel Var Estimation. *Studies in Economics & International Finance*, Vol. 1, No. 2, pp. 121-136.

Abstract: The large scale skilled international migration influences the labour market and economic development of the host countries. This paper examines the causal effect of net migration on the GDP, wages, and native-born and foreign-born unemployment in 20 OECD countries using panel data over the period 2000-2018 applying the panel fixed effects vector autoregression (VAR) method. The panel VAR results show that net migration in OECD countries depends significantly on its own lags. The employment rate in the host country is positively influenced by net migration, whereas the GDP and employment rate of host economies do not affect the net migration rate. While net migration is negatively related to the native-born and foreign-born unemployment rates, the foreign-born unemployment rate does not influence the net migration rate. The host country wages affect net migration positively, but the net migration rate has no effect on wages. Overall, international migration has a positive effect on the economy of the host country.

Keywords: Immigration, labour market, wages, unemployment, economic growth, panel VAR estimation

JEL classification: B23, C13, C22, C23, E24, J61

INTRODUCTION

Many OECD countries have seen large increases in immigration in recent years, and much more can be expected. Immigration is understandably a subject of public debate and economic analysis. It is thus no surprise that economists have focused analysis on the question of how immigrant flows affect native economy especially wages. The OECD countries experience an increase in net migration and immigrants make up a large part of their labour force. Burdened with an ageing population, the OECD countries look for working-age young immigrants as the principal source for economic growth. However, the main concern for the native population is the effect of immigration on native-born unemployment and the average wage rate, and the main concern for the immigrants is the macroeconomic condition of the country of destination. Immigrants choose their host countries based on the foreign-born unemployment rate and the prevailing wage rates. A higher GDP is likely to attract more immigrants but a higher foreign-born unemployment rate entices few immigrants. Immigrants also contribute to the economic activity of the host country, thus influencing the host country GDP. The native citizens accept more immigrants if they contribute significantly to their country's economy. Not only do immigrants take a decision to migrate to a certain country based on its macroeconomic conditions, but immigrants are likely to influence these variables also. Thus, immigration and macroeconomic variables are endogenous and the relationship is bidirectional.

As the main and immediate effect of immigration is on the host country labour market, a large and contentious literature studies immigration and the labour market. An extensive literature investigates the effect of the large influx of immigrants on native workers' labour market opportunities. However, this literature has not reached a consensus about the consequences of immigration. The frequently studied central questions in this literature are: who decides to immigrate and how do they decide where to go? how do immigrants fare in the labour market relative to natives?, what effect do immigrants have on natives? what effect do immigrants have on the host country wage structure? what effect do immigrants have on the host country aggregate or per capita GDP? The dificulty in analysing these effects is that this is a general equilibrium question. How might flows of immigrants into a given area aflect wages of natives depends on the size of immigrants flows, substitutability between natives and immigrants, relative abundance of natives in different skill, education, occupation and/or experience groups, integration of the host labour market with other markets, etc. The locational choice of immigrants and natives presumably depend on expected labour market opportunities. Immigrants tend to move to cities where the growth in demand for labour can accommodate their supply. Even if new immigrants cluster in only a few cities, inter-city migration of natives will tend to offset the adverse effects of immigration. Hence, simply correlating immigrant densities with native wages is unlikely to be informative about causal parameters.

In recent years, immigration to OECD countries reffect the high skill levels of migrants. The arrival of immigrants discourages job seekers and prompts them to leave the labour force. As result, unemployment decreases while employment may be constant. Overall changes in aggregate employment can hide important differences between native- and foreign-born. The main concern in the host countries is about the link between migration flows and employment opportunities of native-born residents and whether increased migration negatively impacts native-born employment. Since foreign-born persons can decide to migrate to a country or leave it because of the high unemployment rate of foreign-born persons, there exists an interaction between migration and foreign-born unemployment and wages.

Theoretical analysis suggests that there exists a positive bidirectional relationship between net migration and GDP - when net migration increases then the GDP of the country increases. There is a negative bidirectional relationship between net migration and native-born unemployment rate - as net migration increases native-born unemployment decreases. Net migration does not affect foreign-born unemployment while an increase in foreign-born unemployment will lead to a decrease in net migration. There is a positive bidirectional relationship between wages and net migration - as net migration increases, wage levels increase and vice versa when the immigrants are highly skilled workers, but immigrants lower wages in sectors requiring low to semi-skilled workers. Empirically, studies have shown a positive contribution of immigration to the GDP of the host country. Studies also show that immigration does not affect the native-born unemployment rate while the foreign-born unemployment rate has a negative relationship with immigration. Studies also observe a negative effect of immigration on wages and native-born unemployment rate, but generally, the effect is negligible.

Given the bidirectional causality between immigration and the host country macroeconomic variables, empirical studies on the effect of immigration on the host country macroeconomic variables generally use the instrumental variable method to avoid the problem of endogeneity, usually the wages of the occupation sector that the immigrants are working in. An alternative is to use time series analysis between immigration and macroeconomic variables of the host country. A better approach to analyse the endogeneity and the time effects is to study the effect of immigration across time and between countries i.e. panel data analysis. The panel vector autoregression (VAR) approach addresses the endogeneity problem by allowing for the endogenous interaction between the variables. Specifically, it allows measuring a variable in terms of its own lags as well as the lags of the other endogenous variables.

Since immigration has been a heavily debated issue throughout OECD countries, understanding the effect of immigration on the host country economy is important and relevant for framing policies. This paper examines the endogenous interaction between net migration, GDP, wages and unemployment in 20 OECD countries using panel data over the period 2000-2018 derived from the OECD sources applying the panel fixed/random effects vector autoregression (VAR) method. The panel VAR captures the contemporaneous effect between net migration and the economic conditions of the host country.

REVIEW OF LITERATURE

Card (1990) in his influential study analyses the effect of the Mariel Boatlift of 1980, the arrival of 125,000 relatively unskilled Cuban immigrants in Miami between May to September 1980 which increased the size of the Miami labour force by 7 percent, on the Miami labour market. Card compares by education and occupation the difference-in-difference of wages and unemployment rates of ethnic groups between Miami and four other high immigration cities: Atlanta, Houston, Los Angeles, and Tampa-St.Petersburg. Card finds that Cubans are more likely to compete with Hispanics and blacks than whites in less-skilled occupations. The Mariel influx has virtually no effect on the wages or unemployment rates of less-skilled workers, as the Mariel immigrant Cubans are much less educated and earn 3.4 points less than other Cubans who had immigrated earlier. The counterpoint to area studies are analyses that attempt to do a more explicitly general equilibrium approach like the well-known Brookings study by Borjas, Freeman and Katz (1997).

Borjas et al. (1997) try to quantify the potential effects of immigration and trade on the rise in the wage differential between more and less educated workers in the US. The paper notes that the substantial growth in immigration and trade between the United States and the less developed countries has brought a large flow of less-educated immigrants from raising the effective supply of less educated labour relative to more educated labour in the United States. The study finds that the effects of immigration and trade flows on relative skill supplies have not been substantial enough to account for more than a small proportion of the overall widening of the wage structure. The combined effects of immigration and trade may explain half of the decline of the relative wages of high school dropouts since 1980. The immigration and trade flows have played only a modest role in the expansion of the college-high school wage differential. The main adverse effect of immigration and trade on US native outcomes falls on workers with less than a high school education. Immigration increased the relative supply of workers with less than a high school degree by 15 to 20 percent over the period 1980-95. Therefore, increased trade from LDCs has been much less important than immigration for the relative earnings of low-wage US workers.

Friedberg (2001), unlike the Mariel Boatlift case, in another great event study analyses the effect of the large influx from the Soviet Union between 1990 and 1994 to Israel, after the lifting of Soviet Union emigration restrictions which increased the Israeli population by 12 percent, relative to the national labour market. Unlike the Mariel Boatlift study, this study allows a measurable general equilibrium effect. The study finds native employment and wage growth in occupations that employed more immigrants were lower than others. The instrumental variables estimation shows no adverse effect of immigration on native outcomes as the large immigrant flows do not harm either wages or employment of natives.

Borjas (2003) studies the labour market impact of immigrant workers of the same education but of different age or experience who are unlikely to be perfect substitutes. The evidence shows that within an education group, young workers are closer substitutes for one another than are young and old workers. The study finds that a 10 percent increase in immigrant labour lowers the wages of competing workers by 3 to 4 p percent. The effects of immigration on native earnings are substantial: -0.032 points, with -0.089 points for high school dropouts and -0.049 for college graduates.

Barcellos (2009) analyse the relationship between immigration and wages in the US states using 26-year panel data applying the panel VAR method. A flexible model of the joint dynamics of wages, foreign immigration and internal migration, allowing for capital mobility is used. The VAR analysis shows that immigration has no significant effect on either wages or internal migration but wages has a positive impact on immigration. The estimated coefficients imply that a 10 percent increase in wages causes up to a 20 percent increase in the rate of immigrant inflow after 3 years and the effect is strongest for low-skill immigrants but small and insignificant for high-skill immigrants.

Boubtane et al. (2013) examine the interaction between immigration and host country economic conditions in 22 OECD countries over the period 1987-2009 applying a panel vector autoregression method. The study finds that migration is influenced by the host country economic conditions and contributes to the host country economic prosperity. The estimated VAR results show a bidirectional relationship between immigration flows and the host country macro variables, migration responding positively to GDP per capita and negatively to the total unemployment rate, and affecting positively the GDP per capita and negatively the aggregate unemployment, native and foreign born unemployment rates in the host country.

DATA AND METHODOLOGY

This paper uses data from 20 OECD countries across the time period 2000-2018 consisting of 380 observations to analyse the causal relationship between immigration and macroeconomic variables. The 20 countries considered in this paper are Australia, Austria, Belgium, Canada, Denmark, France, Germany, Greece, Hungary, Italy, Ireland, Netherlands, New Zealand, Portugal, Poland, Sweden, Switzerland, Spain, United Kingdom and the United States of America. This paper uses six variables viz. net migration, GDP, employment, native-born unemployment, foreign-born unemployment and wages. The data on net migration is sourced from the OECD population and vital statistics database. The data on employment rate, native-born unemployment rate, foreign-born unemployment rate and wages are taken from the OECD annual labour force statistics. The GDP data are derived from the OECD national accounts.

The variable net migration captures both the number of people entering a country and the number of people leaving it. The employment rate reflects the labour participation rates of native-born workers. The presence of immigrants in a particular sector could discourage citizens from seeking work there since they expect foreign-born workers to work for less. The native-born unemployment rate addresses the concern of citizens about immigration, whether the presence of more immigrants will increase unemployment for native-born workers. The foreign-born unemployment rate is important to decide to immigrate to a particular country. The wage levels affect the number of immigrants that migrate into a country while immigrants have an impact on the wage level of the host country since immigrants alter the labour supply in the market.

PANEL VECTOR AUTOREGRESSION METHOD

Since the net migration of a country and its economic conditions are contemporaneous, a panel VAR model is used as it allows to express each variable in the model as a function of its own lag and lag of the other variables in the model. Before VAR estimation, the data need to be checked for stationarity of the series. We find that the data is stationary at first difference. A stochastic process is said to be stationary if its mean and variance are constant over time. And the value of the covariance depends only on the distance between the two time periods and not the actual time at which the covariance is computed. To test whether a given panel dataset is stationary or not, a panel unit root test is applied on each variable at levels and its first difference.

Panel Unit Root Test: The widely used Dickey-Fuller (DF) unit root test is specified as:

$$y_t = \rho y_{t-1} + u_t \tag{1}$$

If ρ<1, the series is stationary while ρ>1 means non-stationary data. Subtracting y_{t-1} from both sides yields:

$$\Delta y_t = (\rho - 1) y_{t-1} + u_t = \gamma y_{t-1} + u_t \tag{2}$$

where Δ is the first difference of y_t. The null hypothesis is H_0: γ = 0, which means ρ=1 and the data is non-stationary. The alternative hypothesis is H_1: γ=0, which means ρ < 1 and the data is stationary.

Augmented Dickey-Fuller Test: The ADF test augments the DF unit root equation with more lagged variables. The panel ADF unit root test is specified as:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{it-1} + \delta x_{it} + \varepsilon_{it} \tag{3}$$

where p_i is the lag order that varies across the cross-section and $\alpha = \rho\text{-}1$. The null hypothesis is H_0: $\alpha = 0$, the data is non-stationary. The alternative hypothesis is H_1: $\alpha \neq 0$, the data is stationary.

Panel Cointegration Test: Given the stationarity of the data, the nature of the relationship among the variables needs to be ascertained. The Johannsen cointegration test tests for the cointegration of variables in the model (Johansen, 1988). Two variables are said to be cointegrated if there is a long-term relationship between the two variables. If y_t and x_t series are not stationary but could become stationary over time, then there is a long-term relationship between them i.e, they are cointegrated if the error term is stationary. Given $u_t = y_t - \hat{y}_t$:

$$\Delta u_t = \lambda u_{t-1} + \varepsilon_t \tag{4}$$

The null hypothesis is H_0: $\lambda = 0$ i.e. $\rho - 1 = 0$, the data is non-stationary. The alternative hypothesis is H_1: $\lambda \neq 0$ i.e. $\rho - 1 < 0$, the data is stationary and the two variables x and y are cointegrated.

Consider the VAR model of order p:

$$y_t = a_1 y_{t-1} + \cdots + a_p y_{t-p} + b x_t + \varepsilon_t \tag{5}$$

where y_t is a k-vector of non-stationary variables, x_t is a d-vector of deterministic variables and ε_t is a vector of innovations. Rewriting this VAR as:

$$\Delta y_t = \pi y_{t-1} + \sum_{i=1}^{p-1} \tau_i \Delta y_{t-i} + b x_t + \varepsilon_t \tag{6}$$

where
$$\pi = \sum_{i=1}^{p} a_i - I \text{ and } \tau_i = -\sum_{j=i+1}^{p} a_j \tag{7}$$

The Johannsen method consists of estimating the π matrix unrestricted and testing whether the restrictions implied by the reduced rank of π (r<k) is rejected, where r is the number of cointegrating relations. When the variables are not cointegrated, the relationship between them can not be estimated. Hence, the first difference of all the variables is to be used. The optimal lag length is to be determined by any of the standard information criteria - AIC, SIC, etc.

Panel VAR: The VAR approach treats every endogenous variable as a function of the lagged values of all of the endogenous variables in the system. The panel VAR model with one lag is specified as:

$$\begin{aligned}
NM_t &= a_{10} + a_{11} NM_{t-1} + a_{12} GDP_{t-1} + a_{13} EMP_{t-1} + a_{14} NUE_{t-1} + a_{15} FUE_{t-1} + a_{16} WAG_{t-1} + \varepsilon_{1t} \\
GDP_t &= a_{20} + a_{21} NM_{t-1} + a_{22} GDP_{t-1} + a_{23} EMP_{t-1} + a_{24} NUE_{t-1} + a_{25} FUE_{t-1} + a_{66} WAG_{t-1} + \varepsilon_{1t} \\
EMP_t &= a_{30} + a_{31} NM_{t-1} + a_{32} GDP_{t-1} + a_{33} EMP_{t-1} + a_{34} NUE_{t-1} + a_{35} FUE_{t-1} + a_{36} WAG_{t-1} + \varepsilon_{1t} \\
NUE_t &= a_{40} + a_{41} NM_{t-1} + a_{42} GDP_{t-1} + a_{43} EMP_{t-1} + a_{44} NUE_{t-1} + a_{45} FUE_{t-1} + a_{46} WAG_{t-1} + \varepsilon_{1t} \\
FUE_t &= a_{50} + a_{51} NM_{t-1} + a_{52} GDP_{t-1} + a_{53} EMP_{t-1} + a_{54} NUE_{t-1} + a_{55} FUE_{t-1} + a_{56} WAG_{t-1} + \varepsilon_{1t} \\
WAGE_t &= a_{60} + a_{61} NM_{t-1} + a_{62} GDP_{t-1} + a_{63} EMP_{t-1} + a_{64} NUE_{t-1} + a_{65} FUE_{t-1} + a_{66} WAG_{t-1} + \varepsilon_{1t}
\end{aligned} \tag{8}$$

The VAR model in terms of matrix notation is specified as:

$$\begin{bmatrix} NM_t \\ GDP_t \\ EMP_t \\ NUE_t \\ FUE_t \\ WAG_t \end{bmatrix} = \begin{bmatrix} a_{10} \\ a_{20} \\ a_{30} \\ a_{40} \\ a_{50} \\ a_{60} \end{bmatrix} + \begin{bmatrix} a_{11} a_{12} a_{13} a_{14} a_{15} a_{16} \\ a_{21} a_{22} a_{23} a_{24} a_{25} a_{26} \\ a_{31} a_{32} a_{33} a_{34} a_{35} a_{36} \\ a_{41} a_{42} a_{43} a_{44} a_{45} a_{46} \\ a_{51} a_{52} a_{53} a_{54} a_{55} a_{56} \\ a_{61} a_{62} a_{63} a_{64} a_{66} a_{66} \end{bmatrix} \begin{bmatrix} NM_{t-1} \\ GDP_{t-1} \\ EMP_{t-1} \\ NUE_{t-1} \\ FUE_{t-1} \\ WAG_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix} \quad (9)$$

where the errors are white noise.

The panel VAR equations are estimated by random effects/fixed effects methods. The panel fixed effects model recognises that are some unobservable unique and time-invariant characteristics that are specific to the sample. As they are not there explicitly in the regression, the presence of unobservables may impact the outcome and bias the estimates, and hence they have to be controlled. As such observation-specific unobservables are time-invariant, they are added with the constant term and hence assumed to be uncorrelated with the other covariates and the error term. The panel fixed effects regression is specified as:

$$y_{it} = (\alpha + \lambda_i) + \beta x_{it} + u_{it} \quad (10)$$

The panel fixed effects produces only intercept differences and no change in the slope parameters. However, the fixed effects estimation assumes that the error terms are uncorrelated. If the errors are correlated, the fixed effects regression estimates are biased and inconsistent.

Instead of assuming that the sample-specific heterogeneity is time-invariant, the panel random effects regression recognises individual effects $ë_i$ to be random, and hence need not be absorbed in the intercept term of the regression. As $ë_i$ is now random and have a distribution, but unobserved, it becomes a part of the error term. Assuming that $ë_i$ are uncorrelated with the other independent variables, a distribution function can be specified for the composite error term. The panel random effects model is specified as:

$$y_{it} = \alpha + \beta x_{it} + \varepsilon_{it} \quad (11)$$

where $\varepsilon_{it} = (\lambda_i + u_{it})$. The ordinary least squares regression estimates of the random effects model are consistent, but inefficient because of serial correlation in errors i.e. $Cov(u_{it}, u_{is}) = \sigma_2 \neq 0$ To avoid inefficiency, the generalised least squares regression method is to be used in the estimation.

Hausman Test: Both the random effects and fixed effects estimators are unbiased and consistent, but the random effects estimator is more efficient as it relaxes the time-invariant assumption and allows randomness of the individual-specific heterogeneity λ_i. Hence, the standard error ($\hat{\beta}_{re}$) < standard error ($\hat{\beta}_{fe}$). Therefore, the choice between fixed effects and random effects panel regression estimation methods is critical. To determine the appropriate panel fixed effects vs random effects VAR estimation methods the Hausman specification test *a la* Hausman (1978) is used. The specification test tests for orthogonality i.e. whether the covariance of an efficient estimator with its difference from an inefficient estimator is zero. In essence, the Hausman specification test is to test the covariance matrix of the difference vector $[\hat{\beta}_{fe} - \hat{\beta}_{re}]$ for statistical significance:

$$Var[\hat{\beta}_{fe} - \hat{\beta}_{re}] = Var[\hat{\beta}_{fe}] + Var[\hat{\beta}_{re}] - Cov[\hat{\beta}_{fe}, \hat{\beta}_{re}] - Cov[\hat{\beta}_{re} - \hat{\beta}_{fe}] \quad (12)$$

$$Var[\hat{\beta}_{fe} - \hat{\beta}_{re}] = Var[\hat{\beta}_{fe}] - Var[\hat{\beta}_{re}] = \Omega \quad (13)$$

The chi-squared test is based on the Wald criterion:

$$W = \chi^2_{k-1} = [\hat{\beta}_{fe} - \hat{\beta}_{re}]' \Omega^{-1} [\hat{\beta}_{fe} - \hat{\beta}_{re}] \quad (14)$$

The null hypothesis is $H_0: cov(\lambda_i, x_{it}) = 0$, no correlation between the individual-specific heterogeneity and independent variables and the random effects model is the appropriate specification is the random effects model and the alternative hypothesis is $H_1: cov(\lambda_i, x_{it}) \neq 0$,, individual-specific heterogeneity and independent variables are correlated and the fixed effects model appropriate specification.

EMPIRICAL ANALYSIS

This paper specifies four models with three variables in each model. Each model takes net migration as the dependent variable, GDP as the independent variable and one of the unemployment/employment variables as another explanatory variable. The first model examines the effect the employment rate has on net migration, taking the employment rate to account for the effect immigration may have on the labour force participation rate. The second model examines the effect the native-born unemployment rate has on net migration, taking into account the concern many native citizens have about immigration in general. The third model examines the effect the foreign-born unemployment rate has on net migration. The fourth model examines the effect wages has on net migration. Given the endogeneity between these variables, the interest is on the bidirectional relationship between these variables, which a VAR model estimates.

Table 1 presents the description and descriptive statistics of the variables. The net migration rate is 4.07, the average GDP is US$36867.84 and the average wages is $42340.96 in the 20 OECD countries during the period 2000-2018. The average employment rate is 67.31, the average native-born unemployment rate is 7.37 and the average foreign-born unemployment rate is 10.32 during this period.

Table 1: Descriptive Statistics of the Variables

Variable	*Description*	*Mean*	*Std. dev.*
NM	Net migration rate - total annual arrivals less total annual departures divided by the total population	4.071	3.696
GDP	Gross domestic product in 2000 US$ PPP	36867.84	11491.42
EMP	Employment rate - ratio of employed to working age population	67.314	7.061
NUE	Native-born unemployment rate - share of unemployed native-born persons aged 15-64 in the native-born labour force of the same age	7.377	4.292
FUE	Foreign-born unemployment rate - share of unemployed foreign-born persons aged 15-64 in the foreign-born labour force of the same age	10.319	6.105
WAG	Average wages - national-accounts-based total wage bill divided by the average number of employees multiplied by the ratio of the average usual weekly hours per full-time employee to the average usually weekly hours for all employees (US$)	42340.96	11091.33
Observations		380	

Note: Standard deviations in parentheses.

Panel Unit Root Test: The panel unit root tests on each of the six variables viz. NM, GDP, EMP, NUE, FUE and WAG presented in Table 2 indicate that these variables are not stationary at levels, since at least 3 of the 5 tests accept the null hypothesis of the presence of unit root since the p-values are greater than the critical 0.05 level. The variables are stationary at the first difference.

Table 2: Panel Unit Root Tests

Variable	*Levin, Lin and Chu t**		*Breitung t-statistic*		*Im, Pesaran and Shin W-statistic*		*ADF-Fischer chi-square*		*Phillips-Perron - Fischer chi-square*	
	Level	*Differenced*	*Level*	*Differenced*	*Level*	*Differenced*	*Level*	*Differenced*	*Level*	*Differenced*
NM	0.106	0.000	0.059	0.000	0.161	0.000	0.150	0.000	0.939	0.000
GDP	0.671	0.000	0.045	0.000	0.156	0.000	0.331	0.0002	0.999	0.002
EMP	0.183	0.000	0.469	0.0001	0.361	0.000	0.162	0.000	0.974	0.000
NUE	0.134	0.000	0.277	0.000	0.138	0.000	0.100	0.000	0.984	0.000
FUE	0.638	0.000	0.783	0.0004	0.980	0.000	0.930	0.000	0.984	0.000
WAG	0.130	0.000	0.100	0.0002	0.180	0.003	0.202	0.0002	0.552	0.000

Panel Cointegration Test: The panel cointegration test checks if there exists any long-term relationship between the variables. Table 3 presents the results of 11 cointegration tests for four of the three variable models. Each model takes net migration as the dependent variable, GDP and one of the unemployment/

employment variables as the independent variables. For the model [NM=f(GDP, EMP)], 7 of the 11 tests compute a p-value greater than 0.05, thus failing to reject the null hypothesis that there is no cointegration. For the second model [NM=f(GDP, NUE)], 7 of the 11 tests compute a p-value greater than 0.05, thus failing to reject the null hypothesis that there is no cointegration. For the third model [NM=f(GDP, FUE)], 6 of the 11 tests compute a p-value greater than 0.05, thus failing to reject the null hypothesis that there is no cointegration. For the fourth model [NM=f(GDP, WAG)], 6 of the 11 tests compute a p-value greater than 0.05, thus failing to reject the null hypothesis that there is no cointegration. As the variables are cointegrated at levels, models with the differenced variables are used. The Hausman test identifies the random effects regression as the appropriate estimation method as the calculated p-values are greater than 0.05, failing to reject the null hypothesis that random effect is the better estimate.

Table 3: Panel Cointegration Tests

Panel cointegration test	*NM, GDP, EMP*	*NM, GDP, NUE*	*NM, GDP, FUE*	*NM, GDP, WAG*
V-statistic	0.901	0.758	0.635	0.975
Rho-statistic	0.989	0.984	0.964	0..990
PP- statistic	0.669	0.272	0.142	0.534
ADF- statistic	0.000	0.000	0.000	0.006
V- statistic (weighted)	0.100	0.999	0.998	0.100
Rho-statistic (weighted)	0.874	0.854	0.847	0.804
PP-statistic (weighted)	0.002	0.001	0.003	0.000
ADF-statistic (weighted)	0.000	0.000	0.000	0.000
Group rho statistic	0.100	0.100	0.100	0.100
Group PP-statistic	0.311	0.161	0.048	0.018
Group ADF-statistic	0.000	0.000	0.000	0.000

Panel VAR Estimates: The panel VAR model is estimated by the random effects method in the first differenced form. The prefix D refers to the first difference. To further verify if the independent variables do indeed affect the dependent variable, the Wald test is used. For each of the variables, the optimal lag length is two as determined by the Schwartz information criterion. There are eight equations in the panel VAR model viz. DNM=f(DGDP, DEMP), DNM=f(DGDP, DNUE), DNM=f(DGDP, DFUE), DNM=f(DGDP, DWAG), DEMP=f(DGDP, DNM), DNUE=f(DGDP, DNM), DFUE=f(DGDP, DNM) and DWAG=f(DGDP, DNM). Table 4 presents the panel VAR estimates of net migration and other macro variables and the Wald test results are presented in Table 5.

In the specification DNM=f(DGDP, DEMP), the coefficients of DNM(-1) and DNM(-2) are statistically highly significant, implying that net migration depends on its lags. Net migration is positively affected by net migration in the previous year and negatively affected by net migration two years before. However, the coefficients on DGDP(-1), DGDP(-2), DEMP(-1), DEMP(-2) are statistically insignificant and therefore are not affecting net migration. To check if the coefficients on the lags of DGDP and DEMP have any impact on the dependent variable DNETMIG, the Wald test on the null hypothesis that DGDP(-1)=DGDP(-2)=0 and DEMP(-1)=DEMP(-2)=0 are applied. The Wald tests fail to reject the null since the calculated p-values are greater than 0.05, and hence there is no significant effect of GDP and employment on net migration in the OECD countries.

In the specification DNM=f(DGDP, DNUE), the coefficients on lagged net migration and native-born unemployment variables are statistically significant while the effects of lagged GDP are insignificant. Net migration is positively influenced by net migration in the previous year and negatively affected by net migration two years before. An increase in the lagged native-born unemployment rate negatively affects migration showing the dampening employment scenario in the host country. The Wald test fails to reject the null hypothesis of DGDP(-1)=DGDP(-2)=0, implying no economic growth effect on net migration. For the null hypothesis that DNUE(-1)=DNUE(-2)-0, the Wald test rejects the null hypothesis since the computed p-value is less than 0.05, showing previous years' net migration does influence current migration.

In the specification DNM=f(DGDP, DFUE), the coefficients on the lags of DNM and the first lag of DFUE are statistically significant as the p-values are greater than 0.05. This implies that foreign-born unemployment has a significant effect on net migration rates. Net migration is positively influenced by net migration in the previous year and negatively affected by net migration two years before. The coefficient of one year lag of foreign-born unemployment is statistically significant at 10 percent level but the two-year lag is insignificant. Thus, the previous year foreign-born unemployment causes a reduction in current migration. For the null hypothesis that DFUE(-1)=DFUE(-2)=0, the Wald test fails to reject the null hypothesis since the calculated p-value is greater than 0.05 implying current migration is not influenced by the previous year migration. The Wald test fails to reject the null hypothesis of DGDP(-1)=DGDP(-2)=0, since the calculated p-value is greater than 0.05, and hence there is no significant effect of GDP on net migration.

In the specification DNM=f(DGDP, DWAG), the coefficients on the lags of DNM, one year lag of DGDP and the two year lag of DWAG are statistically significant as the p-values are greater than 0.05. Current year net migration is positively influenced by net migration in the previous year and negatively affected by net migration two years before. Previous year GDP and two years lag of wage rate have a marginally positive effect on current migration. The Wald test fails to reject the null hypothesis of DGDP(-1)=DGDP(-2)=0 since the calculated p-value is greater than 0.05 implying lagged economic growth rates have no effect on current migration. For the null hypothesis that DWAG(-1)=DWAG(-2)=0, the Wald test rejects the null hypothesis since the calculated p-value is less than 0.05 implying current migration is influenced by previous year wages and hence host country wages affect net migration positively.

In the specification DEMP=f(DGDP, DNM), the coefficients on one year lagged DNM and DEMP and both lags of DGDP are statistically significant. While previous year employment level has a strong positive effect on current employment, previous year net migration and GDP have a marginal positive influence on current employment. Two-year lags in migration and employment have no effect whereas GDP has a marginal negative effect on current year employment. The Wald test rejects the null hypothesis of DGDP(-1)=DGDP(-2)= DNM(-1)=DNM(-2)=0, as the calculated p-values are lesser than 0.05 implying that lagged economic growth and employment rates have a significant effect on current employment.

In the specification DNUE=f(DGDP, DNM), the coefficients on the lags of net migration and native-born unemployment are negative showing that the native-born unemployment is negatively influenced by net migration and its previous years' unemployment rate. This implies that net migration has no increasing effect, in fact, it has a reducing effect, on native-born unemployment. The Wald test fails to reject the null hypothesis that DGDP(-1)=DGDP(-2)=0, since the calculated p-value is greater than 0.05, but rejects the null hypothesis that DNM(-1)=DNM(-2)=0, since the p-value it computes is less than 0.05. Therefore, net migration has an impact on native-born unemployment but no effect on economic growth.

In the specification DFUE=f(DGDP, DNM), the coefficients on the lags of net migration are negative showing that migration reduces foreign-born unemployment. The coefficient on one-period lagged foreign-born unemployment is positive showing that net migration has no increasing unemployment effect among the foreigners. One year lag in the economic growth of the host country significantly reduces the foreign-born unemployment rate. The Wald test rejects the null hypothesis that DGDP(-1)=DGDP(-2)=0 and DNM(-1)=DNM(-2)=0 since the calculated p-values are lesser than 0.05. Therefore, net migration has an impact on native-born unemployment but no effect on economic growth. Hence, the foreign-born unemployment rate declines when the host country experiences economic growth and migration inflows.

In the specification DWAG=f(DGDP, DNM), the coefficient on the first lag of net migration is negative but statistically insignificant showing that previous years' net migration has no effect on host country wages. The coefficient on one-period lagged GDP and wages are positive showing that growing economies experience positive wage growth. The Wald test fails to reject the null hypothesis that DGDP(-1)=DGDP(-2)=0 and DNM(-1)=DNM(-2)=0 since the calculated p-values are greater than 0.05. Therefore, net migration has no impact on wages in the host country.

Table 4: Panel VAR Estimates of Net Migration and Macro Variables

Variable	*DNM, DGDP, DEMP*	*DNM, DGDP, DNUE*	*DNM, DGDP DFUE*	*DNM, DGDP, DWAG*	*DEMP, DGDP, DNM*	*DNUE, DGDP, DNM*	*DFUE, DGDP DNM*	*DWAG, DGDP, DNM*
DNM(-1)	0.307*	0.309*	0.309*	0.314*	0.095*	-0.097*	-0.252*	-2.882
	(5.611)	(5.755)	(5.696)	(5.858)	(3.156)	(3.309)	(3.696)	(1.524)
DNM(-2)	-2.918*	-0.298*	-0.321*	-0.326*	-0.025	-0.016	-0.099	3.050
	(5.135)	(5.328)	(5.508)	(5.867)	(0.885)	(0.536)	(1.400)	(1.553)
DGDP(-1)	$8.8*10^{-5}$	$7.2*10^{-5}$	$7.8*10^{-5}$	0.0001***	$7.2*10^{-5}$***	$-5.2*10^{-5}$	-0.0002**	0.048***
	(1.055)	(0.899)	(0.988)	(1.727)	(1.782)	(1.18)	(2.596)	(1.710)
DGDP(-2)	$-1.98*10^{-5}$	$-2.77*10^{-5}$	$6.7*10^{-5}$	$-3.0*10^{-5}$	$-7.4*10^{-5}$***	$8.1*10^{-5}$***	$6.3*10^{-5}$	0.011
	(0.239)	(0.339)	(0.835)	(0.389)	(1.805)	(1.821)	(0.624)	(0.384)
DEMP(-1)	0.164	-	-	-	0.569*	-	-	-
	(1.312)				(9.158)			
DEMP(-2)	-0.210	-	-	-	-0.081	-	-	-
	(1.762)				(1.368)			
DNUE(-1)	-	-0.241**	-	-	-	-0.595*	-	-
		(2.194)				(9.962)		
DNUE(-2)	-	-0.219**	-	-	-	-0.068	-	-
		(2.194)				(1.170)		
DFUE(-1)	—	-	-0.089***	-	-	-	0.163*	-
			(1.852)				(2.666)	
DFUE(-2)		-	0.012	-	-	-	-0.009	-
			(0.262)				(0.156)	
DWAG(-1)	-	-	-	$2.1*10^{-5}$	-	-	-	0.247*
				(0.129)				(4.300)
DWAG(-2)	-	-	-	0.0004**	-	-	-	0.013
				(2.521)				(0.230)
Constant	0.074	-0.049**	0.006	0.038	0.149***	-0.085	0.268	1.611**
	(0.448)	(2.055)	(0.037)	(0.230)	(1.815)	(0.37)	(1.221)	(2.538)

Note: Absolute t-values in parentheses. * Significant at 1 percent level ** Significant at 5 percent level *** Significant at 10 percent level.

Table 5: Wald Test on the Causal Effects of Net Migration and Macro Variables

Equation	*Lags*	*F-statistic p-value*	*Chi-square p-value*
DNM, DGDP, DEMP	DGDP(-1)=DGDP(-2)=0	0.570	0.569
	DEMP(-1)=DEMP(-2)=0	0.185	0.183
DNM, DGDP, DNUE	DGDP(-1)=DGDP(-2)=0	0.442	0.523
	DNUE(-1)=DNUE(-2)=0	0.044	0.043
DNM, DGDP DFUE	DGDP(-1)=DGDP(-2)=0	0.360	0.387
	DFUE(-1)=DFUE(-2)=0	0.180	0.179

contd. table 5

Equation	*Lags*	*F-statistic p-value*	*Chi-square p-value*
DNM, DGDP, DWAG	DGDP(-1)=DGDP(-2)=0	0.298	0.269
	DWAG(-1)=DWAG(-2)=0	0.028	0.027
DEMP, DGDP, DNM	DGDP(-1)=DGDP(-2)=0	0.047	0.045
	DNM(-1)=DNM(-2)=0	0.002	0.002
DNUE, DGDP, DNM	DGDP(-1)=DGDP(-2)=0	0.114	0.113
	DNM(-1)=DNMI(-2)=0	0.005	0.004
DFUE, DGDP DNM	DGDP(-1)=DGDP(-2)=0	0.033	0.032
	DNM(-1)=DNM(-2)=0	0.001	0.0008
DWAG, DGDP, DNM	DGDP(-1)=DGDP(-2)=0	0.209	0.207
	DNM(-1)=DNM(-2)=0	0.135	0.133

CONCLUSION

The OECD largely depends on migration for its labour force and hence economic growth. These countries attract skilled labour not from the developing countries but from among the western countries also. Such large migration inflows have a significant effect on the host country macro variables, especially on unemployment and wages. While a higher and growing GDP is likely to attract more immigrants, immigrants also contribute to the economic activity of the host country, thus influencing the host country GDP. As the main and immediate effect of immigration is on the host country labour market, a large and contentious literature studies the effect of immigration on the local unemployment and wage rates. However, the relationship between immigration and macroeconomic variables may be endogenous and there may also exist bidirectional causality. Simply correlating immigrant densities with native unemployment and wages is unlikely to be informative about the causal relationship that exists between them. A better approach to analyse the causal effects is to study the effect of immigration across time and between countries i.e. panel data analysis. The panel vector autoregression (VAR) approach addresses the endogeneity problem by allowing for the endogenous interaction between the variables. Specifically, it allows measuring a variable in terms of its own lags as well as the lags of the other endogenous variables. This paper examines the causal relationship between net migration, GDP, wages, and native-born and foreign-born unemployment in 20 OECD countries using panel data over the period 2000-2018 applying the panel fixed effects vector autoregression (VAR) method.

The panel VAR results show that net migration in the OECD countries depends significantly on its own lags i.e. the past levels of net migrations influence the present levels. GDP and employment rate seem to have no effect on the net migration rate. However, the employment rate in the host country is positively affected by the GDP and net migration. This implies that net migration does not reduce but increase the employment rate. While net migration is negatively affected by the native-born unemployment rate, net migration has a negative effect on the native-born unemployment rate. This implies as net migration increases, native-born unemployment declines. The foreign-born unemployment rate has no effect on the net migration rate while net migration has a negative effect on the foreign-born unemployment rate. The Wald tests show that host country wages affect net migration positively, but the net migration rate has no effect on wages. Overall, this paper finds that migration has a positive effect on the economy of a host country, a conclusion reached by the majority of studies in the literature on the impact of immigration on the host economy.

References

Barcellos, S.H. (2009) "The Dynamics of Immigration and Wages", RAND Working Paper WR-755, RAND Corporation, Santa Monica, CA, USA.

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

Borjas, G.J., R.B. Freeman and L.F. Katz (1997) "How Much Do Immigration and Trade Affect Labor Market Outcomes?", *Brookings Papers on Economic Activity*, 1, 1-90.

Boubtane, E., D. Coulibaly and C. Rault (2013) "Immigration, Growth, and Unemployment: Panel VAR Evidence from OECD Countries", *Labour*, 27, 4, 399-420.

Card, D. (1990) "The Impact of the Mariel Boatlift on the Miami Labor Market", *Industrial and Labor Relations Review*, 43, 2, 245-257.

Friedberg, R.M. (2001) "The Impact of Mass Migration in the Israeli Labor Market", *Quarterly Journal of Economics*, 116, 4, 1373-1408.

Hausman, J. (1978) "Specification Tests in Econometrics", *Econometrica*, 46, 6, 403-426.

Johansen, S. (1988) "Statistical Analysis of Cointegrating Vectors", *Journal of Economic Dynamics and Control*, 12, 2-3, 231-254.