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International immigration and its effects on native labor market: evidence from OECD countries

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This study aims to investigate the impact of international immigration on the native labor market of host countries. With the growing number of cross-border movements, the relationship between immigration and unemployment in the domestic labor market has become a concern for economists and policy makers. This study utilizes the comprehensive dataset of the years spanning from 2000 to 2020 and employs panel regression analysis to analyze the intricate dynamics of international migration and unemployment of native-born workers of 16 selected OECD countries. The results have disclosed a significant negative relationship between net migration rate and unemployment rate of domestic laborers. Furthermore, it was concluded that an increase in GDP, wages and government expenditure on education will significantly reduce the unemployment rate as well. However, the positive relationship of gross national expenditure with the unemployment rate of natives is found to be insignificant. In the light of this negative relationship between net migration rates and native unemployment rates, policy makers should take into account promoting immigration policies internationally that are consistent with economic growth goals. Moreover, investments in GDP growth, wage increases and education expenditure must be made to further reduce unemployment among native born workers.

KEYWORDS

international immigration, unemployment, GDP, panel regression analysis, OECD

1 Introduction

Immigration is a prevailing and dynamic force which has been influencing the economies and societies around the world. In the labor market, international migration has become a crucial subject of extensive study for economists and policy makers due to the rising cross-border movements (Margiani, 2023; Guzi et al., 2023; Přivara et al., 2023). The International Organization of Migration (IOM) has published in the World Migration Report of 2022 that a bulk of world population lives in the countries they are not born in. In 2020, about 281 million populations, which are 3.6% of the overall world population, were estimated to be living in foreign countries.¹ Furthermore, it has been observed that the Organization for Economic Co-operation and Development (OECD) countries have been the major receiver of international migration since 1990. In 2000, the stock of immigrants in OECD countries has been the 7.5% of their total

¹ <https://worldmigrationreport.iom.int/wmr-2022-interactive/>

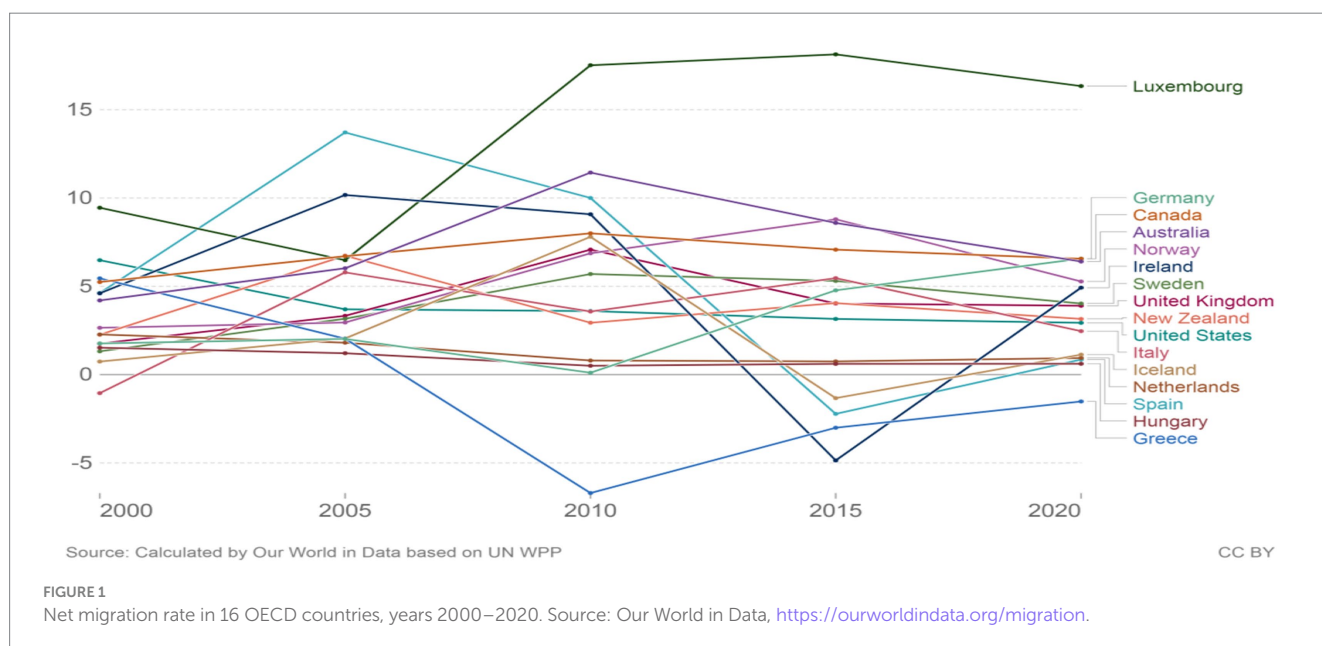
population. Moreover, between the years 1990 and 2010, their total number of immigrants significantly increased from 82 million to 127 million (Damette and Fromentin, 2013). Resultantly, such a great influx of immigrants raises the concerns about their impact on the economic factors of the host countries.

Migration in simple terms is associated with the movement of individuals from poor to relatively rich geographical regions (Kilic et al., 2019; Tufail et al., 2023). Most of the time, individuals prefer moving across the borders, in search of better standards of living, over within-country migration. There are multiple other reasons that encourage people to migrate including drastic economic conditions in origin countries, high unemployment rates, political instability, better quality of education in the chosen countries, natural disasters etc. (Escalonilla et al., 2024). The “Push and Pull” theory introduced by Lee (1966) explains the motivation of individuals behind their decision of migration. The dire state of countries like rising poverty, increased unemployment or low wages “Push” the individuals to make the decision of migration. On the other hand, the countries who offer better employment opportunities, higher wages and good quality of education etc. “Pull” the people to immigrate in those countries (Gündoğmuş and Bayir, 2021). Contrary to this, the Dual Labour Market theory, introduced by Piore (2018) argues that international migration is mainly due to pull factors, the labor demand of industrialized countries, rather than the push factors (Piore, 2018). No matter the conditions of the origin country, the individuals will opt for international migration as long as they are offered better conditions from across the borders (Wickramasinghe and Wimalaratana, 2016). Apart from this, migration is also observed during the political turmoil in countries. Like in late 2010, civil protests originated in many Arab countries which gave rise to Syrian uprising. Due to this unrest, many refugees opted to migrate to European countries which influenced the unemployment rates and wages of natives of the host countries (Cohen, 2017).

Figure 1 highlights how net migration rates have varied across 16 selected OECD countries. The data shows that countries with strong labor markets, welcoming immigration policies, and political stability such as

Germany, Australia and Canada tend to experience higher migration inflows. On the other hand, declines or even negative migration rates are often tied to economic downturns, stricter immigration policies, or geopolitical crises, as seen in Italy, Greece, and Spain. Certain years show noticeable fluctuations, which can be linked to major global events. For example, the 2008 financial crisis led to economic slowdowns that impacted migration patterns, while the European refugee crisis in 2015 resulted in increased migration to countries like Germany, Sweden, and the Netherlands. This data offers valuable insights for policymakers, underscoring the importance of balancing labor market needs, social integration, and sustainable migration policies to effectively address demographic and economic challenges.

Now the question arises, how does the increased immigration affect the economic condition of host countries? It is understandable that a great influx of immigrants cannot be absorbed by the economies easily even if they are developed like OECD countries. Many people fear that the arriving immigrants will either steal their jobs or will be the reason for their reduced wages (Feridun, 2004; Sengupta and Mihalache, 2021; Afzal and Kalra, 2024). Many researchers have grasped this notion and performed analysis to determine the impact of international migration on the unemployment of natives in the host countries. Some studies support the fear of natives and conclude that the increasing immigration rate reduces the employment opportunities for the natives (Feridun, 2004; Chamunorwa and Mlambo, 2014; Dustmann et al., 2016). On the other hand, some argue that immigration has a negative relationship with the unemployment rate of natives (Longhi et al., 2010; Kilic et al., 2019). This means that with the increasing number of immigrants in the host countries, the competition for the employment opportunities will also increase due to inelastic capital. In addition, the skill composition of the economy is also influenced by the inflow of immigrant. If the immigrants are not similarly skilled to natives then an imbalance will be created between the “supply of and cost-minimizing labor demand for” the varying types of worker at the same wages and production. This disequilibrium can only be restored through the changes in wages and employment opportunities (Dustmann et al., 2005).



Apart from this, some researchers have mixed reviews about the relationship of immigration with unemployment. They argue that the nature of this relation changes in short and long runs. For example, [Latif \(2015\)](#) concluded that in short run increased immigration will increase the unemployment rate however this relation will become insignificant in the long run. On the other hand, studies have also proved that immigration and unemployment of natives has no relation from the beginning. This conclusion was obtained by [Friedberg and Hunt \(1995\)](#) and [Boubtane et al. \(2013\)](#) among others. Other than the negative aspects of immigration, there are benefits of immigration for both the origin and host countries. Primarily, according to the Migration System theory, the labor-sending countries experience socio-economic development due to the remittances received by the families of immigrants ([Wickramasinghe and Wimalaratana, 2016](#); [York, 2022](#)). Secondly, the labor receiving countries have both social and economic benefits. Through these migrants, the different cultures are introduced to the nations and understanding about the issues of the less privileged countries is increased. However, still some nations vehemently oppose the concept of international immigration due to both economic and cultural reasons ([Edo and Özgüzel, 2023](#); [Chassamboulli et al., 2024](#)). In regards to this, [Tabellini \(2018\)](#) explains that the opposition to international migration from the population of USA is basically due to the cultural differences of immigrant from that of natives even though the natives receive huge benefits in occupations and wages.

Up till now, multiple studies have determined the impact of immigration rate on unemployment and wages of natives in a country. However, no significant attention has been given to the OECD countries. This study aims to investigate the relationship between international immigration and the unemployment rate of native-born workers in OECD countries. Specifically, it examines whether an increase in the net migration rate contributes to higher or lower unemployment among natives. This study focuses on 16 OECD countries over the period 2000 to 2020, using panel regression methods to estimate the relationship. We also incorporate control variables such as GDP growth, average wages, public expenditure on education, and gross national expenditure to provide a comprehensive view of labor market dynamics. Furthermore, the study considers how national migration policies may influence outcomes across different host countries. The models explaining the different impacts of variables on the unemployment rate are added in [Table 1](#).

The structure of the paper is as follows: Section 2 provides the review of the relevant literature. Section 3 provides the theoretical background. Section 4 details the data sources and explains the

methodological approach used in the study. Section 5 presents the findings and discusses their implications. Finally, Section 6 summarizes the key conclusions and provides the potential policy implications.

2 Literature review

For years, researchers have invested their efforts in understanding the impact of immigration on different economies. In recent years, European countries have become the focus of many studies due to the rise of immigration there. Comparatively, lesser focus is given to the OECD countries. It has been observed that, majorly, an increased immigration in a country can increase the unemployment of the natives and lower their wages as well ([Maffei-Faccioli and Vella, 2021](#)). On the other hand, some researchers have also raised the point that immigration can also reduce the unemployment in the host countries. However, there is also a school of thought that immigration has no significant relationship with unemployment. In line with this, [Gündoğmuş and Bayir \(2021\)](#) performed panel regression in their study and found out that there is no significant relation between unemployment and migration. Comparatively, GDP, wages, public expenditure, and education expenditure have a significant negative relation with unemployment. This means that an increase in economic growth, public expenditure, wage rises, and expenditure on education will lower the unemployment rates in the 27 OECD countries rather than their immigration rate. The study by [Afzal and Kalra \(2024\)](#) showed that OECD countries benefit from increased productivity when immigrants settle within their countries, while native employment remains stable. The study demonstrates how immigration creates economic output benefits by both stimulating employment shifts and developing human capital resources. Likewise, [Friedberg and Hunt \(1995\)](#) also concluded that there is no significant relationship between immigration and unemployment. On the other hand, immigration does lower down the wages of the natives, but that reduction is quite insignificant, i.e., a 10% increase in the fraction of immigrants will lower down the wages by 1%.

[Kilic et al. \(2019\)](#) concluded an inverse relationship between unemployment and migration. In their study, they focused on the 23 OECD countries, as well, from 2000 to 2015. Their Panel Data analysis included the impact of economic growth, wages, and inflation on unemployment as well. In the end, the authors concluded that migration and GDP have a significant negative impact on unemployment. On the other hand, wages and inflation have an

TABLE 1 Variables, proxies, and sources.

Variable	Proxies	Denoted by	Sources
Dependent variable			
Unemployment of natives in host countries	Unemployment rate of native born	UENB	OECD
Independent variables			
International migration	Net migration rate	NMR	United Nations Data
Economic growth	GDP per capita	GDP	WDI, World Bank
Wages	Average annual wages	LWages	OECD
Education and skill expenditure	Government expenditure on education	GEE	WDI, World Bank
National/public expenditure	Gross national expenditure	GNE	WDI, World Bank

insignificant positive and negative relation with unemployment, respectively. Chassamboulli et al. (2024) conducted research on labor market flows to show that migrants demonstrate better economic response capabilities to changes in the economy. According to their argument, the ability to adjust to changing conditions serves as an essential factor that stabilizes labor demand when economic uncertainty occurs. Similarly, Longhi et al. (2010) found a negative relation between immigration and unemployment through meta-analytic approach. However, they explained that this impact is quite small, i.e., 1% increase in the share of immigrants in any host country will decrease the employment of its natives by 0.011% only. Contrary to this study, another study supported the notion of positive relationship of immigration and unemployment in South Africa during the years of 1980 to 2010. They further concluded, through the OLS estimation results, that the increase in GDP will significantly reduce the unemployment in South Africa (Chamunorwa and Mlambo, 2014).

There are multiple studies which have determined the impacts of immigration on the economy in the short and long run. Latif (2015) studied about the impact of permanent immigration on the unemployment rate in the Canadian provinces during 1983 to 2010. The results of the Vector Error Correction Model (VECM) suggested that in the short run there is a significant positive relationship between migration and unemployment. However, in the long run this relationship becomes negative and insignificant. Hence, according to Latif (2015), in short run an increase in immigration will increase the unemployment in Canada but in long run immigration will not have any influence on unemployment. Similarly, Islam (2007) performed a bi-directional causality test between unemployment and immigration in his study about Canada, as well. He observed from this test that immigration does not have a significant effect on unemployment, however, minimal adverse effect of unemployment on immigration was found. These results were further confirmed by the VEC model performed in the same article. Furthermore, he also concluded that in the long run immigration has no effect on unemployment. Even if there is a temporary increase in unemployment due to increased immigration then that is easily solved in the long run.

Similar to Canada, the people of Finland have also shown concerns about the saturated job market due to the rapidly increasing number of the immigrants. They believe that the arrival of the similar skill-set foreigners will probably occupy the jobs of the natives, and a tough competition will be created. In this competition, wages will also suffer, and they will be reduced for the workers. Hence, immigration will increase the unemployment and decrease the wages in Finland. To empirically analyze this fear, Granger Causality Test was performed between immigration and unemployment. It was concluded that the immigration does have a significant positive relation with unemployment, i.e., an increase in immigration increases unemployment in Finland (Feridun, 2004). On the other hand, Boubtane et al. (2013) has explained that immigration has no relationship with unemployment in any selected country but the impact of economic factors (unemployment and economic growth) on immigration is country specific. When the authors performed Granger causality test on 22 OECD countries, they discovered only in Portugal unemployment negatively Granger causes immigration. Likewise, Feridun (2005) also performed Granger Causal test on immigration and unemployment rate with respect to Norway. However, he concluded that immigration has no impact on the unemployment of the natives and vice versa. Escalonilla et al. (2024)

studied how immigrants and natives integrate into the workforce during economic downturns, specifically through the COVID-19 pandemic. The study revealed that economic downturns lead to heightened immigration concerns, but such concerns exceed the actual workforce effects of migration. Apart from the causal effects, researchers have also studied the impact of immigration on the economy based on the skill sets of the immigrants. Many authors have stressed upon the skills of the immigrant and the elasticity of the capital. If the skills of the immigrants are similar to that of the natives and the capital supply in the country is perfectly elastic, then the economy will not have any problem of unemployment and lowered wages. In fact, with perfectly elastic capital supply, the economy will absorb the arriving immigrants easily. However, if the immigrants have the skill-sets different from that of natives and other adjustments like elastic capital supply are not made then the problems of unemployment and less wages will arise. To absorb the immigrants in economy, some changes will need to be made which will be depending on the skills of the people. For example, if the unskilled labor is in abundance, then the companies will hire them on lower wages. Some will gain from this while others will face loss due to their lacking skills (Dustmann et al., 2008).

Many countries, including United Kingdom, experienced saturated market due to high immigration rate. Dustmann et al. (2005), in their study performed the empirical analysis according to the population of Britain. They explained that overall, immigration has no effect on the unemployment of natives in UK. However, if the skills of the immigrants are considered then they will have some impacts on the similar skill-set groups. In their work, they divided the immigrants into three groups depending on the level of education; low, intermediate and advanced levels. They observed that the 1 percent increase in the immigration of intermediate level of educated individuals will increase the unemployment rate by 1%, decrease the employment rate by 1.8% and reduce the participation rate by 1.1% of the natives. However, these impacts are leveled by the decreased unemployment rate of the natives with advanced level education. On the other hand this study was unable to find the significant impact on the low skilled level individuals due to the un-availability of data.

In November 1989, Berlin Wall which separated the East Germany from the West Germany fell during the protests. Fourteen months after this incident, a policy was implemented in Germany which resulted in the supply shock of Czech workers in the municipalities closer to the German border. This excessive supply of workers had a sharp negative impact on the employment of the natives of those municipalities. Along with this, moderate decline in the wages of the native was also observed (Dustmann et al., 2016). Contrariwise, Damette and Fromentin (2013) explained in their study that immigration has no effect on the unemployment of natives of 14 OECD countries in both short and long term. On the other hand, they claim that immigration increases employment opportunities in the host countries instead of reducing them.

Nickell (2009) explains that in the last two decades an increase in the number of immigrants in the developed OECD countries has been observed. Based on this observation he estimated the relationship between immigration and unemployment in the selected countries. He found out that impact of unskilled immigrants on the unemployment of unskilled natives is minimal which is similar to the results of Dustmann et al. (2005). Furthermore, Nickell (2009) also concluded that in the long run immigration reduces unemployment

which was observed in the case of Spain where immigration helped in reducing the overall unemployment rate. However, he also added that in the short run immigration increases unemployment especially in the presence of employment protection laws. The study conducted by [Přivara et al. \(2023\)](#) investigated migrant population effects on labor market competitiveness within EU membership states. Through their investigation, the authors found that immigration strengthens workforce skills and reduces structural employment gaps and creates less unemployment, which leads to better market efficiency. Apart from this, [Tabellini \(2018\)](#) describes that immigration is beneficial for the economy of USA. He explained that the increased immigration fosters “industrial production” which increases the employment opportunities and “occupational standing” of the natives. He further explains that the natives of the USA are extremely against immigration not because of economic reasons but due to cultural differences.

[Cohen \(2017\)](#) made a different approach towards the impact of immigration on the local unemployment rate. He highlighted the importance of policies introduced by the government which play a role in the relationship of immigration and unemployment. He focused on the three countries, namely Greece, Germany and United States, which were the focus of international migration due to the Syrian civilian protests and better living standards. All three of these countries have different welfare employment policies which attracted the immigrants. Greece promotes idleness as all the basic needs were provided by the government and strict regulations were not kept which gave the people to avoid tax and authorities. During Syrian protest, Greece allowed the entry of the refugees which gave an ongoing supply of workers to the Greek corporate sector. With the lenient policies, the Greek economy could not absorb the immigrants and increased unemployment. However, the author has explained that immigrants were not the only reason for increasing unemployment in Greece. Still, there is a positive relation between immigration and unemployment for the natives of Greece. Moving on, [Cohen \(2017\)](#) described that Germany had serious shortage of labor due to the low percentage of young generation. Hence, the German government opened their border to international immigrants to occupy the employment opportunities. This is an example of the impact of employment on immigration. However, the author further explains that immigration will result in increased economic growth which will later on control the economic indicators like unemployment. Hence, the increase in immigration due to economic and welfare policies in Germany resulted in reducing unemployment rate.

On the other hand, [Cohen \(2017\)](#) also observed a different system in United States of America. Contrary to Greece and Germany, who have policies for immigration, USA employs the “Invisible Hand” system for immigrants. In this liberal system where the government does not step in, he observed a cycle that high unemployment rates in USA during the financial crisis of 1930 led to a drop in international migration. This drop was followed by the recovering economic growth and low unemployment rates in 1940, after which immigration again stepped in due to the same factors of high GDP and low unemployment rates. However, the influx of immigrants will push the natives out of the market, and this will result in the rising unemployment rates which will be followed by the reduction of economic growth and the cycle continues. In the end, he concluded that the relationship between immigration and unemployment is dependent on the policies introduced by the host countries. [Jean and Jiménez \(2011\)](#) also

stressed the importance of policies in the host countries. They concluded that immigration has no impact on unemployment in the long run. However, based on the policy framework, temporary effect of immigration on the local unemployment can be observed. Still, he maintains, like [Cohen \(2017\)](#), that depending on the policies, host countries can control the adverse effects of international migration.

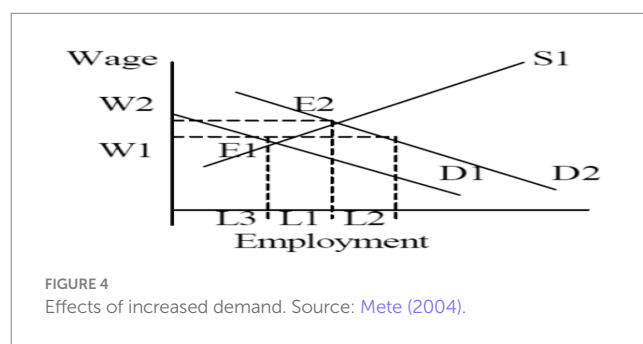
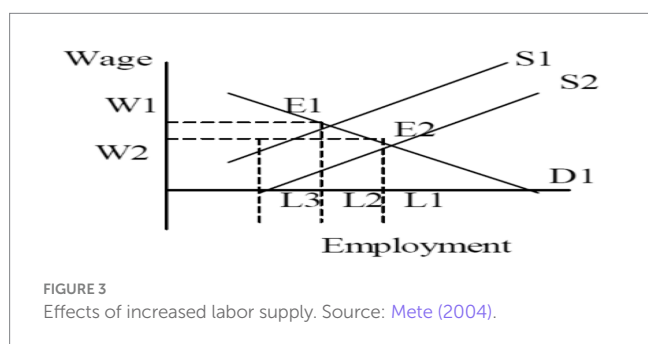
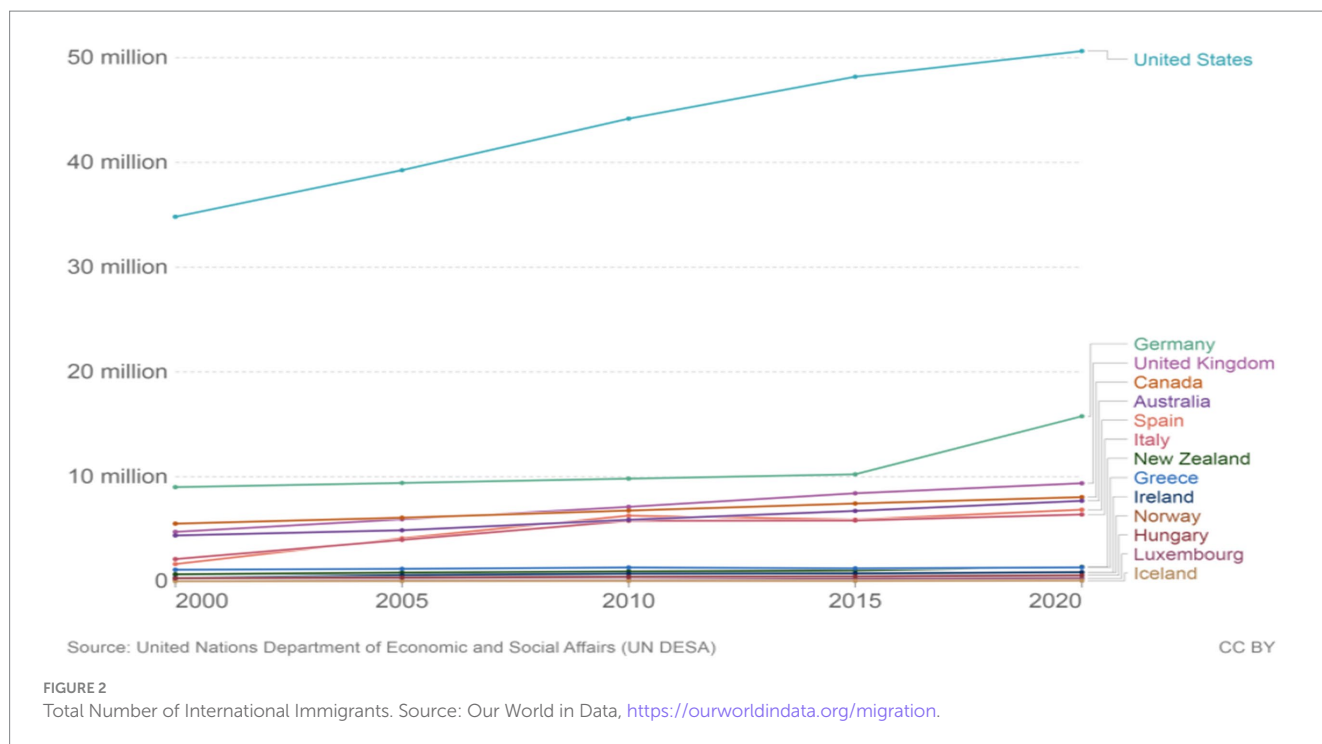
In conclusion, there are mixed reviews of the economists on the effect of international immigration on the unemployment of domestic workers. Some support the positive relation, and others concluded the negative bond of these variables. The estimation of this study will further add in to these speculations and conclusions.

Hypothesis: Net migration rate has a significant negative effect on native-born unemployment in OECD countries.

3 Theoretical background

In this study, the impact of international immigration on the unemployment rate of native residents of 16 OECD countries (see [Table A](#)) has been analyzed. These are the combination of both European and Non-European countries around the world where the net migration rate has changed quite a lot in the last two decades. It has been observed that the percentage of foreign-born population in the OECD countries has increased considerably from 7% in 1990 to greater than 12% in 2020 ([Edo et al., 2020](#)). Among these countries, Luxembourg has the highest net migration rate due to the cross-border commuting which allows the residents to legally live and work in different countries ([Nickell, 2009](#)). Furthermore, from the [Figure 2](#), it can be observed that apart from United States and Germany, having greater than 10 million foreign populations, the remaining countries had gradually accepted close to 10 million foreign individuals in their population in the previous 20 years. Due to this great number, the impact of international migration on the unemployment of natives in the selected OECD countries has been evaluated.

[Feridun \(2004\)](#) has theoretically explained that the immigration impacts the unemployment and wages depending on the demand and supply of labor in a country. The foreign and domestic labors substitute each other when the skill composition of both of them is similar. On the other hand, different levels of skill between immigrants and natives make them complementary in nature. In [Figure 3](#), the changes in wage and employment due to the excess Supply (S) of labors, while keeping their Demand (D) constant, have been depicted. S1 is the initial supply of labor in reply to its demand D1 before the arrival of immigrants in an economy. The wages of the domestic labors is denoted by W1 which is reduced to W2 when immigrants enter the economy and supply curve is moved to S2 in the graph. If the foreign and domestic labors are substitute of each other, the competition for the jobs will increase substantially. This will result in the reduction of employment opportunities for the natives because, for the same skills, the employers will prefer to hire cheap labor, i.e., immigrants. The movement from L1 to L3 in [Figure 3](#) explains the amount employment opportunities seized by the foreigners. Due to this, the wages of native will also suffer a backlash as explained previously through the graph. Contrariwise, if the immigrants and natives are complimentary of each other, presumably natives are better skilled than immigrants, then the low skilled jobs will be grabbed by the immigrants and new jobs demanding high-skilled labor will be created for the natives. In



this way, the unemployment in the economy will decrease and wages of natives will increase. Similarly, Dustmann et al. (2005) has also stressed upon the changes in unemployment and wage due to skill compositions of labor force.

On the other hand, the demand of basic needs of immigrants will also affect the labor market. The expenditure of immigrants, on the goods and services, will inject capital in the economy. This will increase the production of goods and services which will ultimately lead to increase in wages and employment as explained in Figure 4. However, this will also depend on the relative ratio of expenditure of immigrants and their employment rates. If their expenditure is greater than their ability to gain employment then unemployment will be reduced and wages will increase. Contrarily, if the expenditure is lesser than the employments of immigrants then unemployment will increase due to less job opportunities.

3.1 Net migration rate

According to the “Neo-classic theory,” people choose migration due to high unemployment and low wages in their origin countries.

Hence, they migrate to countries where they will have higher wages and employment opportunities (Gündoğmuş and Bayir, 2021; Foged et al., 2022). However, this can also cause a labor surplus in the host countries which, in turn, might affect their unemployment rates and wages of the natives and pre-existing migrants (Wickramasinghe and Wimalaratana, 2016). Similarly, the “Cumulative Causation theory” explains that the immigration is a self-reinforcing process. New immigrants are attracted by the favorable conditions of the already present immigrants and this process leads to the economic spillover in those countries. The study of Tabellini (2018) also supported that the immigrants stimulate the economic growth and potentially reduces unemployment of natives. Additionally, as explained earlier, immigrants and the natives are either substitutes or complementary of each other in an economy. If the immigrants are the perfect substitutes of natives, then the choice between them by their employer will be based on the wages. Usually, immigrants are the cheap labor due to which employers substitute the natives with the immigrants. In this way, the unemployment rate of natives in the host countries will increase. On the other hand, if the immigrants and natives are complementary of each other then they are divided into two distinct labor markets which reduce unemployment rates of natives and increase their wages. This happens because the

employers prefer to give low skilled jobs to immigrants and high-skilled jobs to the natives (Feridun, 2004). Similarly, Nickell (2009) concluded that the arrival of unskilled labor in the host country has the minimal impact on the employment and wages of unskilled natives. However, this relationship differs in the short and long run. Contrarily, there are also studies which have concluded that the increase in international migration will increase the unemployment rate in the given countries (Chamunorwa and Mlambo, 2014). Hence it is expected that the international migration will either have negative impact on unemployment of native born or vice versa.

Moving forward, the first control variable in this study is the GDP per capita. According to the Okun's Law, there is an inverse relation between the percentage change in economic growth and percentage change in unemployment, i.e., as the 1% increase in GDP of a country will cause its unemployment rate to decrease by some percent and vice versa. Hence, it is expected that the GDP will have a significant negative relation with the unemployment of native residents (Kilic et al., 2019; Gündoğmuş and Bayir, 2021). The second control variable is the annual wages of the selected countries. The Efficient Wage Theory suggests a negative relation between wages and unemployment. This theory explains that higher wages encourage the labor to work efficiently. In this way, the productivity of the laborers is increased which in turn helps in reducing the unemployment, ultimately. In line with this theory, Gündoğmuş and Bayir (2021) have also concluded a significant negative relation between the unemployment and annual wages in the OECD countries. Contrary to this, there is also a study where the authors have found that wages do not have any significant relation with unemployment, i.e., any change in wage will not cause a change in unemployment (Kilic et al., 2019). Hence, it is expected that the wages will either have negative or no relation with unemployment in the final estimation.

Another variable in this study is the government expenditure on education. Higher literacy rate and better skill set offer a helping hand to the workers in attaining a better paid job in a competitive market. Similarly, Human Capital Theory, primarily introduced by Gary Becker and Theodore Schultz in 1950s and early 1960s, explains that education enhances a person's human capital which reduces their likelihood of experiencing unemployment. Education is considered to be an investment which results in improved job prospects and higher wages. Moreover, studies have also shed a positive light to immigration based on human capital. They have concluded that immigrants with higher level of education will counterbalance the drawbacks of increased immigration in the host country due to their accumulated human capital (Dolado et al., 1994). Hence, it is expected that the government expenditure in education will have a negative effect on the unemployment.

Lastly, gross national expenditure which is the sum of government consumption expenditure, private consumption expenditure and domestic investments is taken to be a control variable as well. The reasoning behind adding this variable is to find out the impact of combined consumption expenditure, of government and public, and the investment on the unemployment of a country. According to Keynes, an insufficient aggregate demand in the economy can result in unemployment. He explains that during economic recession, reduced spending of individuals and businesses causes the aggregate demand and the investments to lower down. Resultantly, the companies may reduce the production and workforce which will increase the unemployment in the nation. At this time, the

government needs to step in to boost the national expenditure and investment in the businesses which will ensure that the production, employment and economic growth remain in safe zones. Hence, it is hypothesized that, like government expenditure on education, gross national expenditure will also have a negative relation with unemployment. Later on, based on the results of empirical analysis, the significance of the relationship of dependent and independent variables have been evaluated.

4 Methodology and data

4.1 Estimation technique

The main goal of this study is to examine the relation of international migration and unemployment rate of natives in the host countries through panel regression analysis. The empirical model for this analysis will be as follows:

$$UENB_{it} = \beta_0 + \beta_1 NMR_{it} + \beta_2 GDP_{it} + \beta_3 LWages_{it} + \beta_4 GEE_{it} + \beta_5 GNE_{it} + \mu_{it} \quad (1)$$

$$i = 1, 2, \dots, 16$$

$$t = 1, 2, \dots, 21$$

Where UENB is the unemployment rate of native born, NMR is net migration rate, GDP is the gross domestic product (GDP per capita growth, annual), LWages is the natural log of average annual wages, GEE is government expenditure on education, GNE is gross national expenditure, and μ_{it} is the error term. Here, the UENB is the dependent variable and NMR, GDP, LWages, GEE and GNE are the independent variables. The subscripts "i" and "t" represent the cross-section unit and time, respectively. The cross-section units, i.e., the total countries are 16 in number and the time spanning from 2000 to 2020, i.e., total 21 years. The above model is balanced as the time observations are same for all the individuals (cross section units). Moreover, this is a long panel as the time observations are greater in number than the cross-section units. In the above model, β_0 is the intercept and $\beta_1, \beta_2, \beta_3, \beta_4$, and β_5 are the coefficients of the variables (Gujarati, 2014).

The estimation in this study will begin with checking the stationarity of the variables through the unit root test. After confirming that the variables are stationary (mean, variance and covariance are constant) in nature, the regression will be run where the UENB will be the dependent variable and NMR, GDP, LWages, GEE and GNE will be the independent variables.

$$UENB = f(NMR, GDP, LWages, GEE, GNE) \quad (2)$$

Later on, diagnostic tests will be applied on the regression analysis to examine the validity of the results. Firstly, the heteroskedasticity of the data will be determined via Breusch Pagan test. If the data has no heteroskedasticity (i.e., p -value of the test results is greater than 5%), then the next diagnostic test will be performed. However, if the results of this test confirm that the data is heteroskedastic instead of homoskedastic then the fixed effect model or random effect model will be used to treat heteroskedasticity. In fixed effects model (FEM),

all the observations are pooled together but each individual (cross-section unit) is allowed to have its own individual dummy intercept. However, the constant in this model will be time-invariant. The FEM will be given as follows:

$$UENB_{it} = \beta_{0i} + \beta_1 NMR_{it} + \beta_2 GDP_{it} + \beta_3 LWages_{it} + \beta_4 GEE_{it} + \beta_5 GNE_{it} + \mu_{it} \quad (3)$$

In the above FE Model, a subscript “i” is added with the intercept (β_0) which means that the intercept (constant) is indeed varying across different individuals (each country has different NMR, GDP, GEE etc) but the time is kept constant. On the other hand, in random effects model (REM), instead of fixing the intercept, it is randomly chosen from a much larger population of individuals. Here it is assumed that the “ β_{0i} ” is the random variable with a mean value of β_0 and the intercept of any cross-section unit which is expressed as following:

$$\beta_{0i} = \beta_0 + \varepsilon_i \quad (4)$$

where ε_i is the random error term with mean 0 and variance σ^2_ε .

In terms of the variables of this study, it means that the 16 individuals (countries) are randomly drawn from the much larger population of such individuals and they have common mean intercept value, i.e., β_0 . The ε_i reflects the difference in the individual values of intercept for each individual country. Hence the RE model can be written as following:

$$UENB_{it} = \beta_0 + \beta_1 NMR_{it} + \beta_2 GDP_{it} + \beta_3 LWages_{it} + \beta_4 GEE_{it} + \beta_5 GNE_{it} + w_{it} \quad (5)$$

Where,

$$w_{it} = \varepsilon_i + \mu_{it}$$

The composite error term w_{it} is the combination of the individual specific error component ε_i and combined time-series and cross-section error term μ_{it} . In this model, it is also assumed that the error-terms are not correlated with each other and not auto-correlated across panels. Moreover, the composite error term, w_{it} , is also not correlated with the explanatory variables of the model to avoid multicollinearity. If any of these assumptions is violated then the estimation results will be inconsistent with the regression coefficients (Gujarati, 2014).

To select between these two models the Hausman test will be applied on the models. If the probability value is less than 5% then fixed effects model will be selected otherwise the random effects model will be the best fit. Following this, the Wooldridge test for autocorrelation will be performed on the variables. If the model has no autocorrelation, then the estimation will end at the selected model (FEM or REM) otherwise the Generalized Least Square (GLS) regression model will be used to treat autocorrelation. Then the results of the GLS will be the final estimation results of this study.

4.2 Data description and sources

The data on the variables has been collected from multiple international websites like OECD, World Bank and UN Data. In Table 1, the variables and their sources have been mentioned.

Unemployment Rate of Native Born (UENB) in the selected countries has been sourced from the official website of OECD.² The unemployment rate is an important indicator of labor supply underutilization. It indicates an economy’s incapacity to provide employment for individuals who want to work but are unable to do so, despite the fact that they are available for work and actively searching for employment. This data is in percentages and is collected from the population aged from 15 years to 64 years.

Net Migration Rate (NMR) has been sourced from United Nation Data (<https://data.un.org/>) where it is defined as the total number of emigrants subtracted from total number of immigrants and then divided by the time spent by the population in the receiving country in a specific period. In the data, net migration rate has been expressed as the number of migrants in per thousand populations.

Economic Growth (GDP) of a country is determined by its GDP per capita. GDP is the annual data from years 2000 to 2020 in percentages. The data on this variable has been collected from the official website of World Bank Indicators (<https://databank.worldbank.org/>) where GDP is divided by the midyear population of the selected countries.

Average Annual Wages (LWages) have been collected from the OECD website. They are calculated by dividing total wages with the average number of employees in the economy. These values are multiplied with the ratio of the average weekly hours of full-time employers to that of all the employees. However, the final average annual wage values are in thousands and are quite different from other variables which are in percentages. Hence, natural logarithm has been taken of wages to minimize the size of the values.

Government Expenditure on Education (GEE) and Gross National Expenditure (GNE) are also sourced from World Bank Indicators. GEE is the general government expenditure on education which also includes the international funds received for the education. It is calculated by dividing all the expenditure on education with the GDP and then multiplying it with 100. Like GEE, GNE is also annual statistic which is expressed as the percentage of GDP. Gross national expenditure is the sum of household final consumption expenditure, general government expenditure and gross capital formation. Table 2 presents the descriptive analysis of the variables.

5 Empirical results and discussions

Panel analysis has been applied on the data where the countries are taken as the cross section and years are taken as the time. Specifically, this analysis was preferred due to its benefits of larger data set including both cross section units and time, reliable estimations and controlled individual heterogeneity (Asteriou and Hall, 2007). The estimations flowchart is also present in Figure 5.

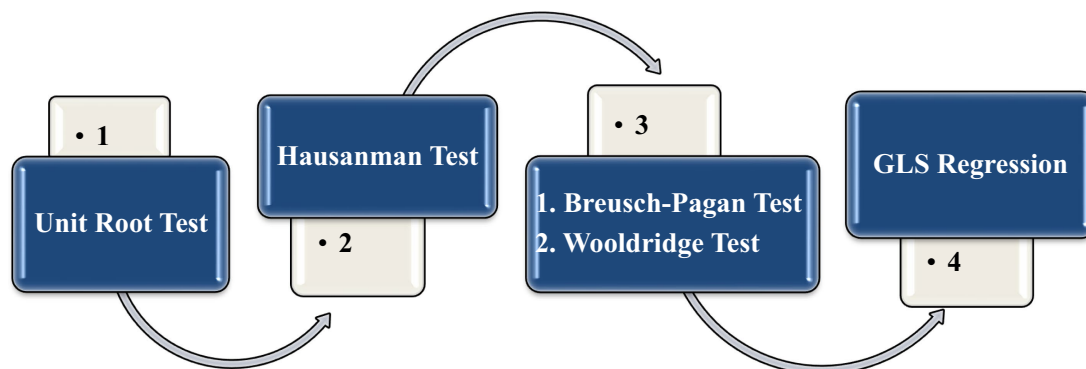
5.1 Unit root test

According to the results of panel unit root test without difference, only the UENB, NMR and GDP had the p -values less than 5% due to which null hypothesis was rejected, and alternative hypothesis was

² <https://stats.oecd.org/>

TABLE 2 Descriptive analysis of variables.

Variable	Observation	Mean	Std. Deviation	Minimum	Maximum
UENB	326	6.811	4.39	1.3	26.5
GNE	336	95.869	9.086	66.24	116.725
GEE	260	5.367	1.194	3.23	8.031
NMR	336	5.24	5.524	−14.919	24.498
GDP	336	1.416	2.786	−10.016	23.999
LWages	336	10.723	0.288	9.709	11.181


FIGURE 5
Estimation flowchart. Source: Author's construction.

accepted. Hence these variables are stationary but other variables LWages, GEE and GNE which had p -values higher than 5% are non-stationary in nature. To transform this non-stationary data, the first difference of the variables is taken which eliminates the chances of long-term trends or drifts from constant mean. In this way, non-stationary data is converted into stationary data. After this, panel unit root test is applied on the variables with 1st order difference. The hypotheses remain similar to the previous test. The final results obtained explain that the p – values of all the variables is less than 5%. This means that the null hypothesis will be rejected, and alternative hypothesis will be accepted. Resultantly, all the variables of the data are stationary in nature with 1st order difference. The results of the panel unit root test without difference and with 1st difference are given in Table 3.

5.2 Hausman, heteroskedasticity and autocorrelation test

The results of the diagnostic tests are present in Table 4. The Breusch-Pagan test gave the p -value “0.000,” meaning the null hypothesis is rejected and the data is heteroskedastic in nature. After generating separate regression tables for both fixed and random effects, Hausman test is applied to make a choice between them. If the p -value of this estimation is less than 5% then the fixed effect model is best fit for this data compared to the random effect model and vice versa. When Hausman test was applied, the p -value obtained was less than 0.05. Hence, the fixed effect model has been chosen to treat the heteroskedasticity of the data in this study.

Moving on, the fixed effect model is analyzed for the autocorrelation through Wooldridge test. Autocorrelation occurs in estimation when there is serial dependence, i.e., error terms of two or more time periods

TABLE 3 Panel unit root test results.

Variables	Fisher ADF Test			
	Level	p -value	1st difference	p -value
UENB	−2.68	0.003	−4.65	0.000
NMR	−6.02	0.000	−8.22	0.000
GDP	−6.07	0.000	−13.49	0.000
LWages	0.113	0.545	−5.25	0.000
GEE	−0.892	0.181	−6.20	0.000
GNE	0.392	0.652	−7.28	0.000

are correlated to each other. This problem can give higher results of R^2 and t -statistic values making the model over-fitted. Wooldridge test hypothesizes that if the p -value is greater than 5% then there is no 1st order autocorrelation in the data and vice-versa. However, the estimation result has rejected this null hypothesis as the resulting p -value is less than 5%. Hence, the estimation has 1st order autocorrelation in it. To treat this autocorrelation, Generalized Least Square (GLS) model is used. This regression model gives the final estimation result after treating diagnostic issues like heteroskedasticity and autocorrelation.

5.3 Regression results

The final result of the regression estimation is present in Table 5, concludes that the net migration rate (NMR), economic growth (GDP), log of wages (LWages) and government expenditure on education (GEE) have significant negative relationship with unemployment rate of native

TABLE 4 Diagnostic tests result.

Diagnostic tests	Results	p-value	Interpretations
Hausman test	66.41	0.000	Null hypothesis is rejected; Fixed Effect Model is best fit for this dataset
Breusch Pagan test	74.68	0.000	Null hypothesis is rejected; The data is heteroskedastic in nature
Wooldridge test	254.8	0.000	Null hypothesis is rejected; There is 1 st order autocorrelation in the data

TABLE 5 Cross-sectional time-series GLS regression.

Dep.Var: UENB	Model 1	Model 2	Model 3	Model 4	Model 5
NMR	−0.346***	−0.335***	−0.225***	−0.233***	−0.235***
GDP		−0.200**	−0.271***	−0.188**	−0.179**
LWages			−5.173***	−2.868***	−2.526***
GEE				−1.306***	−1.322***
GNE					0.038
Constant	8.613***	8.830***	63.838***	45.794***	38.593***

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

born (UENB). However, gross national expenditure (GNE) has an insignificant positive relationship with UENB. Based on the GLS regression, five models with varying number of independent variables are put forward. The addition of a new variable in the models will change the previous value of the existing variables in the new model. This is due to the fact that the relationship of new variables with dependent variable will either enhance or reduce the influence of the already present variables in the model. This phenomenon can be observed in the increasing coefficient of GDP, due to the LWages, in Model 3 compared to Model 2. Similarly, in comparison with the Model 3, a sharp decline can be observed in the value of LWages in Model 4. This can be attributed to the introduction of GEE in Model 4.

The regression analysis of Model 1 shows that on average, 1 percent increase in the net migration rate of host countries will reduce the unemployment rate of natives by 0.346%. The value of constant explains that 8.613% change in UENB is not explained by the selected variable. This relationship is significant at 1% (0.01). Similarly, the Model 2 can be interpreted as; on average, 1% increase in NMR will decrease the UENB by 0.335% while keeping another variable constant. On the other hand, GDP of the same model will be interpreted as; on average, 1% increase in GDP will lower down the UENB by 0.2% while keeping the NMR constant. By keeping the variables constant during the interpretation, an isolated effect of the selected control variable upon dependent variable is determined. Up till now, the models have been the example of Linear-linear model where both the dependent and independent variables are linear in nature. However, from Model 3 and onwards, Linear-Log relationship between the dependent and independent variables will be observed because of LWages. Due to this, the interpretation of log pertaining variable will be different from other variables, i.e., its coefficient will be divided by the 100 to determine 1% change. For example, in Model 3, the relationship of LWages and UENB will be interpreted as; on average, 1% increase in the average annual wages will decrease the unemployment rates of natives by 0.052 ($5.173/100 = 0.0517$) units, while keeping other variables constant.

In the similar manner, Model 4 will be interpreted for all variables while keeping the influence of other variables constant. NMR, on average, will decrease the UENB by 0.233% due to 1 percent increase in itself. One percent increase in the GDP of the country will, on

average, decrease the unemployment of native born by 0.188%. Like in previous model, the interpretation of LWages will be; on average 1% increase in the LWages will decrease the UENB by 0.027 units. The interpretation of GEE will be similar to that of NMR. On average, 1% increase in GEE will decrease the UENB by 1.31%, while keeping other variables constant.

The interpretation of Model 5 is quite different from others because it includes an insignificant variable, gross national expenditure. It is interpreted that 1% increase in the net migration rate, on average, will decrease the unemployment rate of natives by 0.24% while keeping other variables constant. Similarly, on average 1% increase in the GDP will reduce the UENB by 0.179% while ignoring the impact of other variables. The 1% increase in the log of annual wages, on average, will dampen the unemployment rate of native residents by 0.025 units while keeping other variables constant. Like any other linear-linear model, 1% rise in GEE will significantly reduce the unemployment by 1.322% while keeping other variables constant. Lastly, on average, 1% increase in the GNE will have an insignificant positive impact on UENB. In the following table, these five models, based on cross-sectional time-series GLS regression, has been mentioned.

5.4 Discussion

The aim of this study is to evaluate the impact of net migration rate on the unemployment of natives in the host countries. The cross-sectional time-series GLS regression was run on the data of 16 OECD countries after performing the suitable diagnostic tests. Based on the final estimations, it is concluded that the net migration rate has a negative relationship with the unemployment rate of natives. The findings of this study confirmed the hypothesis that higher net migration rates are significantly and negatively associated with lower unemployment rates among native-born workers in OECD countries. This means that the selected economies have the ability to absorb the increasing number of immigrants while providing employment opportunities to both natives and immigrants. This inverse relationship, i.e., increase in net migration rate will lower the unemployment rate of natives down, is supported by the studies of Longhi et al. (2010), Tabellini (2018) and Kilic et al. (2019). Moreover,

like Kilic et al. (2019) and Gündoğmuş and Bayir (2021) the impacts of economic growth, average annual wages, government expenditure on education and gross national expenditure on unemployment rates have been analyzed as well. Similar to Okun's Law, a negative relation of GDP and unemployment has been observed in this study which is in accordance to many works like that of Miskolczi et al. (2012), Chamunorwa and Mlambo (2014) and Gündoğmuş and Bayir (2021).

Likewise, the estimation has also disclosed a negative influence of wages and education expenditure of government on the unemployment rates of natives. These results are assisted by the Efficient Wage Theory and Human Capital Theory, respectively. Efficient Wage Theory explains that higher wages stimulate the efficiency and productivity of workers. This will, in turn, benefit the employers greatly. Depending on the profits received, employers give bonuses and create more jobs which will reduce the overall unemployment rate, ultimately. On the other hand, Human Capital Theory explains the importance of education and human capital accumulation in controlling unemployment.

On the contrary to previous mentioned studies, there are also multiple studies which oppose the negative relation of immigration and unemployment of natives. Friedberg and Hunt (1995), Feridun (2005), Boubtane et al. (2013) and Gündoğmuş and Bayir (2021) explained in their works that there is no significant relationship between immigration and unemployment of domestic workers in the host countries. Similarly, some authors say that immigration might have an influence on unemployment in short run but in long run this influence evaporates (Islam, 2007; Damette and Fromentin, 2013; Latif, 2015). On the other hand, in the opposition of this study, Feridun (2004) and Dustmann et al. (2016) concluded the positive influence of immigration on unemployment which is in accordance to the common fear of people. Cohen (2017) has explained that this difference in nature of relation between international migration and unemployment of natives, in each study, is dependent on the varying policies in each country. Hence while formulating the policies for a country every aspect, including net migration rates, should be considered for better results.

The effects of immigration on OECD members differ substantially from one nation to another during both the distribution and impact

stages. Countries like Germany, Australia, and Canada demonstrate well-planned immigration approaches through their active selection methods, and these features lead them to obtain superior employment results for native residents and immigrant groups. These nations accept professionals with high qualifications while providing complete integration assistance to new residents. Countries with economic instability, such as Greece, Italy, and Spain, along with their reactive migration policies, demonstrate higher tension in receiving migrants. Greece's generous asylum policy toward Syrian refugees created labor market problems because its workforce absorption capacity remained low, which increased joblessness mostly among unskilled workers (Cohen, 2017). The conclusion of the study is presented in Figure 6.

6 Conclusion and policy recommendations

6.1 Conclusion

International migration has been sufficiently facilitated by the prevailing globalization around the world for years now. The growing integration of economies and labor markets provide the individuals with attractive incentives of stable financial source, better living standards and quality education. Apart from these "Pull" factor, escalating poverty, pervasive unemployment and unstable political systems "Push" the individuals towards international migration. However, this decision of migration has its own repercussions on the economy and culture of the host countries. The countries, with no precautionary policies for unbridled migration, might experience the fluctuations in labor market due to the sudden influx of foreign labor. The natives will have a tough competition with the immigrants for the limited employment opportunities and wages. Thus, the fear of immigrations originates from this.

In this study, the impact of international migration on the unemployment rate of natives has been empirically analyzed through panel GLS regression. The findings of this study confirm the hypothesis that higher net migration rates are significantly associated

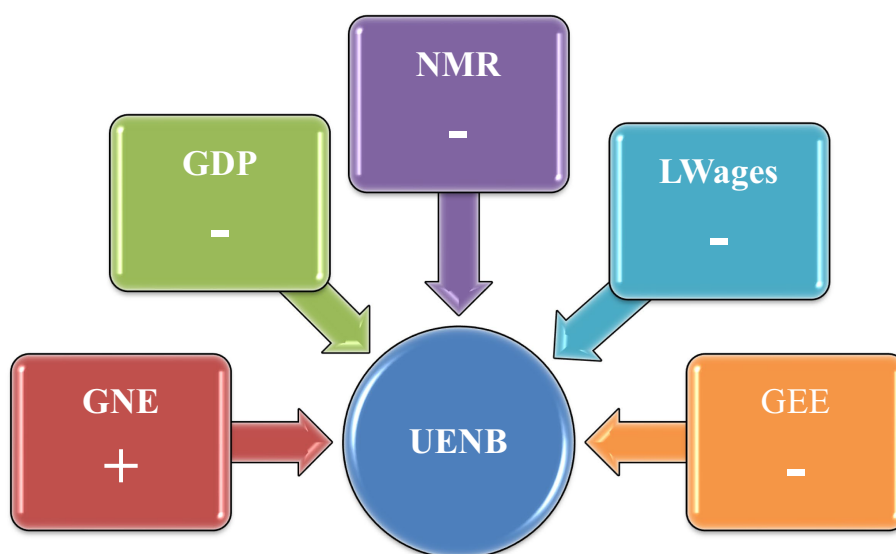


FIGURE 6

The graphical conclusion. Source: Author's construction.

with lower unemployment rates among native-born workers in OECD countries. This conclusion directly challenges the widespread assumption that immigrants take jobs away from natives. The estimation results of this study are both supported and opposed by the various studies and theories formulated by the economists. The supporting theories include Okun's Law, Wage Efficiency theory, Human Capital theory and Cumulative Causation theory. This study concludes that the increasing net migration rate has a significantly negative impact on the unemployment rates of native born in the host countries. Different percentages of the impact of net migration rate on the unemployment have been mentioned in the five models in Table 5. However, the impact of migration is not strictly homogeneous across countries. Cultural attitudes, policy structures, and labor market adaptability play a crucial role in shaping how immigration influences native unemployment. According to the model 5, net migration rate, GDP, wages and education expenditure by government have significant negative effect on the unemployment of domestic workers.

6.2 Policy recommendations

It is mandatory to develop a pragmatic balance between supporting migration and defending the interests of natives through policies. However, the effect of these policies is solely dependent on the characteristics and challenges faced by the host countries. The following are the recommendations for the countries to make the best out of immigration:

- Immigration in a country cannot be completely stopped without disturbing its international relations with other countries. Hence it is essential to keep the data regarding the migration up to date so data-driven policies can be introduced in timely manner. This data collection will keep the authorities on their toes to either introduce strict immigration prerequisites or create more employment opportunities.
- Furthermore, entrepreneurship among natives and foreigners should be actively encouraged so that there is constant supply of employment opportunities to counter the unemployment. This will have an additional influence on the economic growth of the countries.
- Proper wage policies should be effectively implemented which will ensure the suitable minimum wages for both natives and immigrants. Such policies will control the possible exploitation of both domestic and foreign laborers.
- Additionally, skill enhancing trainings along with language and cultural awareness programs should be made accessible for all immigrants so they can be integrated in a country easily. This will create strong social bonds among the public which will give the country a commendable outlook.

Likewise, anti-discriminatory policies should also be introduced by the authorities so the foreigners will not be alienated and disrespected by the natives. Tabellini (2018) has expressed the firm opposition of natives of USA to immigrants due to their cultural differences. To avoid this and ensure fair treatment for all, there is a crucial need to introduce anti-discriminatory regulations.

6.3 Future research directions

Future research would add additional detail about migratory groups based on their skill sets to establish which migrants predominantly influence native employment opportunities. Separating short-term from long-term effects would show how immigration influences labor markets as time passes, thus providing an understanding of transitional labor market changes. Future research should expand control variables to include institutional factors such as labor market regulations, demographic characteristics like age structure and population growth, union density, and welfare generosity. This will improve model robustness and explain cross-country variations in immigration effects.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

RM: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. Iman: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. SW: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. YA: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. VA: Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation. CF: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. MZ: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix

TABLE A List of selected OECD countries.

Australia	Canada	Hungry
Germany	Greece	Iceland
Ireland	Italy	Luxembourg
Netherlands	New Zealand	Norway
Spain	Sweden	United Kingdom
United States of America		