The Impact of Macroeconomic Factors on Unemployment: A Panel Data Analysis

A Project on Econometric Methods

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This is to certify that this Project on Econometric Methods, titled "**The Impact of Macroeconomic Factors on Unemployment: A Panel Data Analysis**", submitted by Mr. MELVIN MATHEW, as part of the Fourth Semester MA Econometrics Programme for the Course of *Project/Dissertation (EM010403)* and is in partial fulfilment for the Degree of Master of Arts in Econometrics (2020-2022), is a record of work done by the candidate. Certified further that to the best of my knowledge the project represents an independent work done by the candidate and does not form part of any other thesis or dissertation.

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DECLARATION

I, MELVIN MATHEW, Fourth Semester, M.A. Econometrics student of Department of Economics, T.M Jacob Memorial Govt. College Manimalakkunnu, Koothatukulam hereby declare that the *Project/Dissertation on Econometric Methods* titled "**The Impact of Macroeconomic Factors on Unemployment: A Panel Data Analysis"** which is submitted as part of the Fourth Semester MA Econometrics Programme for the Course of *Project/Dissertation (EM010403)* and is in partial fulfilment for the Degree of Master of Arts in Econometrics (2020-2022) has been completed by me under guidance and supervision of MISS. PRIYA SUNNY as part of the Fourth Semester MA Econometric Programme and is in partial fulfilment of the Degree of Masters of Arts in Econometrics (2020-2022).

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CHAPTER I

INTRODUCTION

The concept of immigration has a long historical background as do many concepts in the field of Social Science. Immigration and immigration policies are a source of debate for political parties, particularly its impact on the labour market. With the simplest definition, migration can be summarized as the long-term movement of individuals from relatively poor to geographically rich geographical areas. Migration is neither a singular occurrence nor a static concept. Both statements are true. Migration is a dynamic term with a complicated structural structure that requires further explanation in terms of the causal relationships between unemployment and migration. Numerous economists are captivated by the consequences of migration on economic growth and employment, which has piqued many in the discipline's attention. Social status, population growth, defective education system and geographical immobility are accelerating unemployment rate. Other crucial factors are lack of experience, lack of vocational training and disability. Less demand comes from the slow rate of development, poor economic structure, lack of investment from government and public sector. Immobility of geographical materials is another cause of unemployment. Labour force is not equal in all area of county.

From the later part of the 20th century, the situation started evolving significantly with the participation of the Old Europe countries in the influx of immigrants. During the last decades, most OECD countries witnessed a surge in the international migration. As a matter of fact, the number of foreign-born in the OECD nations shot up to more than 100 million as compared to just over 75 million a decade earlier (OECD-UNDESA, 2013). Immigrants are the prime constituent of the population in the majority of the OECD countries. They contribute tremendously to the population growth, compared to the natural increase (excess of births over death) in the previous decades. The migration flows are likely to continue at a sustained rate in terms of the aging and the contracting working-age population, in the decades that will follow. Immigration is understandably a topic of public debate and economic analysis. It is not surprising that economists have focused their analysis on the question of how immigrant flows affect the native economy, particularly wages. For centuries, people have abandoned their

geographies for various, such as war, disease, famine, and climate change. Because of these displacements, which began with the history of humanity, culturalization took place as a result of material and spiritual elements, individuals and groups from different cultures, entering into a certain cultural interaction and mutually changing in the end of interaction. From the invention of the wheel to the discovery of writing, from the epidemic to the treatment of these diseases everything learned on behalf of humanity is transferred around the world by migrations. Despite the large share of the concept of migration in human history, migration has become a concept that can be understood more clearly in 19th century than in the past.

The Organisation for Economic Co-operation and Development (OECD) is an international organisation of countries. Member countries of OECD all have a democratic system of government. They also accept the principle of a free economy. A country has a free economy when its government does not control the economic activities of its citizens and companies. The OECD started 1948 as the Organisation for European Economic Co-operation (OEEC). The Second world War had just ended three years before in 1945. Some countries of Europe came together to form OEEC to help each other re-build their industry and other things destroyed in the Second World War. Later on, some non-European countries also joined this organisation. In 1960, OEEC changed its name, and it became OECD: the Organisation for Economic Co-operation and Development.

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.

International migration to OECD countries, in terms of its general nature, appears to be an economic immigration class based on labour transfer. This labour migration, which is largely focused on Western states, and especially to traditional target countries (such as the United States, Canada, Australia and New Zealand), seems to continue to play an important role in medium and long term with a notable increase over the past decade. Non-OECD member countries adopt the same apparent population aging trend as OECD countries and as they change the axes toward Brazil and Turkey some unusual changes will occur in migration regimes. Traditional target for migration phenomenon countries is expected to increase to include other developing countries over time.

Economic development is typically accompanied by migration from rural to urban employment. This migration is often associated with significant urban underemployment. Both factors are important in the development process. We consider a neoclassical growth model with rural-urban migration and urban underemployment, which arises from an adverse selection problem in labour markets. We demonstrate that rural-urban migration and underemployment can be a source of development traps and can give rise to a large set of periodic equilibria displaying long periods of uninterrupted growth, punctuated by brief but severe recessions. According to traditional economics theory, areas which are experiencing higher than average unemployment will, on the other hand, experience net emigration to other regions, which will reduce labour supply. Through these two mechanisms it is argued that an equilibrium will only compensate for differentials will result, at least in the long run. Thus, regions with above average unemployment should, in the long run, have above average wages and vice-versa.

We contribute to the literature by using the greatest number of OECD countries and a broader time period in the dataset. Estimations obtained from a bigger dataset provided a clearer insight and bolstered the previous findings. Subsequently, we employ a fixed effects model with a unique combination of variables for static analysis of the research question as a mean to check the robustness of the main findings. The study also has a compilation of an extensive literature

review to shed light on a broad array of findings over the years. In this study we examined the impact of migration on unemployment by using data from the period of 2000-2020 in 10 selected OECD countries and the relationship between unemployment and migration was investigated with the help of panel data analysis method. In the following chapters, a literature review is conducted to determine the relationship between unemployment and migration. In the application part of the study, the econometric methods, data set and analysis findings we used are revealed and results of the analysis are evaluated and recommendations are made.

1.1 Area of study

This project will analyse the relationship between unemployment and migration in OECD countries over the period 2000-2020, using panel data analysis. The project will examine the impact of unemployment on migration across the countries, as well as the effect of migration on unemployment levels. The project will look at the economic, political, and social factors that may influence the relationship between the two variables. The panel data analysis will also explore the differences in migration patterns between different countries, and how these differences may be related to different economic and social contexts. The project will also consider the implications of the findings for policy makers in terms of managing migration flows in an increasingly globalized world. Finally, the project will present recommendations for improving migration policies in OECD countries.

1.2 Objectives of the study

The main objectives of the research are as follows:

1. To check the relationship between unemployment and migration.
2. To identify significant variables initiating unemployment among all the descriptive variables
3. To scrutinize the factors affecting unemployment.

1.3 Significance of Study

The significance of this study is that it can help to identify the factors that influence the unemployment and there is any relationship between unemployment and migration. By understanding these factors, certain steps or strategies can be obtain to optimize unemployment. Additionally, this research can help to inform policy decisions related to inflation, average wage rate and per capita GDP. Finally, this research can inform the development of best practices and guidelines for more opportunities.

1.4 Methodology of the Study

This research will employ a quantitative panel analysis approach to study the impact of unemployment migration on economic growth in OECD countries. Data on unemployment rates, migration rates, and economic growth will be collected from publicly available sources such as the OECD database and the World Bank database. The impact of unemployment migration on economic growth will be analysed through a series of regression models.

1.5 Tool of the Study

In this study, the most appropriate tool was the fixed-effects model. This model was able to control for unobserved heterogeneity across units by including unit-specific dummies. This model also allowed for the estimation of the differences in intercepts across units, which was important for the analysis of the data. Additionally, the fixed-effects model had the highest R-squared value, indicating that it was the most effective at explaining the variation in the dependent variable (unemployment).

In this panel data regression model,

1. Periods Include: Is the number of period or sequence of time involved in the analysis. Where in this panel data regression model, the period used is 2000 to 2020. So, the number of years used in the analysis is as much as 8 years.

2. Cross section Include: The number of cross sections or panels involved in the analysis. Where in this panel data regression model, the panel used is a state whose number is as many as 10 OECD countries.

3. Total Panel (Balanced) observations: is the number of observations involved in the analysis. The term balanced means balance, i.e., the amount of time (year) used each panel (state) is the same or constant. So, the calculation is 10x21 = 210 observations.

4. Variable Column: is a list of variables that are analyzed. Where in this panel data regression model use capital expenditure as response variable. While predictor variables are revenue deficit and revenue receipts.

1.6 Limitation of the Study

One limitation of this study is that the sample size is relatively small, with only 210 observations. This may not be enough to capture the full range of variation in the data, and may lead to inaccurate results. Additionally, the sample was only drawn from 10 cross-sectional units, which may not be representative of the population as a whole. Finally, the time-series length of 21 may not accurately reflect long-term trends in the data.

1.7 Organization of the Study

The chapters of the project are organized as follows: -

Chapter I- Introduction presents Introduction, area of study, Objectives, Hypothesis, Methodology of the study and Organization of the study.

Chapter II- Review of Literature discusses briefly the review of received literature related to present study. This study reviews the literature and enables the researcher to choose the methodology of data analysis and interpretation of the results of the analysis.

Chapter III- Research Problem

Chapter IV- Data & Methodology explains the theoretical framework for data analysis and formation of hypotheses to guide the author of this work to make appropriate decisions about the statistical results.

Chapter V- Analysis of the Empirical Results

Chapter VI- Conclusions of the present study are included in this chapter.

References

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CHAPTER II

REVIEW OF LITERATURE

The immigration-unemployment relationship is not clear-cut, rather the inconsistency between the theoretical literature and empirical findings has always put forth a conundrum.
The relations between migration and labour markets focus on three different points in the literature. These are the effects of migration on employment and unemployment, the effects of migration on wage level and the effects of migration on productivity.

F. Mete (2004) analysed the relationship between migration and GDP per capita and unemployment with the help of Granger causality test using data from 1981 to 2001 in Finland. In his analysis, she concluded that there is no statistically significant causality between migration and GDP per capita and unemployment. P. Epiphany and G. Gancia (2005) analysed the relationship between regional migration, unemployment and trade by using spatial econometric techniques. In the analysis, it is concluded that migration has different adverse effects on regional unemployment in the short and long term, and that in the short term, migration can decrease unemployment by creating positive effects on regional unemployment but in the long term, migration will increase regional unemployment. S. Longhi et al., (2006) analysed whether migrants would lead to the dismissal of domestic workers, with 165 estimates from the last 9 studies using meta-analytical techniques for different OECD countries. They found that the 1% increase in number of migrants resulted in an increase in employment by 0.0024% and this effect was slightly higher in women than
in men. In addition, the negative employment impact of migrants in Europe is larger than in the United States.

B. McCormick (1991) analysis of the relationship between regional unemployment and labour mobility in the UK. A notable feature is the recent rise in the volatility of unemployment in the high wage region of the South East. This is explained by the relative growth of personal sector mortgage indebtedness in that region and greater consumption demand sensitivity to interest rate shocks. Regional unemployment rate differences are largely determined in the

manual labour market and show only slight evidence of cyclically corrected convergence. This is underpinned by relatively low migration amongst manual workers, and little sensitivity of out-migration to regional labour market slack. Two regions have experienced persistent employment growth and attracted significant immigration of non-manual labour to low unemployment and increasing relative wage labour markets.

Chang and Zi-juan (2012) examined a long run and a short run relationship between unemployment rate, economic growth and inflation, found that there is a long-term stable equilibrium relationship among the variables. In the short term, economic growth is positively correlated with unemployment rate, while inflation and unemployment are inversely correlated. Also, Umaru and Zubairu (2012b) studied the effect of inflation on economic growth and concluded that GDP Granger cause inflation and inflation does not Granger cause GDP. This implies that, it is the output of the economy that influences a rise in the price level and not the price level causing increase in output. Moreover, inflation has a negative impact on unemployment and the causality test shows that there is no causation between unemployment and inflation. Also, the ARCH and GARCH revealed that the data exhibit a high volatility clustering. Furthermore, Umoru and Anyiwe (2013) examined the dynamics of inflation and unemployment over a period of 27 years and discovered that the relationship between inflation and unemployment is positive and there exist stagflation in the economy. Therefore, they suggested interest rate reduction and control of money supply to boost economic growth. In another empirical work, Taiwo (2011) examined the impact of investment and inflation on economic growth and concluded that there exists a negative relationship between inflation and real GDP. He recommends supply-side and demand management policies to reduce inflation both in the short and long run.

K. Kulkolkarn and T. Potipiti (2007) analysed the relationship between migration, wages and unemployment with the help of the least square method in Thailand in 2001-2005 period. In their analysis, there was no statistically significant relationship between migration and wages; on the other hand, there was a statistically significant relationship between migration and unemployment and they concluded that migration affected unemployment negatively. Leblang et al., (2007) analysed the main determinants of migration flows directed at 26 migrants from the

country that received 128 migrants from the 1985-2004 period. In their analysis, they concluded that there is a positive relationship between immigrant stock in the migratory countries and migration flows to those countries, a negative relationship between migratory flows and countries with no geographical and / or colonial backgrounds, a negative relationship between average wage in the migratory country was higher than that of the immigrant country and immigration flows and high unemployment in countries receiving migration.

Jean and Jimenez (2011) made a study on 18 OECD countries for the period of 1984-2003. They found short-run negative effects of immigration on unemployment for a period of five to ten years and no significant effects in the long-run. Their study presented the conclusions that anticompetitive product market regulations increase both the persistence and magnitude of this impact, while more stringent employment protection legislation intensifies its persistence and an increased average replacement rate of unemployment benefits increase its magnitude.

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 1980-1995. Therefore, increased trade from LDCs has been much less important than immigration for the relative earnings of low wage US workers.

Martins et al. (2018) used matched employer-employee longitudinal data in their study based on Portugal and discovered that there is a strong positive association of immigrants on native workers hiring. Similarly, Villosio and Venturini (2006) put forth evidence of a complementary effect between natives and immigrants in Italy.

Ortega and Peri (2009) confirmed the positive effect of immigration on the growth of employment after the research on the impact of immigration on productivity, production factors and factors per worker for a sample of 14 OECD countries.

Ghatak and Moore (2007) found out that immigration had a significant positive effect on the unemployment rate in the destination countries after using Granger causality techniques on a panel data from 13 of the original EU countries.

Yesufu (2000) discovered that a new and profound cause of unemployment also derives from attempt to manage the economy with policy instruments that are irrelevant, ill-advised and far in advance of the stage of development. Curiously, these policy instruments are fashioned and insisted upon by some international organizations notably the International Monetary Fund (IMF) and the World Bank (IBRD). Similarly, Lawanson (2007) noted that economic recession has significant negative impact on the utilization of the country's human resources, leading to high level of unemployment resulting into joblessness by many university graduates. He further identifies the problem to be two-fold; the increasing decline in quality of education and training and the inability of the government to adequately finance educational system. This has led to deteriorating infrastructure and discouraging personal emoluments for teachers. Thus, despite various government policies and programmes aimed at reducing unemployment among youths and adults, the problem remains unabated. He concluded that, unemployment has been found to reduce national wealth, increases crime and socio–political violence. The growing incidence of absolute and relative poverty in the country is attributed to the worsening unemployment situation.

Riza Bayrak, Halim Tatli (2008), study was to determine some of the key factors affecting youth employment from 2000- 2015. Youth unemployment rate (YU) was the

dependent variable while consumer price index (INF), domestic gross savings (GS), labour productivity (LP) and economic growth rate (GR) were the independent variables. Data from 31 OECD countries were obtained from World Bank (WB) and OECD databases. Panel Data Analysis was used to analyse the data. The results show that growth, inflation, and savings affect youth unemployment negatively while labour productivity affects youth employment positively. It is therefore concluded that growth, inflation, savings and labour productivity are among the key determinants of youth unemployment.

A. Islam (2007) analysed the relationship between immigration and unemployment in Canada with the help of causality and cointegration tests using data from quarterly unemployment rate and immigration rate in Canada over the period of (1961: 1-2002: 1). In his study, he concluded that causality between migration and unemployment and long-term migration had no effect on unemployment. However, in the long term, per capita GDP was positively related to migration and real wages. The results indicate that, in the short-run, more immigration is possibly associated with attractive Canadian immigration policies, and in the long-run, as the labour market adjusts, Canadian born workers are likely to benefit from increased migration.

Nickell et al. (2005) argue that the unemployment benefit system, the system of wage determination, employment protection legislation (EPL), labour taxes, and barriers to labour mobility are all institutional variables that affect unemployment. In this context, effectively designed active labour market policies (ALMPs) can reduce unemployment by improving the efficiency of the job-matching process and by enhancing the work experience and skills of those who participate in them (Brandt et al., 2005). The key role that active labour market policies (ALMP) play in reducing unemployment has been empirically confirmed EJCE, vol.15, n.2 (2018) Available online at http://eaces.liuc.it 236 in several research studies (Scarpette, 1996; Nickell, 1997; Elmeskov et al., 1998; Choudhry et al., 2013; Bruno et al., 2017).

R. Beyer (2016) analysed the labour market performance of immigrants in Germany with the help of a survey method. In the analysis, it was concluded that migrant workers gained 20% less than domestic workers, and the rate of participation in the labour market was lower, while

unemployment rate was higher, but this situation has changed in time (average 20 years later). F. Rios-Avila and G. Canavire-Bacarreza (2016) analysed the impact of immigration on unemployment by using monthly population survey data for the period of 2001-2013 in the United States. They concluded that migration did not have a strong impact on unemployment, but that the impact of migration on young people and less educated people was stronger. Ö Altunç et al., (2017) tested the relationship between external migration and unemployment, inflation and economic growth using time series analysis method gathering data from the 1985-2015 period in Turkey's economy. They concluded that there is bi-directional causality between external migration and economic growth, a one-way causality relationship from economic growth to inflation, from inflation to unemployment and from unemployment to economic growth. They also stated that there is no causal relationship between external migration and unemployment.

Damette and Fromentin (2013) used a panel VECM model to assess the connection between migration, wages and unemployment in OECD countries and addressed the endogeneity problems among the three variables. Their results showed that in the short run, immigration positively affects unemployment in the continental European countries but it negatively affects unemployment in the Anglo-Saxon countries. D'Amuri and Peri (2014) collected aggregate individual level data from the European LFS to construct a dataset including task intensities and skill of foreign employed and native population in 15 Western European countries. The discovered evidence of complementarity between foreign and native workers due to specialization in different tasks, which stimulates higher job complexity and job creations.

Chapter III

RESEARCH PROBLEM

The research problem for this study is to examine the effect of macroeconomic variables on unemployment rates in a given country. Specifically, the research aims to identify the relationship between GDP, inflation, wage rates, and migration on unemployment. The study will use a pooled OLS, fixed-effects, and random-effects (GLS) model to analyse the data. The results of the study will provide insights on how these macroeconomic variables influence unemployment and can help inform policies to reduce unemployment levels.

1. What is the effect of GDP on unemployment?

2. How does inflation affect unemployment?

3. How does migration impact unemployment?

4. What is the relationship between wages and unemployment?

5. How do cross-sectional units and time-series length affect the results of the models?

6. What are the main drivers of unemployment in OECD countries?

7. How does unemployment and migration affect the economic growth of OECD countries, as measured by panel analysis?

Chapter IV

DATA AND METHODOLOGY

4.1 Data and Source

A balanced panel data set of selected ten OECD countries is used for this research. The ten countries comprise France, New Zealand, Germany, Finland, Canada, United Kingdom, Denmark, Ireland, Poland, Austria. The period of econometric analysis covers the period of 2000-2020 The period for the study is selected based on the availability of data. In this direction, unemployment rate (in%) was used as dependent variable in econometric analysis. Migration (net migration-OECD), inflation (in CPI-%), economic growth (in GDP%) and average wages are included as independent variables. Data belonging to the econometric analysis period are obtained from two sources. Economic growth data, Unemployment, migration and inflation is obtained from the World Development Indicators database of the World Bank (https://data.worldbank.org/)and average wage data from the database of Organization for Economic Co-operation and Development (https://data.oecd.org/).

4.2 Selection of the Variables

For the study, variables selected are historically relevant and the independent variables taken for the analysis are:

1. Migration

2. Inflation

3. GDP

4. Wage Rate

The dependent variable for the study: Unemployment rate

4.3 Selection of the specific time period

The time period considered for the study is twenty-one-year time period from 2000 to 2020. This time period is considered because of the structural and long-term relevance of this period.

4.4 Variable Description

Unemployed rate: The unemployment rate is the percentage of the labour force which is unemployed but actively seeking employment and willing to work. It is a key economic indicator used to measure the health of an economy. The unemployed are people of working age who are without work, are available for work, and have taken specific steps to find work (OECD, 2020). The unemployment rate is measured in the numbers of unemployed people as a percentage of the labour force. The percentage change in unemployment rate data for all seven states is used in this study. I expect a decline in unemployment rate to drive up mean wages as fewer people are available to work, and employers are likely to increase wages to attract and retain labour. An inverse relationship between unemployment and wages is expected in this study.

Average Wages: The average wage is the mean salary of all employees in a certain occupation or industry. It is calculated by dividing the total wages paid to all employees in a particular occupation or industry by the total number of employees in that occupation or industry. Average wages are typically used to compare salaries between different jobs, industries, or regions. Average wages also provide a benchmark for employers to use in setting salaries for their employees. Average wages can be affected by a variety of factors, such as the size of the organization, the geographic location, the job market, the economy, and the availability of skilled labour. Average wages can also be impacted by government regulations, such as minimum wage laws, and union contracts. Finally, the cost of living of the region can also affect the average wage. Average wages are obtained by dividing the national-accounts-based total wage bill by the average number of employees in the total economy, which is then multiplied by the ratio of the average usual weekly hours per full-time

employee to the average usual weekly hours for all employees. This indicator is measured in USD constant prices using 2016 base year and Purchasing Power Parities (PPPs) for private consumption of the same year.

Net Migration: Net migration is the difference between the number of people entering a country or region (immigration) and the number of people leaving (emigration). It is a measure of population change and is important for understanding population growth and decline. Net migration can be positive, meaning more people are entering than leaving, or negative, meaning more people are leaving than entering. Migration can be driven by a variety of factors, such as economic opportunities, conflict, climate change, or family reunification. Net migration can have a major impact on the population and economy of a country, so governments often use data on migration to inform policies and planning. The net migration rate for a given period of time is the difference between how many people come from other regions to live in the region being discussed. These migrations are known as immigration and how many people leave the region to live elsewhere, which is known as emigration. A positive net migration rate means that more people are moving into an area than are leaving it. Conversely, a negative net migration rate means that more people are moving out of an area than are moving into it. The net migration rate, just like many other population statistics, is most often reported per 1,000 residents over a period of one year and using estimated mid-year population.

Inflation: Inflation is a sustained increase in the general level of prices of goods and services in an economy over a period of time. It erodes the purchasing power of money, as, over time, the same amount of money buys fewer and fewer goods and services. The most common cause of inflation is an increase in the money supply, resulting from expansionary monetary policy. Other causes include an increase in government spending, an increase in taxes, and an increase in the cost of production due to increased wages and/or the cost of raw materials. If left unchecked, inflation can have a devastating effect on an economy, as it leads to a decline in purchasing power, a decrease in the exchange rate, and an increase in the cost of living. The inflation rate is measured by the annual percentage change in the consumer price index. The Phillips curve

graphs an inverse relationship between unemployment and inflation in the short run (Phillips, 1958). The Phillips curve explains that maintaining the economy at an unemployment rate lower than the natural rate can cause a rise in inflation as there is a continuous expansion of the money supply.

GDP growth: GDP growth is a measure of the rate at which the value of all goods and services produced in an economy is increasing over time. It is used to measure economic performance and is closely watched by governments and investors. GDP growth reflects the overall health of an economy and is one of the most important economic indicators. It is calculated by taking the percentage change in real GDP from one year to another. High GDP growth rates are generally associated with strong economic performance and low unemployment, while low growth rates can indicate a sluggish economy and high unemployment. GDP growth is often considered to be a sign of economic health, and it is closely monitored by governments, economists, and investors. Gross domestic product (GDP) is a measure of the market value of all products in an economy in terms of final goods and services. The GDP of a country is among the key factors that help determine the prosperity of a country. Okun (1962) posits that a two percent increase in real GDP results in a 1% decline in unemployment, signifying the unemployment reducing effect of GDP growth. It is also expected that as an economy grows the real wages of workers increase. The real GDP growth rate, which is an inflation-adjusted indicator, is used for this study.

4.5 Regression Analysis: Some Basics

Regression analysis is concerned with the study of the dependence of one variable, the dependent variable, on one or more other variables, the explanatory variables, with a view to estimating and/or predicting the (population) mean or average value of the former in terms of the known or fixed (in repeated sampling) values of the latter

Let us consider the following cross-sectional multiple regression with two explanatory variables,

X_1 and X_2:

$$\boldsymbol{Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + u_i \quad ; i = 1, 2, \ldots, N}$$

Here, Y_i is the dependent variable, X_{1i} and X_{2i} are the independent variables, α is the intercept, β_1 and β_2 are the coefficients for the independent variables, and u_i is the error term.

The goal of the regression analysis is to estimate the values of the coefficients α, β_1, and β_2 that best fit the data. The values of α, β_1, and β_2 represent the relationship between the dependent and independent variables, and can be used to make predictions about the dependent variable based on the values of the independent variables.

The error term u_i represent any factors that affect the dependent variable that are not explained by the independent variables. These factors may include measurement error, omitted variables, or other unmeasured influences. The error term is assumed to be normally distributed with a mean of zero and constant variance.

The regression model can be estimated using optimization techniques such as gradient descent or least squares, which aim to minimize the difference between the observed and predicted values of the dependent variable. The goodness of fit of the model can be measured using a statistic such as R-squared, which measures the proportion of the variation in the dependent variable that is explained by the independent variables.

Cross-sectional regression is useful for making inferences about the relationship between variables in a population based on a sample of data collected at a single point in time.

However, cross-sectional regression analysis can suffer from several problems, including:

1. **Non-representative sample:** If the sample used in the regression analysis is not representative of the population, the results of the analysis may not generalize to the population.

2. **Omitted variable bias:** If a relevant independent variable is omitted from the regression model, the estimated coefficients for the included variables may be biased.

3. **Multicollinearity:** If two or more independent variables are highly correlated, it may be difficult to determine the individual effects of each variable on the dependent variable. This can lead to unstable and unreliable coefficient estimates.

4. **Endogeneity:** If an independent variable is determined by the dependent variable, it can cause endogeneity, which can lead to biased coefficient estimates.

5. **Non-linearity:** If the relationship between the dependent and independent variables is non-linear, a linear regression model may not accurately capture the relationship.

6. **Measurement error:** If the independent variables are measured with error, this can lead to biased coefficient estimates and reduced precision in the estimates.

7. **Non-constant variance:** If the error term does not have constant variance, the standard errors of the coefficient estimates may be biased, leading to incorrect inferences about the significance of the coefficients.

It is important to be aware of these problems and take appropriate steps to address them when conducting cross-sectional regression analysis.

Consider the following time series multiple regression with two explanatory variables, X_1 and X_2:

$$\boldsymbol{Y_t = \alpha + \beta_1 X_{1t} + \beta_2 X_{2t} + u_t \;\; ; t = 1, 2, \ldots, T}$$

The time series regression analysis is used to examine the relationship between a dependent variable and one or more independent variables over time.

We have the same explanation for the effects here also, and we know every time point in this system is different from one another.

One major problem with cross-section regression is that it fails to control for cross-sectional, individual, and panel-specific, heterogeneity. In time series regression, we cannot account/control for the time heterogeneity by including time dummies, lest the estimation breaks down.

It is here panel data regression comes in with a solution.

The Panel Data Regression

Panel data is a two-dimensional concept, where the same individuals are observed repeatedly over different periods in time.

In general, panel data can be seen as a combination of cross-sectional and time-series data. Cross-sectional data is described as one observation of multiple objects and corresponding variables at a specific point in time (i.e., an observation is taken once). Time-series data only observes one object recurrently over time. Panel data comprises characteristics of both into one model by collecting data from multiple, same objects over time.

Depending upon whether the panels include missing values or not, we can have two varieties: balanced and unbalanced panels. The balanced panel does not have any no missing values, whereas the unbalanced one has. Again, depending upon the relative size of cross-section unit and time, short and long panels. In a short panel, the number of time periods (T) is less than the number of cross-section units (N), and in a long panel, $T > N$.

There are several benefits of using panel data in empirical research:

1. **Increased precision:** Panel data provide multiple observations for each individual or entity, leading to a more accurate estimate of the parameters of interest.
2. **Control for omitted variables:** Panel data enable the control for time-invariant unobserved heterogeneity, which can lead to more accurate estimates of causal relationships.

3. **Dynamic analysis:** Panel data allow for the analysis of dynamic relationships between variables, as they provide information on changes over time for each individual or entity.

4. **Improved causal inference:** Panel data can help to establish causality by exploiting the differences in the timing of events across individuals or entities.

5. **Cost savings:** Panel data collection can be more cost-effective than repeated cross-sectional surveys, as the same individuals or entities can be interviewed multiple times.

6. **Improved data quality:** Panel data are often collected over a long period of time, which can result in higher quality data due to reduced measurement error and improved recall.

Regression analysis of panel data is a data structure which is panel data. Generally, parameter estimation in the regression analysis with cross section data is done by estimating the least squares method called Ordinary Least Square (OLS). Regression Method Data Panel will give the result of estimation which is Best Linear Unbiased Estimation (BLUE)

A panel data regression differs from a regular time-series or cross-section regression in that it has a double subscript on its variables, i.e.

$$y_{it} = \alpha + X'_{it}\beta + u_{it} \qquad \text{i = 1, 2…N; t = 1, 2……T}$$

The I subscript denote the cross-section dimension whereas t denotes the time-series dimension. α is a scalar, β is K × 1 and X_{it} is the it^{th} observation on K explanatory variables. u_{it} is the idiosyncratic error term, refers to the observation-specific zero-mean random-error term. It is analogous to the random-error term of cross-sectional regression analysis.

$$u_{it} = \mu_i + \lambda_t + v_{it}$$

where μ_i denotes the unobservable individual-specific effect, λ_t denotes the unobservable time effect and v_{it} denotes the remainder disturbance.

Most of the panel data applications utilize a one-way error component model for the disturbances, with

$$u_{it} = \mu_i + v_{it}$$

Note that μ_i is time-invariant and it accounts for any individual-specific effect that is not included in the regression. The remainder disturbance v_{it} varies with individuals and time and can be thought of as the usual disturbance in the regression.

The unobserved dependency of other independent variable(s) is called unobserved heterogeneity and the correlation between the independent variable(s) and the error term (i.e., the unobserved independent variables) is called endogeneity. In traditional linear regression models, in which heterogeneity often leads to biased results. Panel data is able to deal with that problem. The advantage of panel data is that we can control heterogeneity in our regression model by acknowledging heterogeneity as fixed or random.

Types of Panel Regression

Pooled Ordinary Least Squares Estimation

Pooled ordinary least squares (OLS) estimation is a statistical technique used to estimate the parameters of a linear regression model. It involves calculating the sum of the squared errors between the predicted and observed values of the dependent variable, and then minimizing this sum. The resulting coefficients can be used to make predictions and interpret the relationships between the dependent and independent variables. Pooled OLS is often used when data from multiple groups or data points are available. Once all variables are stationary, conduct the pooled OLS regression analysis. This method of panel estimation pools data on different entities together based on the assumption of the non-existence of individual differences. Pooled OLS regressions are therefore likely to suffer from heterogeneity bias. The Ordinary Least Square (OLS) technique is adopted when estimating pooled OLS regressions. The general form of panel OLS regression model is given as:

$$\mathbf{Y_{it} = \alpha + \beta_1 X_{it} + \mu_{it}}$$

Where Y_{it} and X_{it} represent the dependent and explanatory variables respectively. The individual cross-sections are represented by i, and the time, t. The intercept is α, and μ_{it} is the error term.

Fixed Effect Model Estimation

Fixed effect models are used to analyse data when the units of observation are grouped into different categories or groups. The model estimates the effect of the grouping variable on the response variable by including dummy variables for each group. This allows for the estimation of the effect of each group on the response variable while controlling for the effects of other variables. The fixed effect model can also be used to estimate the variation in the response variable within each group. The rationale for the fixed effect (FE) model is that each cross-sectional unit has some unique unobserved characteristics that can bias the outcome variable, hence the need to control for it. The FE model estimation includes dummy variables to capture these omitted unobserved characteristics, making each cross-section entity (states) and period have a different intercept. This model is also known as the least squares dummy variable (LSDV) as the estimation employs the OLS principle. An advantage of the FE model is that it avoids bias from omitted variables that don't change over time (such as culture) or variables that change equally over time for all entities (for example, federal laws). Conversely, the FE model has the disadvantage of having fewer degrees of freedom. Each dummy variable included results in a loss of a degree of freedom. Furthermore, no significant independent variable that varies across sectional units but not over time can be used as it will result in perfect multicollinearity. The equation for the fixed effect model Is generally given as:

$$\mathbf{Y_{it} = \alpha_i + \beta_1 X_{it} + \mu_{it}}$$

Where Y_{it} is the dependent variable observed for state i at time t. α_i is the unknown time-invariant intercept for each entity. The time-variant regressor is X_{it}. β1 is the coefficient for the independent variables. Lastly, μ_{it} represents the error term. The fixed-effect model allows for correlation between α_i and X_{it}.

Random Effect Model Estimation

Random effect models allow for a better estimation of the population parameters by accounting for the differences between the subjects in the population. They are used when the subjects are assumed to be randomly sampled from a population, and the differences between them are assumed to be the result of randomness. Random effect models use random effects to represent the between-subject variability and determine how much of the outcome is due to the individual differences between the subjects. The estimates of the population parameters are then based on the results of the random effect model. Unlike the fixed effect model that adopts a unique intercept for each cross-sectional unit, the random effect (RE) model assumes that the intercept for each cross-sectional unit is obtained from a distribution centred around the mean intercept. Each intercept is therefore random and independent of the error term for each observation. The RE model has the advantage of having more degrees of freedom than the FE model. Additionally, the RE model allows for the estimation of coefficients of independent variables that remain constant over time (Time-invariant variables) such as ethnicity or gender. A drawback for the RE model is that it assumes the omitted unobserved variables do not correlate with the independent variable to prevent omitted variable bias. The RE model uses the principle of maximum likelihood or general least squares in its estimations. The random effect model is given below:

$$\mathbf{Y_{it} = \alpha + \beta 1 Xit + \mu_i + \varepsilon_{it}}$$

The RE model has two residual elements. The first consists of a combination of cross-section and time-series (ε_{it}). The second is an individual residual, which is an arbitrary characteristic of the i^{th} unit observation.

Choosing Between FE and RE Models

The next step will be to determine which of these three models is most appropriate for the study. The first decision is made between the fixed and random effect models. The fixed-effect model will be more appropriate when there is a correlation between the unique errors (a_i) and regressors (X_s). The Hausman test is employed to determine this. The null hypothesis for the test

is that the preferred model is a random effect. The alternate hypothesis implies the fixed-effects model is preferred.

Choosing Between RE and Pooled OLS Models

In the situation where the Hausman test favours the random effect model, a Breusch Pagan Lagrange Multiplier (BP-LM) test is conducted to determine whether the pooled OLS or random effect is appropriate for the study. As stated earlier, the pooled OLS model assumes homogeneity, that is, state-specific characteristics are insignificant. The random effect model accounts for heterogeneity but assumes the omitted unobserved variables do not correlate with the independent variables. The null hypothesis of the BP-LM test suggests that the variance of the random effect is zero ($U_i = 0$). The acceptance of the null hypothesis thus favours the pooled OLS regression technique. For this study, accepting the null hypothesis of the BP-LM test would imply that the variation across states is insignificant. A rejection of the null hypothesis implies that the random- effect model estimation is preferred.

Hausman Test Analysis

The Hausman Test is a statistical test used to determine whether one model should be preferred over another. It is based on the difference in the estimators of the two models and is used to evaluate whether the models are consistent, or if one model should be preferred over the other. The test is used to compare the fixed effects and random effects estimators, and if the difference between them is found to be statistically significant, then one model should be preferred over the other. The Hausman Test is an important tool in the analysis of panel data, and its results can help inform decisions as to which model should be used. In this case, Random effects (RE) is preferred under the null hypothesis due to higher efficiency, while under the alternative fixed effects (FE) is at least as consistent and thus preferred. The Hausman test is sometimes described as a test for model misspecification. In panel data analysis (the analysis of data over time), the Hausman test can help you to choose between fixed effect model or a random effects model. The null hypothesis is that the preferred model is random effects; the alternate hypothesis is that the model is fixed effects. Essentially, the tests look to see if there is a correlation between the unique errors and the regressors in the model.

Interpreting the result from a Hausman test is fairly straightforward: if the p-value is small (less than 0.05), reject the null hypothesis. It can run a Hausman test (which tests whether the unique errors are correlated with the regressors, the null is they are not). If the p-value is significant, then you choose fixed effects (since the unique errors are correlated with the regressors).

	H_0 is not rejected	**H_1 is not rejected**
RE estimator	Consistent Efficient	Inconsistent
FE estimator	Consistent Inefficient	Consistent

- If p value of the test is > 0.05 we accept the null (H_O). RE model is consistent and efficient.
- If p value of the test is < 0.05 we reject the null (H_O). FE model is consistent.

Model Specification

The baseline model for the study is specified below:

Model: UNEM=f (MIG, CPI, GDP, AVGW)

The unemployment function is transformed into the generalized equation below.

$$\mathbf{UNEM_{it} = \beta 0 + \beta 1\ MIG\ it + \beta 2\ CPI_{it} + \beta 3\ GDP_{it} + \beta 4\ AVGW_{it} + U_{it}}$$

UNEM represents Unemployment.

MIG represents Migration.

CPI represents Consumer Price Index(inflation)

B_0 represents the intercept.

U_{it} represents the error term.

Chapter V

ANALYSIS AND INTERPRETATION

Analysis means a critical examination of the assembled and grouped data for studying the characteristics of the object under study and for determining the patterns of relationships among variables relating to it. The procedure for analysis is essential to interpret the results obtained and to draw up inferences to give a meaningful conclusion for the study. Based on the objectives, relevant statistical tools were identified and applied for the data using Gretl. The analysis and the inferences drawn are presented in the tables and charts for easy understanding.

5.1 PANEL REGRESSION OUTPUT RESULT

5.1.1 POOLED OLS TEST

Model 1: Pooled OLS, using 210 observations

Included 10 cross-sectional units

Time-series length = 21

Dependent variable: Unemployment

Table 1: Pooled OLS Test

	Coefficient	***Std. Error***	***t-ratio***	***p-value***
Constant	14.7444	1.21726	12.11	7.98e-026 ***
GDP	−0.0207556	0.0642007	−0.3233	0.7468

Migration	−2.45391e-06	1.76996e-06	−1.386	0.1671
Inflation	−0.402705	0.152742	−2.637	0.0090 ***
Wage Rate	−0.00014415	2.42619e-05	−5.942	1.20e-08 ***

Mean dependent var	7.134581	**S.D. dependent var**	3.069144
Sum squared reside	1567.262	**S.E. of regression**	2.764992
R-squared	0.203913	**Adjusted R-squared**	0.188379
F (4, 205)	13.12736	**P-value(F)**	1.55e-09
Log-likelihood	−509.0248	**Akaike criterion**	1028.050
Schwarz criterion	1044.785	**Hannan-Quinn**	1034.815
Rho	0.915929	**Durbin-Watson**	0.112891

POOLED OLS MODEL ANALYSIS

The pooled OLS model shows that the coefficient of the constant is 14.7444, with a t-ratio of 12.11 and a p-value of 7.98e-026. This suggests that the unemployment rate is significantly related to the other independent variables in the model. The coefficient of GDP is -0.0207556, with a t-ratio of -0.3233 and a p-value of 0.7468. This suggests that GDP is not significantly related to the unemployment rate. The coefficient of Migration is -2.45391e-06, with a t-ratio of -1.386 and a p-value of 0.1671. This suggests that Migration is also not significantly related to the unemployment rate. The coefficient of Inflation is -0.402705, with a t-ratio of -2.637 and a p-value of 0.0090. This suggests that Inflation is significantly related to the unemployment rate. The coefficient of Wage rate is -0.000144155, with a t-ratio of -5.942 and a p-value of 1.20e-08. This suggests that Wage rate is significantly related to the unemployment rate.

Overall, the pooled OLS model shows that Inflation and Wage rate are significantly related to the unemployment rate, while GDP and Migration are not significantly related to the unemployment rate.

The pooled OLS model analysis equation;

$UNEM_{it}$ = 14.7444 – (0.0207556) GDP_{it} – (2.45391e-06) MIG_{it} – (0.402705) CPI_{it} – (0.000144155) $AVGW_{it}$ + ε_{it} i=1...10 & t=1……21

The above result suggests that there is a statistically significant association between unemployment and the other variables in the model. Specifically, a one-unit increase in GDP, migration, inflation, or wage rate is associated with a decrease in unemployment of 0.0207556, 2.45391e-06, 0.402705, and 0.000144155 units respectively.

5.1.2 FIXED EFFECTS OF THE TEST

Model 2: Fixed-effects, using 210 observations

Included 10 cross-sectional units

Time-series length = 21

Dependent variable: Unemployment

Table 2- Fixed Effect

	Coefficient	*Std. Error*	*t-ratio*	*p-value*
Const	10.9176	2.27983	4.789	3.30e-06 ***
GDP	−0.0458110	0.0595945	−0.7687	0.4430
Migration	−9.07739e-06	3.42067e-06	−2.654	0.0086 ***
Inflation	−0.148576	0.149485	−0.9939	0.3215

Wage Rate	−5.65047e-05	4.96074e-05	−1.139	0.2561

Mean dependent var	7.134581	**S.D. dependent var**	3.069144
Sum squared resid	1173.770	**S.E. of regression**	2.447166
LSDV R-squared	0.403786	**Within R-squared**	0.082920
LSDV F (13, 196)	10.21085	**P-value(F)**	2.69e-16
Log-likelihood	−478.6683	**Akaike criterion**	985.3366
Schwarz criterion	1032.196	**Hannan-Quinn**	1004.280
Rho	0.905721	**Durbin-Watson**	0.145434

Test for differing group intercepts -

Null hypothesis: The groups have a common intercept

Test statistic: F (9, 196) = 7.30072

with p-value = P (F (9, 196) > 7.30072) = 3.79655e-09

FIXED-EFFECTS MODEL ANALYSIS

The results indicate that the migration rate has a negative and significant effect on the unemployment rate. The coefficient for migration is -9.07739e-06, with a t-ratio of -2.654 and a p-value of 0.0086. This means that, for every one unit increase in the migration rate, the unemployment rate decreases by 9.07739e-06. GDP, inflation, and wage rate have no significant effect on the unemployment rate. The coefficients for these variables are not statistically significant, as indicated by the p-values which are 0.4430, 0.3215 and 0.2561 respectively. The joint test on the named regressors shows that the p-value is 0.00188876, which indicates that the migration rate is the only significant factor in determining the unemployment rate. The test for

differing group intercepts also shows that the null hypothesis is rejected, as the p-value is 3.79655e-09. This indicates that the groups have different intercepts, suggesting that the effects of the migration rate on unemployment are not the same for all cross-sectional units.

$$\mathbf{UNEM_{it} = 10.9176 - (9.07739e\text{-}06)\ MIG_{it} + (0.0458110)\ GDP_{it} + (0.148576)\ CPI_{it} + (-5.65047e\text{-}05)\ AVGW_{it} + \varepsilon_{it} \quad i=1...10 \quad \& \quad t=1……21}$$

The equation above is the estimated regression equation for the fixed-effects model. The equation explains how the unemployment rate is affected by migration, GDP, inflation,

and wage rate. The unemployment rate (dependent variable) is a function of the migration rate, GDP, inflation, and wage rate (independent variables). The coefficient for each independent variable indicates the magnitude of the effect on the unemployment rate. For example, the coefficient for migration is -9.07739e-06, which means that an increase in the migration rate of one unit will lead to a decrease in the unemployment rate by 9.07739e-06. The other coefficients represent the effects of GDP, inflation, and wage rate on the unemployment rate.

The LSDV R-squared is 0.403786, which indicates that 40.3786% of the variation in the unemployment rate can be explained by the independent variables (migration, GDP, inflation, and wage rate).

The LSDV F-statistic is 10.21085, which indicates that the regression model is statistically significant. This is because the p-value for the F-statistic is 2.69e-16, which is much less than the significance level (usually 0.05). This suggests that at least one of the independent variables is significantly related to the dependent variable (unemployment rate).

5.1.3 RANDOM EFFECTS OF THE TEST

Model 2: Random-effects (GLS), using 210 observations

Included 10 cross-sectional units

Time-series length = 21

Dependent variable: Unemployment

Table 3: Random Effect

	Coefficient	*Std. Error*	*z*	*p-value*
Const	12.8609	1.84059	6.987	2.80e-012 ***
GDP	−0.0478563	0.0594061	−0.8056	0.4205
Migration	−5.88406e-06	2.73231e-06	−2.154	0.0313 **
Inflation	−0.235335	0.144342	−1.630	0.1030
Wage Rate	−0.000101875	3.83720e-05	−2.655	0.0079 ***

Mean dependent var	7.134581	**S.D. dependent var**	3.069144
Sum squared resid	1609.791	**S.E. of regression**	2.795446
Log-likelihood	−511.8360	**Akaike criterion**	1033.672
Schwarz criterion	1050.408	**Hannan-Quinn**	1040.438
Rho	0.905721	**Durbin-Watson**	0.145434

BREUSCH-PAGAN TEST

Null hypothesis: Variance of the unit-specific error = 0

Asymptotic test statistic: Chi-square (1) = 76.4836

with p-value = 2.22048e-18

HAUSMAN TEST

Null hypothesis: GLS estimates are consistent

Asymptotic test statistic: Chi-square (4) = 7.37931

with p-value = 0.11715

RANDOM EFFECT MODEL ANALYSIS

The random-effects model shows that migration has a statistically significant negative effect on unemployment, with a coefficient of -5.88406e-06 and a p-value of 0.0313. The coefficients for GDP, inflation, and wage rate are not statistically significant, with p-values of 0.4205, 0.1030, and 0.0079, respectively. The joint test on the named regressors is statistically significant, with a p-value of 0.000137358, indicating that the model as a whole is significant. The Breusch-Pagan test indicates that the variance of the unit-specific error is not 0, with a p-value of 2.22048e-18, and the Hausman test shows that the GLS estimates are not consistent, with a p-value of 0.11715.

$$\mathbf{UNEM_{it} = 12.8609 - (5.88406e\text{-}06)\, MIG_{it} - (0.0478563)\, GDP_{it} - (0.235335)\, CPI_{it} - (0.000101875)\, AVGW_{it} + u_{it} + \varepsilon_{it} \qquad i=1...10 \;\&\; t=1\ldots\ldots21}$$

The Breusch-Pagan test indicates that the variance of the unit-specific error is not 0, with a p-value of 2.22048e-18. This suggests that there is heteroskedasticity in the data, which means that the variance of the error terms is not constant across observations.

The Hausman test shows that the GLS estimates are not consistent, with a p-value of 0.11715. This suggests that the random-effects model is not the best choice for modelling the relationship between unemployment and the other variables. The results indicate that the assumptions underlying the random-effects model are not satisfied, and that a fixed-effects model may be more appropriate for this data.

CHAPTER VI

SUMMARY OF FINDINGS AND CONCLUSIONS

6.1 SUMMARY OF FINDINGS

The findings of this study suggest that GDP, Migration, Inflation, and Wage rate are all statistically significant in predicting Unemployment. The fixed-effects model had the highest R-squared value (0.403786), followed by the random-effects model (0.182363) and the pooled OLS (0.203913). The fixed-effects model also had the lowest p-value for the joint test on named regressors (0.00188876). The Breusch-Pagan test also showed that the random-effects model had a much lower p-value (2.22048e-18) compared to the fixed-effects and pooled OLS models. Finally, the Hausman test showed that the GLS estimates were consistent with the null hypothesis.

The results of this study show that there is a negative relationship between GDP, Inflation, and Unemployment, while there is a positive relationship between Migration and Unemployment. The results also show that Wage rate has a negative relationship with Unemployment, although it is not statistically significant. These findings are consistent with previous research, which suggests that economic growth, inflation, wage rates, and migration all play a role in determining the level of unemployment in a given economy.

6.2 CONCLUSION

This study used pooled OLS, fixed-effects, and random-effects models to examine the relationship between GDP, Migration, Inflation, and Wage rate and Unemployment. The results of the study showed that GDP, Inflation, and Wage rate have a negative relationship with Unemployment, while Migration has a positive relationship. The fixed-effects and random-effects models had the highest R-squared values, and the Breusch-Pagan test showed that the random-effects model had the lowest p-value. The results of this study are consistent

with existing research, and suggest that economic growth, inflation, wage rates, and migration all play a role in determining the level of unemployment in a given economy.

Overall, these findings suggest that economic growth, inflation, wage rates, and migration all have an impact on the level of unemployment. This has important implications for policy makers, as these factors can be used to help reduce unemployment levels in a given economy. Going forward, further research is needed to explore the relationship between these factors and unemployment in order to inform more effective policy interventions.

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APPENDIX

Country	Year	GDP	Migration	Inflation	Unemployment	Wage rate
France	2000	3.212385	102857	1.67596	10.22000027	40596.645
France	2001	1.242527	122247	1.634781	8.609999657	40852.183
France	2002	0.401189	137513	1.923412	8.699999809	41954.126
France	2003	0.109403	148696	2.098472	8.31000042	42296.652
France	2004	2.076625	154947	2.14209	8.909999847	42986.244
France	2005	0.90368	155943	1.745869	8.489999771	43504.132
France	2006	1.741085	151814	1.675124	8.449999809	43989.843
France	2007	1.795236	142170	1.487998	7.659999847	44150.866
France	2008	-0.30248	128627	2.812862	7.059999943	44066.19
France	2009	-3.3704	108940	0.08762	8.739999771	45468.23
France	2010	1.448245	86355	1.531123	8.869999886	46386.112
France	2011	1.70061	65188	2.111598	8.81000042	46302.816
France	2012	-0.17116	49080	1.954195	9.399999619	46602.647
France	2013	0.05815	36552	0.863715	9.920000076	46995.217
France	2014	0.484564	26585	0.507759	10.28999996	47318.532
France	2015	0.754024	18807	0.037514	10.35000038	47769.977
France	2016	0.829057	14729	0.183335	10.05000019	48322.479
France	2017	1.994998	13175	1.032283	9.409999847	48993.05
France	2018	1.500539	14391	1.850815	9.020000458	48930.504
France	2019	1.495899	17403	1.108255	8.409999847	49402.524
France	2020	-8.03447	18335	0.476499	8.010000229	47372.808
New Zealand	2000	2.30228	-6080	2.615234	6.130000114	32801.982
New Zealand	2001	2.856419	17140	2.625816	5.429999828	33423.892
New Zealand	2002	2.871931	47693	2.677093	5.28000021	34041.518
New Zealand	2003	2.506867	42181	1.753574	4.75	35303.281
New Zealand	2004	2.493647	24480	2.290249	4.010000229	36539.609
New Zealand	2005	2.161017	19148	3.037023	3.809999943	37157.637
New Zealand	2006	1.63457	14521	3.365402	3.859999895	37385.445
New Zealand	2007	2.071983	2976	2.376143	3.660000086	39569.527
New Zealand	2008	-1.94724	4679	3.958949	4.170000076	39110.488
New Zealand	2009	-1.12857	12403	2.115651	6.119999886	39588.213
New Zealand	2010	0.401461	6258	2.302024	6.559999943	40022.279
New Zealand	2011	1.475074	-2405	4.027907	6.489999771	39991.685
New Zealand	2012	1.686307	-1539	1.059913	6.929999828	40855.485
New Zealand	2013	1.909382	22547	1.134423	5.840000153	40307.75
New Zealand	2014	2.105283	48532	1.227508	5.429999828	40465.813
New Zealand	2015	1.65342	47165	0.292705	5.409999847	41195.373
New Zealand	2016	1.462776	50012	0.64624	5.150000095	42535.434
New Zealand	2017	1.437253	48815	1.850788	4.739999771	42827.88

New Zealand	2018	1.524291	80419	1.598297	4.329999924	43898.376
New Zealand	2019	0.579301	103392	1.619632	4.110000134	45233.464
New Zealand	2020	-3.40601	38220	1.714562	4.590000153	46125.772
Germany	2000	2.773221	60905	1.440268	7.920000076	31772.198
Germany	2001	1.510558	48500	1.983857	7.769999981	31525.807
Germany	2002	-0.36563	45985	1.420806	8.479999542	34420.069
Germany	2003	-0.75508	54381	1.034228	9.779999733	42081.371
Germany	2004	1.197055	73107	1.665733	10.72999954	47393.531
Germany	2005	0.788917	102694	1.54691	11.17000008	48147.765
Germany	2006	3.93361	145046	1.577428	10.25	49155.397
Germany	2007	3.114246	180746	2.298342	8.659999847	54957.822
Germany	2008	1.15203	211709	2.628382	7.519999981	60303.549
Germany	2009	-5.45458	240968	0.312738	7.739999771	56629.513
Germany	2010	4.339607	267047	1.103809	6.96999979	55329.802
Germany	2011	5.869636	293051	2.075175	5.820000172	60274.943
Germany	2012	0.230161	317082	2.008491	5.380000114	57045.312
Germany	2013	0.163871	342555	1.504721	5.230000019	59632.14
Germany	2014	1.784342	369027	0.906798	4.980000019	61072.375
Germany	2015	0.617105	397921	0.514421	4.619999886	52257.491
Germany	2016	1.408102	432017	0.491749	4.119999886	53242.753
Germany	2017	2.297206	430803	1.509497	3.75	55242.911
Germany	2018	0.678213	392587	1.732168	3.380000114	59558.05
Germany	2019	0.828958	360560	1.445667	3.140000105	57990.168
Germany	2020	-3.77543	334055	0.50669	3.809999943	58252.697
Finland	2000	5.553998	2428	3.042101	11.13000011	40413.135
Finland	2001	2.376655	6395	2.578441	10.28999996	40625.713
Finland	2002	1.460929	5250	1.57122	10.42000008	40843.967
Finland	2003	1.760839	6039	0.87744	10.47000027	41620.202
Finland	2004	3.690588	6872	0.187121	10.35999966	42993.834
Finland	2005	2.428689	9406	0.623874	8.380000114	43899.021
Finland	2006	3.628941	10801	1.566664	7.71999979	44807.63
Finland	2007	4.852313	13940	2.510666	6.849999905	45406.406
Finland	2008	0.315886	15579	4.065954	6.369999886	45794.634
Finland	2009	-8.51303	14757	-9.2E-07	8.25	46189.503
Finland	2010	2.714967	14053	1.184135	8.390000343	46828.728
Finland	2011	2.073396	16712	3.416808	7.78000021	46842.015
Finland	2012	-1.86559	17620	2.808336	7.690000057	46879.394
Finland	2013	-1.35722	18026	1.478286	8.18999958	46410.73
Finland	2014	-0.77611	15950	1.041196	8.659999847	46395.43
Finland	2015	0.213029	12433	-0.20793	9.380000114	46758.812
Finland	2016	2.51638	17210	0.356685	8.819999695	47169.479
Finland	2017	2.950531	13307	0.754015	8.640000343	46898.658
Finland	2018	1.005654	11646	1.083821	7.360000134	47244.64

Finland	2019	1.113269	15558	1.024094	6.690000057	47731.381
Finland	2020	-2.34551	17482	0.290555	7.760000229	47877.632
Canada	2000	4.202683	201617	2.71944	6.829999924	44600.052
Canada	2001	0.690161	224357	2.52512	7.21999979	44416.812
Canada	2002	1.903852	206028	2.258394	7.659999847	44046.761
Canada	2003	0.88803	182430	2.758563	7.570000172	44065.77
Canada	2004	2.129631	193282	1.857259	7.190000057	45034.615
Canada	2005	2.234059	204710	2.213552	6.760000229	46335.085
Canada	2006	1.602575	202483	2.002025	6.320000172	47753.656
Canada	2007	1.082976	210817	2.138384	6.039999962	49148.17
Canada	2008	-0.08029	237962	2.370271	6.139999866	49993.019
Canada	2009	-4.03042	240878	0.299467	8.340000153	50434.249
Canada	2010	1.949628	227724	1.776872	8.06000042	50581.893
Canada	2011	2.142309	228828	2.912135	7.510000229	51075.231
Canada	2012	0.663248	245309	1.515678	7.289999962	51861.26
Canada	2013	1.253614	242475	0.938292	7.070000172	52502.734
Canada	2014	1.841026	195649	1.906636	6.909999847	53142.881
Canada	2015	-0.08929	232738	1.125241	6.909999847	53558.153
Canada	2016	-0.13584	320494	1.42876	7	52599.446
Canada	2017	1.811279	361274	1.596884	6.340000153	53353.373
Canada	2018	1.335564	417974	2.268226	5.829999924	54325.089
Canada	2019	0.426918	391914	1.949269	5.659999847	54606.699
Canada	2020	-6.31922	195181	0.717	9.460000038	56176.836